PROJECT MANUAL

FOR

SYLVANIA WPCP UPGRADES

Prepared For:

CITY OF SYLVANIA, GEORGIA
A GREAT PLACE TO VISIT, A BETTER PLACE TO LIVE
EST. 1847

Bid Date: June 6, 2024 at 2 p.m.

Prepared By:

INTEGRATED Science & Engineering

1039 Sullivan Road
Suite 200
Newnan, GA 30265
(p) 678.552.2106 | (f) 678.552.2107

GEORGIA REGISTERED PROFESSIONAL ENGINEER
DAVIS OZIER
11-14-22

Revision Date: 4/9/2024
ISE No. 1521.2201

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ADVERTISEMENT FOR BIDS

Project Name: Sylvania WPCP Upgrades
Date of Issue: April 12, 2024

Project No.: 1521.2201
Bid Date: June 6, 2024 at 2 p.m.

Owner Contract No.: N/A

Owner	Engineer
City of Sylvania 104 South Main Street Sylvania, GA, 30467 (phone) (912) 564-7411 Contact: Stacy Mathis, csylv@planters.net	Integrated Science and Engineering 1039 Sullivan Rd Newnan, GA, 30265 (phone) (678) 552-2106 Contact: Davis Ozier, PE, dozier@intse.com

The City of Sylvania will be receiving separate sealed Bids for all material, labor and equipment for the "Sylvania WPCP Upgrades". This includes the following, with all related accessories as shown on the Construction Drawings and called for in the Contract Documents and Technical Specifications:

> The WPCP upgrades include installation of a new staged reactor basin, sludge collection box, filter system, Parshall flume, chlorine contact chamber, cascade aeration structure, RAS pump station, aerobic digestor, and dewatering system. Additional modifications include enhancements to the existing aeration basins and aerobic digestor, modifications to existing clarifier piping, and replacement of several gates.

The estimated project cost is $N/A. This contract is funded by the American Rescue Plan Act State and Local Fiscal Recovery Fund (ARPA SLFRF) and must comply with 2 CFR §200, including Davis Bacon Act compliance.

Contract Documents may be examined at the following locations:

- City of Sylvania, 104 South Main Street, Sylvania, GA, 30467 (https://www.cityofsylvaniaga.com/)
- Integrated Science and Engineering, 1039 Sullivan Rd, Newnan, GA, 30265 (https://www.intse.com/)
- Construct Connect (www.constructconnect.com)
- Georgia Procurement Registry (https://ssl.doas.state.ga.us/gpr)

To obtain a copy of bidding documents, please go to www.intse.com. Documents are available for download at no charge. However, bidders MUST submit payment for bidding documents to Integrated Science and Engineering in order to become qualified to submit a bid for the project. DO NOT call Integrated Science and Engineering or OWNER for a copy of the bidding documents unless wanting to be a qualified bidder.

It is **MANDATORY** that all prospective bidders purchase the Project Manual and Construction Drawings from the office of Integrated Science and Engineering. A hard copy may be obtained upon non-refundable payment of $25 electronic copy - $150 hard copy. An electronic copy (downloaded from the website) may be obtained upon non-refundable payment of $25.

It is the Bidder's responsibility to ensure they have all bidding documents and addendums from the website, and verify that payment has been received by Integrated Science and Engineering. For any technical questions, contact Davis Ozier, PE, dozier@intse.com or Stacy Mathis, csylv@planters.net.

Each Bidder must deposit with his bid, security in the amount of **5%**, and shall be subject to the conditions provided in Section 00 21 13 "Instruction to Bidders."

Each Bidder is required to submit a "Construction Contractors Qualification Statement", "Bid Security", "Bid Form", Non-Collusion Affidavit", and "Security and Immigration Compliance Affidavit" as outlined in Section 00 22 13 "Supplementary Instructions to Bidders."

The City of Sylvania will receive sealed bids until **June 6, 2024 at 2 p.m.** at 104 South Main Street, Sylvania, GA, 30467. Bids received after this time will not be accepted. Bids will be opened and publicly read aloud. The contract will be awarded to the low, responsive, and responsible bidder with reservation of right to reject all bids. Bids may not be withdrawn by Bidders for 60 days following opening of the bids.

The project shall be Substantially Complete within 700 calendar days from the date of Notice to Proceed of the contract. Liquidated Damages shall be assessed in the amount of $300 per day for each calendar day required to achieve Substantial Completion.

The project shall be Final Complete within 30 calendar days beyond Substantial Completion. Liquidated Damages shall be assessed in the amount of $300 per day for each calendar day required to achieve Final Completion.

There will be a **Encouraged** "Pre-Bid" meeting on **May 10, 2024 at 2:00 p.m.** located at the Sylvania WPCP, 624 Friendship Rd, Sylvania, Ga 30467. All contractors submitting a Bid are Encouraged to attend.

The City of Sylvania provides assurances to Bidder that all anticipated Federal, State, and Local Permits along with anticipated Rights of Way and Easements have been obtained or will be obtained by Notice to Proceed.

The City of Sylvania will not issue or cause to be issued any addenda modifying the Project Manual or Construction Drawings within a period of 72 hours prior to the advertised time for opening bids, excluding Saturdays, Sundays, and State of Georgia Legal Holidays.

END OF SECTION

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INSTRUCTIONS TO BIDDERS

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ARTICLE 1 – DEFINED TERMS

1.01 Terms used in these Instructions to Bidders have the meanings indicated in the General Conditions and Supplementary Conditions. Additional terms used in these Instructions to Bidders have the meanings indicated below:

A. City of Sylvania or Integrated Science and Engineering – The office from which the Bidding Documents are to be issued and where the bidding procedures are to be administered, otherwise known as issuing office.

B. Business Day(s) – 24 hours measured from midnight to next midnight excluding weekend and State of Georgia observed holidays.

C. Calendar Day(s) – 24 hours measured from midnight to next midnight including weekend and State of Georgia observed holidays.

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.

2.02 Complete sets of Bidding Documents shall be used in preparing Bids; neither Owner nor Engineer assumes any responsibility for errors or misinterpretations resulting from the use of incomplete sets of Bidding Documents.

2.03 Owner and Engineer, in making copies of Bidding Documents available on the above terms, do so only for the purpose of obtaining Bids for the Work and do not authorize or confer a license for any other use.

ARTICLE 3 – QUALIFICATIONS OF BIDDERS

3.01 To demonstrate Bidder's qualifications to perform the Work, within five (5) business days of Owner's request, Bidder shall submit written evidence of any data requested by Owner over and above what is to be provided in Section 00 45 13 "Bidder's Qualifications."

3.02 Bidder is advised to carefully review those portions of the Bid Form requiring Bidder's representations and certifications.

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

4.01 *Subsurface and Physical Conditions, if applicable in Section 00 31 00*

A. The Supplementary Conditions identify:

1. Those reports known to Owner of explorations and tests of subsurface conditions at or contiguous to the Site.

2. Those drawings known to Owner of physical conditions relating to existing surface

or subsurface structures at the Site (except Underground Facilities).

B. Copies of 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 Condition, if applicable in Section 00 31 00*

A. The Supplementary Conditions identify any reports and drawings known to Owner relating to a Hazardous Environmental Condition identified at the Site.

B. Copies of reports and drawings referenced in Paragraph 4.03.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 4.06 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 responsibilities for the adequacy of data furnished to prospective Bidders with respect to subsurface conditions, other physical conditions, and Underground Facilities, and possible changes in the Bidding Documents due to differing or unanticipated subsurface or physical 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 and subsequent approval of Owner and Property Owner, Owner will provide Bidder access to the Site to conduct such examinations, investigations, explorations, tests, and studies as Bidder deems necessary for submission of a Bid. Bidder shall fill all holes and clean up and restore the Site to its former condition upon completion of such explorations, investigations, tests, and studies. Bidder shall comply with all applicable Laws and Regulations relative to excavation and utility locates. Bidder to provide a description of tests, etc. prior to approval.

4.06 A. If a 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 contemplated by these Bidding Documents. On request, Owner will provide to each Bidder for examination access to or copies of contract documents (other than portions thereof related to price) for such other work.

B. Paragraph 6.13.C of the General Conditions indicates that if an Owner safety program exists, it will be noted in the Supplementary Conditions.

4.07 It is the responsibility of each Bidder before submitting a Bid to:

A. examine and carefully study the Bidding Documents, 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, and performance of the Work;

D. if provided in Section 00 31 00, Available Project Information carefully study all: (1) reports of explorations and tests of subsurface conditions at or contiguous to the Site and all drawings of physical conditions relating to existing surface or subsurface structures at the Site (except Underground Facilities) that have been identified in Paragraph 4.02 of the Supplementary Conditions as containing reliable "technical data," and (2) reports and drawings of Hazardous Environmental Conditions, if any, at the Site that have been identified in the Paragraph 4.06 of the Supplementary Conditions as containing reliable "technical data";

E. consider the information known to Bidder; information commonly known to contractors doing business in the locality of the Site; information and observations obtained from visits to the Site; the Bidding Documents; and the Site-related reports and drawings identified in the Bidding Documents, with respect to the effect of such information, observations, and documents on (1) the cost, progress, and performance of the Work; (2) the means, methods, techniques, sequences, and procedures of construction to be employed by Bidder, including applying any specific means, methods, techniques, sequences, and procedures of construction expressly required by the Bidding Documents; and (3) Bidder’s safety precautions and programs;

F. agree at the time of submitting its Bid that no further examinations, investigations, explorations, tests, studies, or data are necessary for the determination of its Bid for performance of the Work at the price(s) bid and within the times required, 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. 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

I. determine that the Bidding Documents are generally sufficient to indicate and convey

understanding of all terms and conditions for the performance of the Work.

4.08 The submission of a Bid will constitute an incontrovertible representation by Bidder that Bidder has complied with every requirement of this Article 4, that without exception the Bid is premised upon performing and furnishing the Work required by the Bidding Documents and applying any specific means, methods, techniques, sequences, and procedures of construction that may be shown or indicated or expressly required by the Bidding Documents, that Bidder has given Engineer written notice of all conflicts, errors, ambiguities, and discrepancies that Bidder has discovered in the Bidding Documents and the written resolutions thereof by Engineer are acceptable to Bidder, and that the Bidding Documents are generally sufficient to indicate and convey understanding of all terms and conditions for performing and furnishing the Work.

ARTICLE 5 – PRE-BID CONFERENCE

5.01 There will be a Encouraged "Pre-Bid" meeting on May 10, 2024 at 2*:00 p.m.* located at the City of Sylvania office. All contractors submitting a Bid are Encouraged to attend. Representatives of Owner and Engineer will be present to discuss the Project. 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. Easements for permanent structures or permanent changes in existing facilities are to be obtained and paid for by Owner unless otherwise provided in the Bidding Documents. All additional 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.

ARTICLE 7 – INTERPRETATIONS AND ADDENDA

7.01 All questions about the meaning or intent of the Bidding Documents are to be submitted to Engineer in writing via Email Communication to Stacy Mathis, *csylv@planters.net* and Davis Ozier, *PE, dozier@intse.com*. Interpretations or clarifications considered necessary by Engineer in response to such questions will be issued by Addenda emailed or delivered to all parties recorded by Engineer as having received the Bidding Documents. Questions received less than five business days prior to the date for opening of Bids may not be answered. Only questions answered by Addenda will be binding. Oral and other interpretations or clarifications will be without legal effect.

7.02 Addenda may be issued to clarify, correct, or change the Bidding Documents as deemed advisable by Owner or Engineer. No Addenda shall be issued later than three business days prior to the date fixed for opening the Bids. Failure of any Bidder to receive any such Addendum shall not relieve the Bidder from any obligation under his Bid submitted. All Addenda so issued shall become a part of the Contract.

ARTICLE 8 – BID SECURITY

8.01 A Bid must be accompanied by Bid security made payable to Owner in an amount of 5%% of Bidder's maximum Bid price and in the form of a certified check, bank money order, or a Bid bond (on the form attached) issued by a surety meeting the requirements of Paragraphs 5.01 and 5.02 of the General Conditions.

8.02 The Bid security of the Successful Bidder will be retained until such Bidder has executed the Contract Documents, furnished the required contract security and met the other conditions of the Notice of Award, whereupon the Bid security will be returned. If the Successful Bidder fails to execute and deliver the Contract Documents and furnish the required contract security within 15 business days after the Notice of Award, Owner may consider Bidder to be in default, annul the Notice of Award, and the Bid security of that Bidder will be forfeited. Such forfeiture shall be Owner's exclusive remedy if Bidder defaults. 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 calendar days after the Effective Date of the Agreement or 61 calendar days after the Bid opening, whereupon Bid security furnished by such Bidders will be returned.

8.03 Bid security of other Bidders whom Owner believes do not have a reasonable chance of receiving the award will be returned within seven calendar days after the Bid opening.

ARTICLE 9 – CONTRACT TIMES

9.01 The number of calendar days within which, or the dates by which, [Milestones are to be achieved and] the Work is to be substantially 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 on the basis of materials and equipment specified or described in the Bidding Documents, or those substitute or "or-equal" materials and equipment approved by Engineer and identified by Addendum. The materials and equipment described in the Bidding Documents establish a standard of required type, function and quality to be met by any proposed substitute or "or-equal" item. No item of material or equipment will be considered by Engineer as a substitute or "or-equal" unless written request for approval has been submitted by Bidder and has been received by Engineer at least 15 calendar days prior to the date for receipt of Bids. Each such request shall conform to the requirements of Paragraph 6.05 of the General Conditions. The burden of proof of the merit of the proposed item is upon Bidder. Engineer's decision of approval or disapproval of a proposed item will be final. If Engineer approves any proposed item, such approval will be set forth in an Addendum issued to all prospective Bidders. Bidders shall not rely upon approvals made in any other manner.

ARTICLE 12 – SUBCONTRACTORS, SUPPLIERS AND OTHERS

12.01 If the Supplementary Conditions require the identity of certain Subcontractors, Suppliers, individuals, or entities to be submitted to Owner in advance of a specified date prior to the Effective Date of the Agreement, the apparent Successful Bidder, and any other Bidder so requested, shall within five business days after Bid opening, submit to Owner a list of all such Subcontractors, Suppliers, individuals, or entities proposed for those portions of the Work for which such identification is required. Such list shall be accompanied by an experience statement with pertinent information regarding similar projects and other evidence of qualification for each such Subcontractor, Supplier, individual, or entity if requested by Owner. If Owner or Engineer, after due investigation, has reasonable objection to any proposed Subcontractor, Supplier, individual, or entity, Owner may, before the Notice of Award is given, request apparent Successful Bidder to submit a substitute, in which case apparent Successful Bidder shall submit an acceptable substitute, Bidder's Bid price will be increased (or decreased) by the difference in cost occasioned by such substitution, and Owner may consider such price adjustment in evaluating Bids and making the Contract award.

12.02 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 The Bid Form is included with the Bidding Documents.

13.02 All blanks on the Bid Form shall be completed in ink and the Bid Form signed in ink. Erasures or alterations shall be initialed in ink by the person signing the Bid Form. A Bid price shall be indicated for each [section, Bid item, alternative, adjustment unit price item, and unit price item] listed therein. In the case of optional alternatives the words "No Bid," "No Change," or "Not Applicable" may be entered.

13.03 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 seal shall be affixed and attested by the secretary or an assistant secretary. The corporate address and state of incorporation shall be shown.

13.04 A Bid by a partnership shall be executed in the partnership name and signed by a partner (whose title must appear under the signature), accompanied by evidence of authority to sign. The official address of the partnership shall be shown.

13.05 A Bid by a limited liability company shall be executed in the name of the firm by a member and accompanied by evidence of authority to sign. The state of formation of the firm and the official address of the firm shall be shown.

13.06 A Bid by an individual shall show the Bidder's name and official address.

13.07 A Bid by a joint venture shall be executed by each joint venturer in the manner indicated on the Bid Form. The official address of the joint venture shall be shown.

13.08 All names shall be printed in ink below the signatures**.**

13.09 The Bid shall contain an acknowledgment of receipt of all Addenda, the numbers of which shall be filled in on the Bid Form.

13.10 Postal and e-mail addresses and telephone number for communications regarding the Bid

shall be shown.

13.11 The Bid shall contain evidence of Bidder's authority and qualification to do business in the state where the Project is located, or Bidder shall covenant in writing to obtain such authority and qualification prior to award of the Contract and attach such covenant to the Bid. Bidder's state contractor license number, if any, shall also be shown on the Bid Form.

ARTICLE 14 – BASIS OF BID; COMPARISON OF BIDS

14.01 *Lump Sum*

A. Bidders shall submit a Bid on a lump sum basis for the base Bid and include a separate price for each alternate described in the Bidding Documents as provided for in the Bid Form. The price for each alternate will be the amount added to or deleted from the base Bid if Owner selects the alternate. In the comparison of Bids, alternates will be applied in the same order as listed in the Bid form.

14.02 *Unit Price*

A. Bidders shall submit a Bid on a unit price basis for each item of Work listed in the Bid schedule.

B. The total of all estimated prices will be the sum of the products of the estimated quantity of each item and the corresponding unit price. The final quantities and Contract Price will be determined in accordance with Paragraph 11.03 of the General Conditions.

C. Discrepancies between the multiplication of units of Work and unit prices will be resolved in favor of the unit prices. Discrepancies between the indicated sum of any column of figures and the correct sum thereof will be resolved in favor of the correct sum.

14.03 *Allowances*

A. For cash allowances the Bid price shall include such amounts as the Owner deems proper for Contractor's overhead, costs, profit, and other expenses on account of cash allowances, if any, named in the Contract Documents, in accordance with Paragraph 11.02.B of the General Conditions.

ARTICLE 15 – SUBMITTAL OF BID

15.01 With each copy of the Bidding Documents, a Bidder is furnished one separate unbound copy of the Bid Form, and, if required, the Bid Bond Form. Or, if Bidding Documents are all electronic, it will be the Contractor's responsibility to print from online resource. The unbound copy of the Bid Form is to be completed and submitted with the Bid security and the following documents:

A. See Section 00 22 13 for a list of documents typically required to be submitted with the Bid.

15.02 A Bid shall be submitted no later than the date and time prescribed and at the place indicated in the advertisement or invitation to bid and shall be enclosed in a plainly

marked package with the Project title (and, if applicable, the designated portion of the Project for which the Bid is submitted), the name and address of Bidder, and shall be accompanied by the Bid security and other required documents. If a Bid is sent by mail or other delivery system, the sealed envelope containing the Bid shall be enclosed in a separate package plainly marked on the outside with the notation "BID ENCLOSED." A mailed Bid shall be addressed to City of Sylvania**,** 104 South Main Street**,** Sylvania, GA, 30467.

ARTICLE 16 – MODIFICATION AND WITHDRAWAL OF BID

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

16.02 If within 24 hours after Bids are opened any Bidder files a duly signed written notice with Owner and promptly thereafter demonstrates to the reasonable satisfaction of Owner that there was a material and substantial mistake in the preparation of its Bid, that Bidder may withdraw its Bid, and the Bid security will be returned. Thereafter, if the Work is rebid, that Bidder will be disqualified from further bidding on the Work.

ARTICLE 17 – OPENING OF BIDS

17.01 Bids will be opened at the time and place indicated in the Advertisement or Invitation to Bid and, unless obviously non-responsive, read aloud publicly. An abstract of the amounts of the base Bids and major alternates, if any, will be made available to Bidders within five business days after the opening of Bids.

ARTICLE 18 – BIDS TO REMAIN SUBJECT TO ACCEPTANCE

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

ARTICLE 19 – EVALUATION OF BIDS AND AWARD OF CONTRACT

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

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

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

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

19.05 Owner may conduct such investigations as Owner deems necessary to establish the responsibility, qualifications, and financial ability of Bidders, proposed Subcontractors, Suppliers, individuals, or entities proposed for those portions of 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 interests of the Project.

ARTICLE 20 – CONTRACT SECURITY AND INSURANCE

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

ARTICLE 21 – SIGNING OF AGREEMENT

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

END OF SECTION

SECTION 00 22 13

SUPPLEMENTARY INSTRUCTIONS TO BIDDERS

With each copy of the Project Manual, the Bidder shall print one separate unbound copy of the Bidding Documents. The unbound copy of the Bidding Documents is to be completed and submitted, which includes the following documents:

1. Bid Form – Section 00 41 00
2. Bid Security – Section 00 43 13
3. Bidder's Qualifications – Section 00 45 13
4. Non-Collusion Affidavit – Section 00 45 19
5. Security and Immigration Compliance – Section 00 45 20

Place all of the above in a sealed envelope clearly marked as follows:

BID PROPOSAL FOR

City of Sylvania

Sylvania WPCP Upgrades

NOTE: The envelope should bear on the outside the **NAME** and **ADDRESS** of the **QUALIFIED BIDDER**, and **Georgia Utilities Contractors License Number (if applicable)**.

If mailed, this envelope should be placed inside the mailing envelope.

Bids will be opened at June 6, 2024 at 2 p.m. at 104 South Main Street, Sylvania, GA, 30467.

END OF SECTION

SECTION 00 31 00

AVAILABLE PROJECT INFORMATION

1.01 SUMMARY

A. Document Includes:

1. Subsurface and physical conditions.

2. Underground facilities.

B. Available Project information has been furnished by Owner to Engineer for use in designing this Project.

1. Each Bidder shall be fully familiar with available Project information, which has been prepared for Owner by separate consultants.

2. Available Project information is offered solely for reference and shall not be considered part of Contract Documents. Data contained in Documents prepared by Owner's separate consultants is believed to be reliable; however, Owner and Architect/Engineer do not guarantee their accuracy or completeness.

3. In preparing their Bids, Bidders shall consider and evaluate data contained in available Project information as well as Contract Documents prepared by Architect/Engineer.

1.02 SUBSURFACE AND PHYSICAL CONDITIONS REPORT

A. A copy of a geotechnical report is included as an attachment to this Document, titled Geotechnical Engineering Report, dated June 25, 2021, and prepared by Whitaker Lab and Engineering.

1.03 UNDERGROUND FACILITIES REPORT

A. A copy of an underground facilities report is included as an attachment to this Document, titled Job Summary, dated May 21, 2021, and prepared by GPRS.

1.04 HAZARDOUS ENVIRONMENTAL CONDITION REPORT (NOT USED)

1.05 SPECIFIED EQUIPMENT PROPOSALS

A. The proposal for the specified precast concrete tank structures included in Bid Form line item 32 is included as an attachment to this Document, titled Scope Proposal, dated March 4, 2024, and prepared by Dutchland, LLC. A supplemental drawing for crane pad locations is also included with this Document.

END OF SECTION

SECTION 00 41 00

BID FORM

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ARTICLE 1 – BID RECIPIENT

1.01 This Bid is submitted to: City of Sylvania
104 South Main Street
Sylvania, GA, 30467

This Bid is submitted from: _____

_____

_____

(Name and Address of Individual, Partnership, or Corporation)

_____

Georgia Utility Contractor No. (if applicable)

This Bid is for: Sylvania WPCP Upgrades
June 6, 2024 at 2 p.m.

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

ARTICLE 2 – BIDDER'S ACKNOWLEDGEMENTS

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

ARTICLE 3 – BIDDER'S REPRESENTATIONS

3.01 In submitting this Bid, Bidder represents that:

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

Addendum No.	Addendum Date
_____	_____

_____	_____
_____	_____
_____	_____

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

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

D. Bidder has carefully studied all (if applicable): (1) reports of explorations and tests of subsurface conditions at or contiguous to the Site and all drawings of physical conditions relating to existing surface or subsurface structures at the Site (except Underground Facilities) that have been identified in SC-4.02 as containing reliable "technical data," and (2) reports and drawings of Hazardous Environmental Conditions, if any, at the Site that have been identified in SC-4.06 as containing reliable "technical data."

E. Bidder has considered the information known to Bidder; information commonly known to contractors doing business in the locality of the Site; information and observations obtained from visits to the Site; the Bidding Documents; and the Site-related reports (if applicable) and drawings identified in the Bidding Documents, with respect to the effect of such information, observations, and documents on (1) the cost, progress, and performance of the Work; (2) the means, methods, techniques, sequences, and procedures of construction to be employed by Bidder, including applying the specific means, methods, techniques, sequences, and procedures of construction expressly required by the Bidding Documents; and (3) Bidder's safety precautions and programs.

F. Based on the information and observations referred to in Paragraph 3.01.E above, Bidder does not consider that further examinations, investigations, explorations, tests, studies, or data are necessary for the determination of this Bid for performance of the Work at the price(s) bid and within the times required, and in accordance with the other terms and conditions of the Bidding Documents.

G. Bidder is aware of the general nature of work to be performed by Owner and others at the Site that relates to the Work as indicated in the Bidding Documents.

H. Bidder has given Engineer written notice of all conflicts, errors, ambiguities, or discrepancies that Bidder has discovered in the Bidding Documents, and the written resolution thereof by Engineer is acceptable to Bidder.

I. The Bidding Documents are generally sufficient to indicate and convey understanding of all terms and conditions for the performance of the Work for which this Bid is submitted.

ARTICLE 4 – BIDDER'S CERTIFICATION

4.01 Bidder certifies that:

A. This Bid is genuine and not made in the interest of or on behalf of any undisclosed individual or entity and is not submitted in conformity with any collusive agreement or rules of any group, association, organization, or corporation;

B. Bidder has not directly or indirectly induced or solicited any other Bidder to submit a false or sham Bid;

C. Bidder has not solicited or induced any individual or entity to refrain from bidding; and

D. Bidder has not engaged in corrupt, fraudulent, collusive, or coercive practices in competing for the Contract. For the purposes of this Paragraph 4.01.D:

1. "corrupt practice" means the offering, giving, receiving, or soliciting of any thing of value likely to influence the action of a public official in the bidding process;

2. "fraudulent practice" means an intentional misrepresentation of facts made (a) to influence the bidding process to the detriment of Owner, (b) to establish bid prices at artificial non-competitive levels, or (c) to deprive Owner of the benefits of free and open competition;

3. "collusive practice" means a scheme or arrangement between two or more Bidders, with or without the knowledge of Owner, a purpose of which is to establish bid prices at artificial, non-competitive levels; and

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

ARTICLE 5 – BASIS OF BID

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

BASE BID					
ITEM NO.	**DESCRIPTION**	**ESTIMATED QUANTITY**	**UNIT OF MEASURE**	**UNIT PRICE (FIGURES)**	**AMOUNT (FIGURES)**
	MISCELLANEOUS CONSTRUCTION ITEMS				
1	GENERAL CONDITIONS	1	LS		
2	DEMOLITION COMPLETE	1	LS		
3	BYPASS PUMPING	1	LS		
4	ELECTRICAL COMPLETE	1	LS		
5	SCADA SYSTEM	1	LS		
6	WPCP CONSTRUCTION COMPLETE	1	LS		
7	LIGHT DUTY ASPHALT PAVING (DEMO, BACKFILL, GAB, ASPHALT, ETC.)	45	SY		
	PHASED ACTIVATED SLUDGE SYSTEM				
8	PHASED ACTIVATED SLUDGE SYSTEM COMPLETE	1	LS		
	CLARIFIER MODIFICATIONS AND SLUDGE COLLECTION BOX				
9	CLARIFIER MISC. METAL ASSEMBLIES	1	LS		
10	CLARIFIER PROCESS PIPING & STRUCTURES	1	LS		
11	CLARIFIER #3 CLEANING	1	LS		
	FILTER SYSTEM				
12	FILTER CONCRETE STRUCTURE	1	LS		
13	FILTER SYSTEM COMPLETE	1	LS		
	PARSHALL FLUME/CHLORINE CONTACT CHAMBER/CASCADE AERATION STRUCTURE				
14	PARSHALL FLUME, CHLORINE CONTACT CHAMBER, CASCADE AERATION CONCRETE STRUCTURE	1	LS		
15	PARSHALL FLUME, CHLORINE CONTACT CHAMBER, CASCADE AERATION STRUCTURE COMPLETE	1	LS		
	RAS PUMP STATION & FORCE MAIN				
16	RAS PUMP STATION AND FORCE MAIN	1	LS		
17	RAS PUMPS AND CONTROL PANEL	1	LS		
	AEROBIC DIGESTOR				
18	AEROBIC DIGESTOR COMPLETE	1	LS		
19	REHAB OF EX. DIGESTOR	1	LS		
	DEWATERING BUILDING				
20	BELT PRESS INSTALLATION	1	LS		

Bid form continued…

	INFLUENT / HEADWORKS MODIFICATIONS				
21	INFLUENT GRAVITY SEWER MODIFICATIONS	1	LS		
22	CHEMICAL FEED SYSTEM	1	LS		
	EROSION CONTROL ITEMS				
23	SILT FENCE (Sd1-S)	950	LF		
24	CONSTRUCTION EXIT (Co)	1	EA		
25	DISTURBED AREA STABILIZATION (Ds1, Ds2, Ds3)	6,980	SY		
	ALLOWANCES				
26	MASS UNSUITABLE SOILS	430	CY	$ 45.00	$ 19,350.00
27	TESTING AND INSPECTION ALLOWANCE	1	LS	$ 20,000.00	$ 20,000.00
28	UTILITY RELOCATION ALLOWANCE	1	LS	$ 10,000.00	$ 10,000.00
29	ENGINEER DIRECTED CHANGES	1	LS	$ 400,000.00	$ 400,000.00
30	PHASED ACTIVATED SLUDGE SYSTEM COMPONENTS	1	LS	$ 810,248.40	$ 810,248.40
31	FILTER SYSTEM COMPONENTS	1	LS	$ 503,571.60	$ 503,571.60
32	PRECAST CONCRETE TANK STRUCTURES	1	LS	$ 1,317,708.00	$ 1,317,708.00
33	COMPONENTS ALLOWANCE	1	LS	$ 150,000.00	$ 150,000.00
	BASE BID TOTAL (IN FIGURES)				
	BASE BID TOTAL (IN WORDS)				
	ADDITIVE ALTERNATES				
34	CLARIFIER TROUGH BRUSH SYSTEM	3	EA		
35	DEWATERING BUILDING DEMOLITION COMPLETE	1	LS		
36	CAST-IN-PLACE CONCRETE STAGED REACTOR STRUCTURE	1	LS		
37	CAST-IN-PLACE CONCRETE AEROBIC DIGESTOR STRUCTURE	1	LS		
	DEDUCTIVE ALTERNATES				
38	PRE-CAST CONCRETE STAGED REACTOR STRUCTURE	1	LS		
39	PRE-CAST CONCRETE AEROBIC DIGESTOR	1	LS		
40	AEROBIC DIGESTOR COMPLETE	1	LS		

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

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

ARTICLE 6 – TIME OF COMPLETION

6.01 Bidder agrees that the Work will be substantially complete and will be completed and ready for final payment in accordance with Paragraph 14.07 of the General Conditions on or before the dates or within the number of calendar days indicated in the Agreement.

6.02 Bidder accepts the provisions of the Agreement as to liquidated damages.

ARTICLE 7 – ATTACHMENTS TO THIS BID

7.01 The following documents are submitted with and made a condition of this Bid:

A. All documents as outlined in Section 00 22 13 "Supplementary Instructions to Bidders."

ARTICLE 8 – DEFINED TERMS

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

ARTICLE 9 – BID SUBMITTAL

9.01 This Bid is submitted by:

If Bidder is:

An Individual

Name (typed or printed): _____

By: _____
(Individual's signature)

Doing business as: _____

A Partnership

Partnership Name: _____

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

Name (typed or printed): _____

A Corporation

Corporation Name: _____ (SEAL)

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

By: _____
(Signature -- attach evidence of authority to sign)

Name (typed or printed): _____

Title: _____
(CORPORATE SEAL)

Attest _____

Date of Qualification to do business in Georgia is ____/____/____.

A Joint Venture

Name of Joint Venture: _____

First Joint Venturer Name: _____ (SEAL)

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

Name (typed or printed): _____

Title: _____

Second Joint Venturer Name: _____(SEAL)

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

Name (typed or printed): _____

Title: _____

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

Bidder's Business Address _____

_____

Phone No. _____ Fax No. _____

E-mail _____

SUBMITTED on _____, 20____.

State Contractor License No. _____. *[If applicable]*

END OF SECTION

SECTION 00 43 13

BID SECURITY FORM

BIDDER *(Name and Address)*:

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

OWNER:
City of Sylvania
104 South Main Street
Sylvania, GA, 30467

BID
Bid Due Date: June 6, 2024 at 2 p.m.
Description: The WPCP upgrades include installation of a new staged reactor basin, sludge collection box, filter system, Parshall flume, chlorine contact chamber, cascade aeration structure, RAS pump station, aerobic digestor, and dewatering system. Additional modifications include enhancements to the existing aeration basins and aerobic digestor, modifications to existing clarifier piping, and replacement of several gates.

BOND
Bond Number:
Date *(Not earlier than Bid due date)*:
Penal sum _____ $ _____
(Words) (Figures)

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

BIDDER	**SURETY**
_____ (Seal)	_____ (Seal)
Bidder's Name and Corporate Seal	Surety's Name and Corporate Seal
By: _____	By: _____
Signature	Signature (Attach Power of Attorney)
_____	_____
Print Name	Print Name
_____	_____
Title	Title
Attest: _____	Attest: _____

Signature	Signature
Title	Title

Note: Surety companies executing bonds must appear on the Treasury Department's most current list (Circular 570 as amended) and be authorized to transact business in the state where the project is located.

1. Bidder and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors, and assigns to pay to Owner upon default of Bidder the penal sum set forth on the face of this Bond. Payment of the penal sum is the extent of Bidder's and Surety's liability. Recovery of such penal sum under the terms of this Bond shall be Owner's sole and exclusive remedy upon default of Bidder.

2. Default of Bidder shall occur upon the failure of Bidder to deliver within the time required by the Bidding Documents (or any extension thereof agreed to in writing by Owner) the executed Agreement required by the Bidding Documents and any performance and payment bonds required by the Bidding Documents.

3. This obligation shall be null and void if:
   3.1 Owner accepts Bidder's Bid and Bidder delivers within the time required by the Bidding Documents (or any extension thereof agreed to in writing by Owner) the executed Agreement required by the Bidding Documents and any performance and payment bonds required by the Bidding Documents, or
   3.2 All Bids are rejected by Owner, or
   3.3 Owner fails to issue a Notice of Award to Bidder within the time specified in the Bidding Documents (or any extension thereof agreed to in writing by Bidder and, if applicable, consented to by Surety when required by Paragraph 5 hereof).

4. Payment under this Bond will be due and payable upon default 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 total time for issuing Notice of Award including extensions shall not in the aggregate exceed 120 days from Bid due date without Surety's written consent.

6. No suit or action shall be commenced under this Bond prior to 30 calendar days after the notice of default required in Paragraph 4 above is received by Bidder and Surety and in no case later than one year after Bid due date.

7. Any suit or action under this Bond shall be commenced only in a court of competent jurisdiction located in the state in which the Project is located.

8. Notices required hereunder shall be in writing and sent to Bidder and Surety at their respective addresses shown on the face of this Bond. Such notices may be sent by personal delivery, commercial courier, or by United States Registered or Certified Mail, return receipt requested, postage pre-paid, and shall be deemed to be effective upon receipt by the party concerned.

9. Surety shall cause to be attached to this Bond a current and effective Power of Attorney evidencing the authority of the officer, agent, or representative who executed this Bond on behalf of Surety to execute, seal, and deliver such Bond and bind the Surety thereby.

10. This Bond is intended to conform to all applicable statutory requirements. Any applicable requirement of any applicable statute that has been omitted from this Bond shall be deemed to be included herein as if set forth at length. If any provision of this Bond conflicts with any applicable statute, then the provision of said statute shall govern and the remainder of this Bond that is not in

conflict therewith shall continue in full force and effect.

11. The term “Bid” as used herein includes a Bid, offer, or proposal as applicable.

END OF SECTION

SECTION 00 45 13

BIDDER'S QUALIFICATIONS

Submitted by:

Name of Organization: _____

Name of Individual: _____

Title: _____

Address: _____

_____

Telephone: (____) _____

Submitted to:

Name: City of Sylvania

Address: 104 South Main Street

Sylvania, GA, 30467

Telephone: (912) 564-7411

Project Name and Description (if applicable):

Sylvania WPCP Upgrades

The WPCP upgrades include installation of a new staged reactor basin, sludge collection box, filter system, Parshall flume, chlorine contact chamber, cascade aeration structure, RAS pump station, aerobic digestor, and dewatering system. Additional modifications include enhancements to the existing aeration basins and aerobic digestor, modifications to existing clarifier piping, and replacement of several gates.

CONTRACTOR's General Business Information

Check if:

[ ] Corporation [ ] Partnership [ ] Joint Venture [ ] Sole Proprietorship

If Corporation:

a. Date and State of Incorporation: _____

b. List of Executive Officers:

Name	Title

If Partnership:

a. Date and State of Incorporation: _____

b. List of Current General Partners:

_____

_____

_____

_____

c. Type of Partnership:

[ ] General [ ]Publicly Traded

[ ] Limited [ ] Other (describe): _____

If Joint Venture:

a. Date and State of Organization: _____

_____

b. Name, Address and Form of Organization of Joint Venture Partners: (Indicate managing partner by an asterisk *)

_____

_____

_____

_____

If Sole Proprietorship:

a. Date and State of Incorporation: _____

b. Name and Address of Owner or Owners:

_____

_____

_____

_____

1. On Schedule A, attached, list major engineered construction projects completed by this organization in the past five (5) years. (If joint venture, list each participant's projects separately.)
2. On Schedule B, attached, list current projects under construction by this organization. (If joint venture, list each participant's projects separately.)
3. Name of surety company and name, address, and phone number of agent:

_____

_____

_____

_____

4. Is your organization a member of a controlled group of corporations as defined in Internal Revenue Code Sec. 1563?

   [ ] Yes [ ] No

   If yes, show names and addresses of affiliated companies.

_____

_____

5. Furnish on Schedule C, attached, details of the construction experience of the principal individuals of your organization directly involved in construction operations.
6. Has your organization ever failed to complete any construction contract awarded to it?

   [ ] Yes [ ] No

   If yes, describe circumstances on attachment.
7. Has any Corporate officer, partner, joint venture participant or proprietor ever failed to complete a construction contract awarded to him or her in their own name or when acting as a principal of another organization?

   [ ] Yes [ ] No

If yes, describe circumstances on attachment.

8. In the last five years, has your organization ever failed to substantially complete a projet in a timely manner?

   [ ] Yes [ ] No

   If yes, describe circumstances on attachment.

9. Indicate general types of work performed with your own work force.

   _____

   _____

10. Describe the permanent safety program you maintain within your organization. Use attachment if necessary.

    _____

    _____

    _____

    _____

11. If required by OWNER during Bid evaluation, Bidder agrees to provide balance sheet for two or more years audited by a registered CPA.

12. Furnish the following information with respect to an accredited banking institution familiar with your organization.

    Name of Bank: _____

    Address: _____

    _____

    Account Manager: _____

    Telephone: (____) _____

13. Has your organization, or any officer or partner thereof, ever been party to any criminal litigation as a result of construction methods, costs, etc.? _____.

    If yes, state case number, case name, and provide pertinent details, including judgment:

    _____

    _____

    _____

    _____

    (Attach extension sheet if necessary)

14. Has your organization, or any officer or partner thereof, ever been party to any civil litigation as result of construction methods, costs, etc? _____.

    If yes, state case number, case name, and provide pertinent details, including judgment:

(Attach extension sheet if necessary)

15. Describe your organizational structure, including the number of permanent employees engaged in estimating, purchasing, expediting, detailing, and engineering, field supervision, field engineering, and layout:

(Use extension sheet if necessary)

16. Percentage of Work to be Performed with Own Forces:

17. Name of Proposed Subcontractors with Whom You Intend to Affiliate. (What phase and percentage of work will each subcontractor perform?)

18. Give total contract value of work accomplished by your organization in each of the last three (3) years:

    20__ - $_____ 20__ - $_____ 20__ - $ _____

19. What is the largest contract (dollar costs) ever performed by your organization?

    Name of Work: _____

    Total Contract Amount: _____

    Amount of Your Contract: _____

20. Give contract value of work now pending award to your organization:

    $_____State amount requiring bond if awarded: $_____

21. Give the value of any judgments or liens outstanding against your organization:

    $_____

    Explain: _____

22. Give names of Surety Companies & Agent under which you have functioned within the last three (3) years:

20__ _____

20__ _____

20__ _____

23. Estimate your maximum bonding capacity: $_____

How much is unencumbered as of this date? $_____

24. Has any Surety Company refused to write you a bond on any construction work?_____

If yes, explain: _____

_____

_____

I hereby certify that the information submitted herewith, including any attachment is true to the best of my knowledge and belief.

_____

By: _____

Title: _____

Dated: _____

SCHEDULE A
MAJOR ENGINEERING CONSTRUCTION PROJECTS COMPLETED IN PAST 5 YEARS

Name, Location and Description of Project	Owner	Design Engineer	Date Completed	Contract Price	Reference/Contact Include Address and Phone

SCHEDULE B
CURRENT PROJECTS UNDER CONSTRUCTION

Name, Location and Description of Project	Owner	Design Engineer	Contract Price	Amount Completed	Date of Scheduled Completion	Reference/Contact Include Address and Phone

SCHEDULE C
PERSONNEL

Name	Position	Date started with this organization	Date started in construction	Prior positions and experience in construction

END OF SECTION

SECTION 00 45 19

NON-COLLUSION AFFIDAVIT

State of Georgia

County of _____

_____, being first duly sworn, deposes and says that:

(1) He is (owner, partner, officer, representative, or agent) of _____ the Bidder that has submitted the attached Bid;

(2) He is fully informed respecting the preparation and contents of the attached Bid and of all pertinent circumstances respecting such Bid;

(3) Such Bid is genuine and is not a collusive or sham Bid;

(4) Neither the said Bidder nor any of its officers, partners, owners, agents, representatives, employees, or parties in interest, including this affiant, has in any way colluded, conspired, connived or agreed, directly or indirectly, with any other Bidder, firm or person to submit a collusive or sham Bid in connection with the Contract for which the attached Bid has been submitted or to refrain from bidding in connection with such Contract, or has in any manner, directly or indirectly, sought by agreement or collusion or communication or conference with any other Bidder, firm or person to fix the price or prices in the attached Bid or of any other Bidder, or to fix any overhead, profit or cost element of the Bid price or the Bid price of any other bidder, or to secure through any collusion, conspiracy, connivance or unlawful agreement any advantage against the _____ or any person interested in the proposed Contract; and

(5) The price or prices quoted in the attached Bid are fair and proper and are not tainted by any collusion, conspiracy, connivance or unlawful agreement on the part of the Bidder or any of its agents, representatives, owners, employees, or parties in interest, including this affiant.

(Signed) _____

Title _____

Subscribed and sworn before me

on this the _____ day of _____, 20____

_____

Notary Public

My Commission Expires:

_____

END OF SECTION

SECTION 00 45 20

SECURITY AND IMMIGRATION COMPLIANCE

Federal Work Authorization Program (§ O.C.G.A. 13-10-91)

The Owner may not enter into a contract for the physical performance of services unless the contractor registers and participates in the federal work authorization program. "Physical performance of services" is defined as the building, altering, repairing, improving, or demolishing of any public structure or building or other public improvements of any kind to public property within Georgia, including the construction, reconstruction, or maintenance of all or part of a public road; or any other performance of labor for a public employer within Georgia under a contract or other bidding process".

Although the Georgia law for private employers has a structured phase-in timeline in an attempt to ease private employers into compliance based upon their business size, only those companies registered with, authorized to use and currently using the federal work authorization program commonly known as E-Verify, or any subsequent replacement program, in accordance with the applicable provisions and deadlines established in § O.C.G.A. 13-10-91, shall be considered.

Before a bid for the physical performance of services is considered by the Owner, the bid must include a signed, notarized affidavit from the contractor attesting to the following:

(1) The affiant has registered with, is authorized to use, and uses the federal work authorization program.

(2) The user identification number and date of authorization for the affiant;

(3) The affiant will continue to use the federal work authorization program throughout the contract period;

and

(4) The affiant will contract for the physical performance of services in satisfaction of such contract only with subcontractors who present an affidavit to the contractor with the same information as required in numbers 1-3 above.

If a contractor does not have any employees and does not intend to hire any employees, in lieu of the above affidavit the contractor may provide a copy of state-issued driver's license or identification card to the Owner for each independent contractor utilized in satisfaction of part or all of the contact with the Owner. However, a driver's license or identification card will be acceptable if it is issued by a state that verifies lawful immigration status. The Georgia Attorney General will provide a list of states that verify lawful immigration status and post this list on its website. The Owner must confirm that all of the copies of driver's licenses and identification cards presented to it come from states that verify lawful immigration status.

Systematic Alien Verification for Entitlements Program (SAVE)

Upon award, consistent with state law, Bidder shall complete the Affidavit Verifying Status for Owner Public Benefit Application.

Sample form is attached.

CONTRACTOR AFFIDAVIT UNDER O.C.G.A. § 13-10-91(b)(1)

By executing this affidavit, the undersigned contractor verifies its compliance with O.C.G.A. § 13-10-91, stating affirmatively that the individual, firm or corporation which is engaged in the physical performance of services on behalf of City of Sylvania has registered with, is authorized to use and uses the federal work authorization program commonly known as E-Verify, or any subsequent replacement program, in accordance with the applicable provisions and deadlines established in O.C.G.A. § 13-10-91.

Furthermore, the undersigned contractor will continue to use the federal work authorization program throughout the contract period and the undersigned contractor will contract for the physical performance of services in satisfaction of such contract only with subcontractors who present an affidavit to the contractor with the information required by O.C.G.A. § 13-10-91(b). Contractor hereby attests that its federal work authorization user identification number and date of authorization are as follows:

_____ _____

Federal Work Authorization User Identification Number *Date of Authorization*

_____

Company Name / Contractor Name

_____

Name of Project

_____

Name of Public Employer

I hereby declare under penalty of perjury that the foregoing is true and correct.

Executed on _____, _____, 20___ in _____ (Owner), _____ (state).

_____

Signature of Authorized Officer or Agent

_____

Printed Name and Title of Authorized Officer or Agent

Subscribed and sworn before me

on this the _____ day of _____, 20____

_____

Notary Public

My Commission Expires: _____

SUBCONTRACTOR AFFIDAVIT UNDER O.C.G.A. § 13-10-91(b) (3)

By executing this affidavit, the undersigned subcontractor verifies its compliance with § O.C.G.A. 13-10-91 , stating affirmatively that the individual, firm , or corporation which is engaged in the physical performance of services under a contract with _____(name of Contractor) on behalf of City of Sylvania has registered with, is authorized to use and uses federal work authorization program commonly known as E-Verify, or any subsequent replacement program, in accordance with the applicable provisions and deadlines established in § O.C.G.A. 13-10-91.

Furthermore, the undersigned subcontractor will continue to use the federal work authorization program throughout the contract period and the undersigned subcontractor will contract for the physical performance of services in satisfaction of such contract only with sub-subcontractors who present an affidavit to the sub-contractor with the information required by § O.C.G.A. 13-10-91 (b).

Additionally, the undersigned subcontractor will forward notice of the receipt of an affidavit from a sub-subcontractor to the contractor within five business days of receipt. If the undersigned subcontractor receives notice of receipt of an affidavit from any sub-subcontractor that has contracted with a sub-subcontractor to forward, within five business days of receipt, a copy of such notice to the contractor. Subcontractor hereby attests that its federal work authorization user identification number and date of authorization are as follows:

_____ _____

Federal Work Authorization User Identification Number *Date of Authorization*

_____

Company Name / Subcontractor Name

_____

Name of Project

_____

Name of Public Employer

I hereby declare under penalty of perjury that the foregoing is true and correct.

Executed on _____, _____, 20___ in _____ (Owner), _____ (state).

_____

Signature of Authorized Officer or Agent

_____

Printed Name and Title of Authorized Officer or Agent

Subscribed and sworn before me

on this the _____ day of _____, 20____

_____

Notary Public

My Commission Expires: _____

END OF SECTION

SECTION 00 51 00

NOTICE OF AWARD

Project: Sylvania WPCP Upgrades	
Owner: City of Sylvania	Owner's Contract No.: N/A
Bidder:	Engineer's Project No.: 1521.2201
Bidder's Address:	

You are notified that your Bid dated _____ for the above Contract has been considered. You are the Successful Bidder and are awarded a Contract for Sylvania WPCP Upgrades.

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

_____ copies of the proposed Contract Documents (except Drawings) accompany this Notice of Award.

_____ sets of the Drawings will be delivered separately or otherwise made available to you immediately.

You must comply with the following conditions precedent within [15] days of the date you receive this Notice of Award.

1. Deliver to the Owner [ ] fully executed counterparts of the Contract Documents.
2. Deliver with the executed Contract Documents the Contract security [Bonds] as specified in the Instructions to Bidders (Article 20), General Conditions (Paragraph 5.01), and Supplementary Conditions (Paragraph SC-5.01).
3. Deliver with the executed Contract Documents the Contract insurance as specified in the General Conditions (Article 5) and Supplementary Conditions (Paragraph SC-5.02 through SC-5.07).
4. Deliver with the executed Contract Documents the Drug Free Work Place Certification.
5. Deliver with the executed Contract Documents the Schedule of Values.
6. Other conditions precedent: _____

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

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

_____

Owner

By:_____

Authorized Signature

Title

Copy to Engineer

END OF SECTION

SECTION 00 52 00

AGREEMENT

THIS AGREEMENT is by and between City of Sylvania ("Owner") and

("Contractor").

Owner and Contractor hereby agree as follows:

ARTICLE 1 – Work

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

Sylvania WPCP Upgrades

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:

The WPCP upgrades include installation of a new staged reactor basin, sludge collection box, filter system, Parshall flume, chlorine contact chamber, cascade aeration structure, RAS pump station, aerobic digestor, and dewatering system. Additional modifications include enhancements to the existing aeration basins and aerobic digestor, modifications to existing clarifier piping, and replacement of several gates.

ARTICLE 3 – Engineer

3.01 The Project has been designed by Integrated Science and Engineering (Engineer), which 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 700 days after the date when the Contract Times commence to run as provided in Paragraph 2.03 of the General Con

ditions, and completed and ready for final payment in accordance with Paragraph 14.07 of the General Conditions within 30 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 as stated in Paragraph 4.01 above and that Owner will suffer financial loss if the Work is not completed within the times specified in Paragraph 4.02 above, plus any extensions thereof allowed in accordance with Article 12 of the General Conditions. The parties also recognize the delays, expense, and difficulties involved in proving in a legal or arbitration proceeding the actual loss suffered by Owner if the Work is not completed on time. Accordingly, instead of requiring any such proof, Owner and Contractor agree that as liquidated damages for delay (but not as a penalty), Contractor shall pay Owner $300 in liquidated damages for each day that expires after the time specified in Paragraph 4.02 above for Substantial Completion until the Work is substantially complete. After Substantial Completion, if Contractor shall neglect, refuse, or fail to complete the remaining Work within the Contract Time or any proper extension thereof granted by Owner, Contractor shall pay Owner $300 for each day that expires after the time specified in Paragraph 4.02 above for completion and readiness for final payment until the Work is completed and ready for final payment.

B. Liquidated damages for each of the required dates and times are independent and additive.

ARTICLE 5 – Contract Price

5.01 Owner shall pay Contractor for completion of the Work in accordance with the Contract Documents an amount in current funds equal to the sum of the amounts determined pursuant to Paragraphs 5.01.A and 5.01.B below:

A. For all Work other than Unit Price Work, a lump sum of: $_____

All specific cash allowances are included in the above price in accordance with Paragraph 11.02 of the General Conditions.

B. For all Unit Price Work, an amount equal to the sum of the established unit price for each separately identified item of Unit Price Work times the actual quantity of that item:

UNIT PRICE WORK

Item No.	Description	Unit	Estimated Quantity	Bid Unit Price	Bid Price

Total of all Bid Prices (Unit Price Work) $_____

The Bid prices for Unit Price Work set forth as of the Effective Date of the Agreement are based on estimated quantities. As provided in Paragraph 11.03 of the General Conditions, estimated quantities are not guaranteed, and determinations of actual quantities and classifications are to be made by Engineer as provided in Paragraph 9.07 of the General Conditions.

ARTICLE 6 – Payment Procedures

6.01 *Submittal and Processing of Payments*

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

6.02 *Progress Payments; Retainage*

A. Owner shall make progress payments on account of the Contract Price on the basis of Contractor's Applications for Payment on or about the _____ day of each month during performance of the Work as provided in Paragraph 6.02.A.1 below. All such payments will be measured by the schedule of values established as provided in Paragraph 2.07.A of the General Conditions (and in the case of Unit Price Work based on the number of units completed) or, in the event there is no schedule of values, as provided in the General Requirements.

1. Prior to Substantial Completion, progress payments will be made in an amount equal to the percentage indicated below but, in each case, less the aggregate of payments previously made and less such amounts as Engineer may determine or Owner may withhold, including but not limited to liquidated damages, in accordance with Paragraph 14.02 of the General Conditions.

a. 100 percent of Work completed (with the balance being retainage). If the Work has been 50 percent completed as determined by Engineer, and if the character and progress of the Work have been satisfactory to Owner and Engineer, then as long as the character and progress of the Work remain satisfactory to Owner and Engineer, there will be no additional retainage; and

b. 200 percent of cost of materials and equipment not incorporated in the Work (with the balance being retainage).

B. Upon Substantial Completion, Owner shall pay an amount sufficient to increase total payments to Contractor to 100 percent of the Work completed, less such amounts as Engineer shall determine in accordance with Paragraph 14.02.B.5 of the General Conditions and less percent of Engineer's estimate of the value of Work to be completed or corrected as shown on the tentative list of items to be completed or corrected attached to the certificate of Substantial Completion.

6.03 *Final Payment*

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

ARTICLE 7 – Interest

7.01 All moneys not paid when due as provided in Article 14 of the General Conditions shall bear interest at the rate allowed per Georgia Code 13-11-7.

ARTICLE 8 – Contractor's Representations

8.01 In order to induce Owner to enter into this Agreement, Contractor makes the following representations:

A. Contractor has examined and carefully studied the Contract Documents and the other related data identified in the Bidding Documents.

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

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

D. Contractor has carefully studied all, if any: (1) reports of explorations and tests of subsurface conditions at or contiguous to the Site and all drawings of physical conditions relating to existing surface or subsurface structures at the Site (except Underground Facilities), if any, that have been identified in Paragraph SC-4.02 of the Supplementary Conditions as containing reliable "technical data," and (2) reports and drawings of Hazardous Environmental Conditions, if any, at the Site that have been identified in Paragraph SC-4.06 of the Supplementary Conditions as containing reliable "technical data."

E. Contractor has considered the information known to Contractor, if any; information commonly known to contractors doing business in the locality of the Site; information and observations obtained from visits to the Site; the Contract Documents; and the Site-related reports and drawings identified in the Contract Documents, with respect to the effect of such information, observations, and documents on (1) the cost, progress, and performance of the Work; (2) the means, methods, techniques, sequences, and procedures of construction to be employed by Contractor, including any specific means, methods, techniques, sequences, and procedures of construction expressly required by the Contract Documents; and (3) Contractor's safety precautions and programs.

F. Based on the information and observations referred to in Paragraph 8.01.E above, Contractor does not consider that further examinations, investigations, explorations, tests, studies, or data are necessary for the performance of the Work at the Contract Price, within the Contract Times, and in accordance with the other terms and conditions of the Contract Documents.

G. Contractor is aware of the general nature of work to be performed by Owner and others at the Site that relates to the Work as indicated in the Contract Documents.

H. Contractor has given Engineer written notice of all conflicts, errors, ambiguities, or

discrepancies that Contractor has discovered in the Contract Documents, and the written resolution thereof by Engineer is acceptable to Contractor.

I. The Contract Documents are generally sufficient to indicate and convey understanding of all terms and conditions for performance and furnishing of the Work.

ARTICLE 9 – Contract Documents

9.01 *Contents*

A. The Contract Documents consist of the following:

1. This Agreement (pages 1 to _____, inclusive).
2. Performance bond (pages _____ to _____, inclusive).
3. Payment bond (pages _____ to _____, inclusive).
4. General Conditions (pages _____ to _____, inclusive).
5. Supplementary Conditions (pages _____ to _____, inclusive).
6. Specifications (as listed in the table of contents of the Project Manual).
7. Drawings (as listed in the table of contents of the Project Manual).
8. Addenda (numbers _____ to _____, inclusive).
9. Exhibits to this Agreement (enumerated as follows):
    a. Contractor's Bid (pages _____ to _____, inclusive).
    b. Documentation submitted by Contractor prior to Notice of Award (pages _____ to _____, inclusive).
    c. *[List other required attachments (if any), such as documents required by funding or lending agencies].*
10. The following which may be delivered or issued on or after the Effective Date of the Agreement and are not attached hereto:
    a. Notice to Proceed (pages _____ to _____, inclusive).
    b. Work Change Directives.
    c. Change Orders.

B. The documents listed in Paragraph 9.01.A are attached to this Agreement (except as expressly noted otherwise above).

C. There are no Contract Documents other than those listed above in this Article 9.

D. The Contract Documents may only be amended, modified, or supplemented as provided in Paragraph 3.04 of the General Conditions.

ARTICLE 10 – Miscellaneous

10.01 *Terms*

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

10.02 *Assignment of Contract*

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

10.03 *Successors and Assigns*

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

10.04 *Severability*

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

10.05 *Contractor's Certifications*

A. Contractor certifies that it has not engaged in corrupt, fraudulent, collusive, or coercive practices in competing for or in executing the Contract. For the purposes of this Paragraph 10.05:

1. "corrupt practice" means the offering, giving, receiving, or soliciting of any thing of value likely to influence the action of a public official in the bidding process or in the Contract execution;

2. "fraudulent practice" means an intentional misrepresentation of facts made (a) to influence the bidding process or the execution of the Contract to the detriment of Owner, (b) to establish Bid or Contract prices at artificial non-competitive levels, or (c) to deprive Owner of the benefits of free and open competition;

3. "collusive practice" means a scheme or arrangement between two or more Bidders, with or without the knowledge of Owner, a purpose of which is to establish Bid prices at artificial, non-competitive levels; and

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

10.06 *Other Provisions*

IN WITNESS WHEREOF, Owner and Contractor have signed this Agreement. Counterparts have been delivered to Owner and Contractor. All portions of the Contract Documents have been signed or have been identified by Owner and Contractor or on their behalf.

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

OWNER:	CONTRACTOR
_____	_____
By: _____	By: _____
Title: _____	Title: _____
	(If Contractor is a corporation, a partnership, or a joint venture, attach evidence of authority to sign.)
Attest: _____	Attest: _____
Title: _____	Title: _____
Address for giving notices:	Address for giving notices:
_____	_____
_____	_____
_____	_____
	License No.: _____ (Where applicable)
	Agent for service of process:
	_____

END OF SECTION

SECTION 00 55 00

NOTICE TO PROCEED

Project: Sylvania WPCP Upgrades	
Owner: City of Sylvania	Owner's Contract No.: N/A
Contractor:	Engineer's Project No.: 1521.2201
Contractor's Address:	

You are notified that the Contract Times under the above Contract will commence to run on _____. On or before that date, you are to start performing your obligations under the Contract Documents. No field work to proceed prior to this date. In accordance with Article 4 of the Agreement, the date of Substantial Completion is _____, and the date of readiness for final payment is _____ [(or) the number of days to achieve Substantial Completion is _____, and the number of days to achieve readiness for final payment is _____].

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

City of Sylvania
Owner

Given by:
Authorized Signature

Title

Date

Copy to Engineer

END OF SECTION

SECTION 00 61 13

PERFORMANCE BOND

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

OWNER: City of Sylvania
104 South Main Street
Sylvania, GA, 30467

CONSTRUCTION CONTRACT

Effective Date of the Agreement: _____

Amount: $_____

Description: Sylvania WPCP Upgrades - The WPCP upgrades include installation of a new staged reactor basin, sludge collection box, filter system, Parshall flume, chlorine contact chamber, cascade aeration structure, RAS pump station, aerobic digestor, and dewatering system. Additional modifications include enhancements to the existing aeration basins and aerobic digestor, modifications to existing clarifier piping, and replacement of several gates.

BOND

Bond Number: _____

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

Amount: $_____

Modifications to this Bond Form: ☐ None ☐ See Paragraph 16

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

CONTRACTOR AS PRINCIPAL	**SURETY**
_____ *(seal)*	_____ *(seal)*
Contractor's Name and Corporate Seal	Surety's Name and Corporate Seal
By: _____	**By:** _____
Signature	Signature *(attach power of attorney)*
_____	_____
Print Name	Print Name
_____	_____
Title	Title

Attest:_____
Signature

_____
Title

Attest:_____
Signature

_____
Title

Note: Surety companies executing bonds must appear on the Treasury Department's most current list (Circular 570 as amended) and be authorized to transact business in the state where the project is located.

1. The Contractor and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors, and assigns to the Owner for the performance of the Construction Contract, which is incorporated herein by reference.

2. If the Contractor performs the Construction Contract, the Surety and the Contractor shall have no obligation under this Bond, except when applicable to participate in a conference as provided in Paragraph 3.

3. If there is no Owner Default under the Construction Contract, the Surety's obligation under this Bond shall arise after:

    3.1 The Owner first provides notice to the Contractor and the Surety that the Owner is considering declaring a Contractor Default. Such notice shall indicate whether the Owner is requesting a conference among the Owner, Contractor, and Surety to discuss the Contractor's performance. If the Owner does not request a conference, the Surety may, within five (5) business days after receipt of the Owner's notice, request such a conference. If the Surety timely requests a conference, the Owner shall attend. Unless the Owner agrees otherwise, any conference requested under this Paragraph 3.1 shall be held within ten (10) business days of the Surety's receipt of the Owner's notice. If the Owner, the Contractor, and the Surety agree, the Contractor shall be allowed a reasonable time to perform the Construction Contract, but such an agreement shall not waive the Owner's right, if any, subsequently to declare a Contractor Default;

    3.2 The Owner declares a Contractor Default, terminates the Construction Contract and notifies the Surety; and

    3.3 The Owner has agreed to pay the Balance of the Contract Price in accordance with the terms of the Construction Contract to the Surety or to a contractor selected to perform the Construction Contract.

4. Failure on the part of the Owner to comply with the notice requirement in Paragraph 3.1 shall not constitute a failure to comply with a condition precedent to the Surety's obligations, or release the Surety from its obligations, except to the extent the Surety demonstrates actual prejudice.

5. When the Owner has satisfied the conditions of Paragraph 3, the Surety shall promptly and at the Surety's expense take one of the following actions:

    5.1 Arrange for the Contractor, with the consent of the Owner, to perform and complete the Construction Contract;

    5.2 Undertake to perform and complete the Construction Contract itself, through its agents or independent contractors;

    5.3 Obtain bids or negotiated proposals from qualified contractors acceptable to the Owner for a contract for performance and completion of the Construction Contract, arrange for a contract to be prepared for execution by the Owner and a

contractor selected with the Owners concurrence, to be secured with performance and payment bonds executed by a qualified surety equivalent to the bonds issued on the Construction Contract, and pay to the Owner the amount of damages as described in Paragraph 7 in excess of the Balance of the Contract Price incurred by the Owner as a result of the Contractor Default; or

5.4 Waive its right to perform and complete, arrange for completion, or obtain a new contractor, and with reasonable promptness under the circumstances:

5.4.1 After investigation, determine the amount for which it may be liable to the Owner and, as soon as practicable after the amount is determined, make payment to the Owner; or

5.4.2 Deny liability in whole or in part and notify the Owner, citing the reasons for denial.

6. If the Surety does not proceed as provided in Paragraph 5 with reasonable promptness, the Surety shall be deemed to be in default on this Bond seven days after receipt of an additional written notice from the Owner to the Surety demanding that the Surety perform its obligations under this Bond, and the Owner shall be entitled to enforce any remedy available to the Owner. If the Surety proceeds as provided in Paragraph 5.4, and the Owner refuses the payment or the Surety has denied liability, in whole or in part, without further notice the Owner shall be entitled to enforce any remedy available to the Owner.

7. If the Surety elects to act under Paragraph 5.1, 5.2, or 5.3, then the responsibilities of the Surety to the Owner shall not be greater than those of the Contractor under the Construction Contract, and the responsibilities of the Owner to the Surety shall not be greater than those of the Owner under the Construction Contract. Subject to the commitment by the Owner to pay the Balance of the Contract Price, the Surety is obligated, without duplication for:

7.1 the responsibilities of the Contractor for correction of defective work and completion of the Construction Contract;

7.2 additional legal, design professional, and delay costs resulting from the Contractor's Default, and resulting from the actions or failure to act of the Surety under Paragraph 5; and

7.3 liquidated damages, or if no liquidated damages are specified in the Construction Contract, actual damages caused by delayed performance or non-performance of the Contractor.

8. If the Surety elects to act under Paragraph 5.1, 5.3, or 5.4, the Surety's liability is limited to the amount of this Bond.

9. The Surety shall not be liable to the Owner or others for obligations of the Contractor that are unrelated to the Construction Contract, and the Balance of the Contract Price shall not be reduced or set off on account of any such unrelated obligations. No right of action shall accrue on this Bond to any person or entity other than the Owner or its heirs, executors, administrators, successors, and assigns.

10. The Surety hereby waives notice of any change, including changes of time, to the

Construction Contract or to related subcontracts, purchase orders, and other obligations.

11. Any proceeding, legal or equitable, under this Bond may be instituted in any court of competent jurisdiction in the location in which the work or part of the work is located and shall be instituted within two years after a declaration of Contractor Default or within two years after the Contractor ceased working or within two years after the Surety refuses or fails to perform its obligations under this Bond, whichever occurs first. If the provisions of this paragraph are void or prohibited by law, the minimum periods of limitations available to sureties as a defense in the jurisdiction of the suit shall be applicable.

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

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

14. Definitions

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

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

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

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

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

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

16. Modifications to this Bond are as follows:

    <Contractor/surety to list if any>

END OF SECTION

SECTION 00 61 15

PAYMENT BOND

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

OWNER: City of Sylvania
104 South Main Street
Sylvania, GA, 30467

CONSTRUCTION CONTRACT

Effective Date of the Agreement: _____

Amount: $_____

Description: Sylvania WPCP Upgrades - The WPCP upgrades include installation of a new staged reactor basin, sludge collection box, filter system, Parshall flume, chlorine contact chamber, cascade aeration structure, RAS pump station, aerobic digestor, and dewatering system. Additional modifications include enhancements to the existing aeration basins and aerobic digestor, modifications to existing clarifier piping, and replacement of several gates.

BOND

Bond Number: _____

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

Amount: $_____

Modifications to this Bond Form: ☐ None ☐ See Paragraph 18

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

CONTRACTOR AS PRINCIPAL

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

By: _____
Signature

_____
Print Name

_____
Title

SURETY

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

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

_____
Print Name

_____
Title

Attest:_____
Signature

_____
Title

Attest:_____
Signature

_____
Title

Note: Surety companies executing bonds must appear on the Treasury Department's most current list (Circular 570 as amended) and be authorized to transact business in the state where the project is located.

1. The Contractor and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors, and assigns to the Owner to pay for labor, materials, and equipment furnished for use in the performance of the Construction Contract, which is incorporated herein by reference, subject to the following terms.

2. If the Contractor promptly makes payment of all sums due to Claimants, and defends, indemnifies, and holds harmless the Owner from claims, demands, liens, or suits by any person or entity seeking payment for labor, materials, or equipment furnished for use in the performance of the Construction Contract, then the Surety and the Contractor shall have no obligation under this Bond.

3. If there is no Owner Default under the Construction Contract, the Surety's obligation to the Owner under this Bond shall arise after the Owner has promptly notified the Contractor and the Surety (at the address described in Paragraph 13) of claims, demands, liens, or suits against the Owner or the Owner's property by any person or entity seeking payment for labor, materials, or equipment furnished for use in the performance of the Construction Contract, and tendered defense of such claims, demands, liens, or suits to the Contractor and the Surety.

4. When the Owner has satisfied the conditions in Paragraph 3, the Surety shall promptly and at the Surety's expense defend, indemnify, and hold harmless the Owner against a duly tendered claim, demand, lien, or suit.

5. The Surety's obligations to a Claimant under this Bond shall arise after the following:

    5.1 Claimants who do not have a direct contract with the Contractor,

        5.1.1 have furnished a written notice of non-payment to the Contractor, stating with substantial accuracy the amount claimed and the name of the party to whom the materials were, or equipment was, furnished or supplied or for whom the labor was done or performed, within ninety (90) days after having last performed labor or last furnished materials or equipment included in the Claim; and

        5.1.2 have sent a Claim to the Surety (at the address described in Paragraph 13).

    5.2 Claimants who are employed by or have a direct contract with the Contractor have sent a Claim to the Surety (at the address described in Paragraph 13).

6. If a notice of non-payment required by Paragraph 5.1.1 is given by the Owner to the Contractor, that is sufficient to satisfy a Claimant's obligation to furnish a written notice of non-payment under Paragraph 5.1.1.

7. When a Claimant has satisfied the conditions of Paragraph 5.1 or 5.2, whichever is applicable, the Surety shall promptly and at the Surety's expense take the following actions:

    7.1 Send an answer to the Claimant, with a copy to the Owner, within sixty (60) days after receipt of the Claim, stating the amounts that are undisputed and the basis

for challenging any amounts that are disputed; and

7.2 Pay or arrange for payment of any undisputed amounts.

7.3 The Surety's failure to discharge its obligations under Paragraph 7.1 or 7.2 shall not be deemed to constitute a waiver of defenses the Surety or Contractor may have or acquire as to a Claim, except as to undisputed amounts for which the Surety and Claimant have reached agreement. If, however, the Surety fails to discharge its obligations under Paragraph 7.1 or 7.2, the Surety shall indemnify the Claimant for the reasonable attorney's fees the Claimant incurs thereafter to recover any sums found to be due and owing to the Claimant.

8. The Surety's total obligation shall not exceed the amount of this Bond, plus the amount of reasonable attorney's fees provided under Paragraph 7.3, and the amount of this Bond shall be credited for any payments made in good faith by the Surety.

9. Amounts owed by the Owner to the Contractor under the Construction Contract shall be used for the performance of the Construction Contract and to satisfy claims, if any, under any construction performance bond. By the Contractor furnishing and the Owner accepting this Bond, they agree that all funds earned by the Contractor in the performance of the Construction Contract are dedicated to satisfy obligations of the Contractor and Surety under this Bond, subject to the Owner's priority to use the funds for the completion of the work.

10. The Surety shall not be liable to the Owner, Claimants, or others for obligations of the Contractor that are unrelated to the Construction Contract. The Owner shall not be liable for the payment of any costs or expenses of any Claimant under this Bond, and shall have under this Bond no obligation to make payments to or give notice on behalf of Claimants, or otherwise have any obligations to Claimants under this Bond.

11. The Surety hereby waives notice of any change, including changes of time, to the Construction Contract or to related subcontracts, purchase orders, and other obligations.

12. No suit or action shall be commenced by a Claimant under this Bond other than in a court of competent jurisdiction in the state in which the project that is the subject of the Construction Contract is located or after the expiration of one year from the date (1) on which the Claimant sent a Claim to the Surety pursuant to Paragraph 5.1.2 or 5.2, or (2) on which the last labor or service was performed by anyone or the last materials or equipment were furnished by anyone under the Construction Contract, whichever of (1) or (2) first occurs. If the provisions of this paragraph are void or prohibited by law, the minimum period of limitation available to sureties as a defense in the jurisdiction of the suit shall be applicable.

13. Notice and Claims to the Surety, the Owner, or the Contractor shall be mailed or delivered to the address shown on the page on which their signature appears. Actual receipt of notice or Claims, however accomplished, shall be sufficient compliance as of the date received.

14. When this Bond has been furnished to comply with a statutory or other legal requirement in the location where the construction was to be performed, any provision in this Bond conflicting with said statutory or legal requirement shall be deemed deleted herefrom and provisions conforming to such statutory or other legal requirement shall be deemed

incorporated herein. When so furnished, the intent is that this Bond shall be construed as a statutory bond and not as a common law bond.

15. Upon requests by any person or entity appearing to be a potential beneficiary of this Bond, the Contractor and Owner shall promptly furnish a copy of this Bond or shall permit a copy to be made.

16. **Definitions**

16.1 **Claim:** A written statement by the Claimant including at a minimum:

1. The name of the Claimant;
2. The name of the person for whom the labor was done, or materials or equipment furnished;
3. A copy of the agreement or purchase order pursuant to which labor, materials, or equipment was furnished for use in the performance of the Construction Contract;
4. A brief description of the labor, materials, or equipment furnished;
5. The date on which the Claimant last performed labor or last furnished materials or equipment for use in the performance of the Construction Contract;
6. The total amount earned by the Claimant for labor, materials, or equipment furnished as of the date of the Claim;
7. The total amount of previous payments received by the Claimant; and
8. The total amount due and unpaid to the Claimant for labor, materials, or equipment furnished as of the date of the Claim.

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

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

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

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

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

18. Modifications to this Bond are as follows:

<Contractor/surety to list if any>

END OF SECTION

SECTION 00 65 16

CERTIFICATE OF SUBSTANTIAL COMPLETION

Project: Sylvania WPCP Upgrades	
Owner: City of Sylvania	Owner's Contract No.: N/A
	Engineer's Project No.: 1521.2201

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

□ All Work under the Contract Documents: □ The following specified portions of the Work:

Date of Substantial Completion

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

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

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

□ Amended Responsibilities □ Not Amended

Owner's Amended Responsibilities:

Contractor's Amended Responsibilities:

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

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

Executed by Engineer	Date
Accepted by Contractor	Date
Accepted by Owner	Date

END OF SECTION

SECTION 00 65 19

AFFIDAVIT OF PAYMENT OF DEBTS AND CLAIMS

TO OWNER:
City of Sylvania

ENGINEER'S PROJECT NO.:
1521.2201

PROJECT:
Sylvania WPCP Upgrades

CONTRACT DATED:

STATE OF: Georgia

COUNTY OF:

The undersigned hereby certifies that, except as listed below, payment has been made in full and all obligations have otherwise been satisfied for all material and equipment furnished, for all work, labor and services performed, and for all known indebtedness and claims against the Contractor for damages arising in any manner in connection with the performance of the Contract referenced above for which the Owner's property might in any way be held responsible or encumbered.

EXCEPTIONS:

SUPPORTING DOCUMENTS ATTACHED HERETO:

1. Consent of Surety to Final Payment.
2. Contractor's Affidavit of Release of Liens.

CONTRACTOR: *(name and address)*

The above personally appeared before me, the undersigned notary public, and provided satisfactory evidence of identification to be the person who signed this document in my presence and swore or affirmed to me that the contents of this document are truthful and accurate to the best of his/her knowledge and belief.

Date: _____

Notary Public: _____

My Commission expires: _____

By: _____
(Signature of authorized representative)

_____
(Printed name and title)

The above personally appeared before me, the undersigned notary public, and provided satisfactory evidence of identification to be the person who signed this document in my presence and swore or affirmed to me that the contents of this document are truthful and accurate to the best of his/her knowledge and belief.

Date: _____

Notary Public: _____

My Commission expires: _____

END OF SECTION

SECTION 00 65 20

AFFIDAVIT OF PAYMENT RELEASE OF LIENS

TO OWNER:
City of Sylvania

ENGINEER'S PROJECT NO.:
1521.2201

PROJECT:
Sylvania WPCP Upgrades

CONTRACT DATED:

STATE OF: Georgia

COUNTY OF:

The undersigned hereby certifies that to the best of the undersigned's knowledge, information and belief, except as listed below, the Releases or Waivers of Lien attached hereto include the Contractor, all Subcontractors, all suppliers of materials and equipment, and all performers of Work, labor or services who have or may have liens or encumbrances or the right to assert liens or encumbrances against any property of the Owner arising in any manner out of the performance of the Contract referenced above.

EXCEPTIONS:

SUPPORTING DOCUMENTS ATTACHED HERETO:

1. Contractor's Release or Waiver of Liens, conditional upon receipt of final payment.
2. Separate Releases or Waivers of Liens form Subcontractors and equipment suppliers, to the extent required by the Owner, accompanied by a list thereof.

CONTRACTOR: *(name and address)*

By: _____
(Signature of authorized representative)

_____
(Printed name and title)

The above personally appeared before me, the undersigned notary public, and provided satisfactory evidence of identification to be the person who signed this document in my presence and swore or affirmed to me that the contents of this document are truthful and accurate to the best of his/her knowledge and belief.

Date: _____

Notary Public: _____

My Commission expires: _____

END OF SECTION

SECTION 00 65 21

CONSENT OF SURETY TO FINAL PAYMENT

TO OWNER: City of Sylvania	ENGINEER'S PROJECT NO.: 1521.2201
PROJECT: Sylvania WPCP Upgrades	CONTRACT DATED:

In accordance with the provisions of the Contract between the Owner and the Contractor as indicated above, the

(insert name and address of Surety)

, SURETY,

on bond of

(insert name and address of Contractor)

, CONTRACTOR,

herby approves of the final payment to the Contractor, and agrees that final payment to the Contractor shall not relieve the Surety of any of its obligations to

(insert name and address of Owner)

, OWNER,

as set forth in said Surety's bond.

IN WITNESS WHEREOF, the Surety has hereunto set its hand on this date:

(insert in writing the moth followed by the numeric date and year)

_____

(Surety)

_____

(Signature of authorized representative)

Attest:
(Seal):

_____

(Printed name and title)

END OF SECTION

TABLE OF CONTENTS

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 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 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.

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.

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

37. *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.

38. *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.

39. *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.

40. *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.

41. *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.

42. *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.

43. *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.

44. *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.

45. *Successful Bidder*—The Bidder submitting a responsive Bid to whom Owner makes an award.

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

47. *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 Subcontractor.

48. *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.

49. *Unit Price Work*—Work to be paid for on the basis of unit prices.

50. *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.

51. *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 words and terms discussed in Paragraph 1.02.B through F are not defined but, when used in the Bidding Requirements or Contract Documents, have the indicated meaning.

B. *Intent of Certain Terms or Adjectives:*

1. The Contract Documents include the terms "as allowed," "as approved," "as ordered," "as directed" or terms of like effect or import to authorize an exercise of professional judgment by Engineer. In addition, the adjectives "reasonable," "suitable," "acceptable," "proper," "satisfactory," or adjectives of like effect or import are used to describe an action or determination of Engineer as to the Work. It is intended that such exercise of professional judgment, action, or determination will be solely to evaluate, in general, the Work for compliance with the information in the Contract Documents and with the design concept of the Project as a functioning whole as shown or indicated in the Contract Documents (unless there is a specific statement indicating otherwise). The use of any such term or adjective is not intended to and shall not be effective to assign to Engineer any duty or authority to supervise or direct the performance of the Work, or any duty or authority to undertake responsibility contrary to the provisions of 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 that have a well-known technical or construction industry or trade meaning are used in the Contract Documents in accordance with such recognized meaning.

ARTICLE 2 – PRELIMINARY MATTERS

2.01 *Delivery of Bonds and Evidence of Insurance*

A. 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; Designation of Authorized Representatives*

A. Before any Work at the Site is started, a conference attended by Owner, Contractor, Engineer, and others as appropriate will be held to establish a working understanding among the parties as to the Work and to discuss the schedules referred to in Paragraph 2.05.A, procedures for handling Shop Drawings and other submittals, processing Applications for Payment, and maintaining required records.

B. At this conference Owner and Contractor each shall designate, in writing, a specific individual to act as its authorized representative with respect to the services and responsibilities under the Contract. Such individuals shall have the authority to transmit instructions, receive information, render decisions relative to the Contract, and otherwise act on behalf of each respective party.

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 reasonably may be inferred from the Contract Documents or from prevailing custom or trade usage as being required to produce the indicated 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, Engineer, or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors, any duty or authority to supervise or direct the performance of the Work or any duty or authority to undertake responsibility inconsistent with the provisions of the 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 discovers, or has actual knowledge of, 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 (a) any applicable Law or Regulation , (b) any standard, specification, manual, or code, or (c) any instruction of any Supplier, then Contractor shall promptly report it to Engineer in writing. Contractor shall not proceed with the Work affected thereby (except in an emergency as required by Paragraph 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 had actual knowledge 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, or code, or the instruction of any Supplier (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 shall not:

1. have or acquire any title to or ownership rights in any of the Drawings, Specifications, or other documents (or copies of any thereof) prepared by or bearing the seal of Engineer or its consultants, including electronic media editions; or

2. reuse any such Drawings, Specifications, other documents, or copies thereof on

extensions of the Project or any other project without written consent of Owner and Engineer and specific written verification or adaptation by Engineer.

B. The prohibitions of this Paragraph 3.05 will survive final payment, or termination of the Contract. Nothing herein shall preclude Contractor from retaining copies of the Contract Documents for record purposes.

3.06 *Electronic Data*

A. Unless otherwise stated in the Supplementary Conditions, the data furnished by Owner or Engineer to Contractor, or by 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 known to Owner of explorations and tests of subsurface conditions at or contiguous to the Site; and

2. those drawings known to Owner of physical conditions relating to existing surface or subsurface structures at the Site (except Underground Facilities).

B. *Limited Reliance by Contractor on Technical Data Authorized:* Contractor may rely upon the 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 officers, directors, members, partners, employees, agents, consultants, or subcontractors with respect to:

1. the completeness of such reports and drawings for Contractor's purposes, including, but not limited to, any aspects of the means, methods, techniques, sequences, and procedures of construction to be employed by Contractor, and safety precautions and programs incident thereto; or

2. other data, interpretations, opinions, and information contained in such reports or shown or indicated in such drawings; or

3. any Contractor interpretation of or conclusion drawn from any "technical data" or any such other data, interpretations, opinions, or information.

4.03 *Differing Subsurface or Physical Conditions*

A. *Notice:* If Contractor believes that any subsurface or physical condition 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, neither Owner or Engineer, or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors shall 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 provided by others; and

2. the cost of all of the following will be included in the Contract Price, and

Contractor shall have full responsibility for:

a. reviewing and checking all 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:* The Supplementary Conditions identify those reports and drawings known to Owner relating to Hazardous Environmental Conditions that have been identified at the Site.

B. *Limited Reliance by Contractor on Technical Data Authorized:* Contractor may rely upon the 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 officers, directors, members, partners, employees, agents, consultants, or subcontractors with respect to:

1. the completeness of such reports and drawings for Contractor's purposes, including, but not limited to, any aspects of the means, methods, techniques, sequences and procedures of construction to be employed by Contractor and safety precautions and programs incident thereto; or

2. other data, interpretations, opinions and information contained in such reports or shown or indicated in such drawings; or

3. any Contractor interpretation of or conclusion drawn from any "technical data" or any such other data, interpretations, opinions or information.

C. Contractor shall not be responsible for 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. Promptly after consulting with Engineer, Owner shall take such actions as are necessary to permit Owner to timely obtain required permits and provide Contractor the written notice required by Paragraph 4.06.E.

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 written notice to Contractor: (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, members, partners, employees, agents, consultants, and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to a Hazardous Environmental Condition, provided that such Hazardous Environmental Condition: (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, members, partners, employees, agents, consultants, and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to a Hazardous Environmental Condition 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 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 or attorney-in-fact must be accompanied by a certified copy of that individual's authority to bind the surety. The evidence of authority shall show that it is effective on the date the agent or attorney-in-fact signed each bond.

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 and loss payee 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 and loss payee 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.

C. Failure of Owner to demand such certificates or other evidence of Contractor's full compliance with these insurance requirements or failure of Owner to identify a deficiency in compliance from the evidence provided shall not be construed as a waiver of Contractor's obligation to maintain such insurance.

D. Owner does not represent that insurance coverage and limits established in this Contract necessarily will be adequate to protect Contractor.

E. The insurance and insurance limits required herein shall not be deemed as a limitation

on Contractor's liability under the indemnities granted to Owner in the Contract Documents.

5.04 *Contractor's Insurance*

A. Contractor shall purchase and maintain such 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, be written on an occurrence basis, include as additional insureds (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, members, partners, employees, agents, consultants, and subcontractors of each and any of all such additional insureds, and the insurance afforded to these additional insureds shall provide primary coverage for all claims covered thereby;
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 contractual liability insurance covering Contractor's indemnity

obligations under Paragraphs 6.11 and 6.20;

4. 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);

5. 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

6. include completed operations coverage:

   a. Such insurance shall remain in effect for two years after final payment.

   b. 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, members, 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 a loss payee;

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

   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 loss payee to whom a certificate of insurance has been issued.

B. Owner shall purchase and maintain such equipment breakdown 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, members, 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 a loss payee.

C. All the policies of insurance (and the certificates or other evidence thereof) required to be purchased and maintained in accordance with this 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 loss payee 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 this 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 as loss payees (and

the officers, directors, members, 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 loss payees thereunder. Owner and Contractor waive all rights against each other and their respective officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them for all losses and damages caused by, arising out of or resulting from any of the perils or causes of loss covered by such policies and any other property insurance applicable to the Work; and, in addition, waive all such rights against Subcontractors and Engineer, and all other individuals or entities identified in the Supplementary Conditions as loss payees (and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them) under such policies for losses and damages so caused. None of the above waivers shall extend to the rights that any party making such waiver may have to the proceeds of insurance held by Owner as trustee or otherwise payable under any policy so issued.

B. Owner waives all rights against Contractor, Subcontractors, and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them for:

1. loss due to business interruption, loss of use, or other consequential loss extending beyond direct physical loss or damage to Owner's property or the Work caused by, arising out of, or resulting from fire or other perils whether or not insured by Owner; and

2. loss or damage to the completed Project or part thereof caused by, arising out of, or resulting from fire or other insured peril or cause of loss covered by any property insurance maintained on the completed Project or part thereof by Owner during partial 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, members, 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 loss payees, 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.

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; and

      3) it has a proven record of performance and availability of responsive service.

   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 if 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 by 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 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 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; and

4) 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 a Change Order in the case of a substitute and 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 so proposed or submitted by Contractor, Contractor shall reimburse Owner for the reasonable charges of Engineer for evaluating each such proposed substitute. Contractor shall also reimburse Owner for the reasonable charges of Engineer for making changes in the Contract Documents (or in the provisions of any other direct contract with Owner) resulting from the acceptance of each proposed substitute.

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 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 a loss payee 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, Engineer, and all other individuals or entities identified in the Supplementary Conditions to be listed as insureds or loss payees (and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them) for all losses and damages caused by, arising out of, relating to, or resulting from any of the perils or causes of loss covered by 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, Owner shall indemnify and hold harmless Contractor, and its officers, directors, members, partners, employees, agents, consultants, and subcontractors from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects,

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

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

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 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, members, partners, employees, agents, consultants and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to any 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. Such responsibility does not relieve Subcontractors of their responsibility for the safety of persons or property in the performance of their work, nor for compliance with applicable safety Laws and Regulations. Contractor shall take all necessary precautions for the safety of, and shall provide the necessary protection to prevent damage, injury or loss to:

1. all persons on the Site or who may be affected by the Work;

2. all the Work and materials and equipment to be incorporated therein, whether in storage on or off the Site; and

3. other property at the Site or adjacent thereto, including trees, shrubs, lawns, walks, pavements, roadways, structures, 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. Contractor shall comply with the applicable requirements of Owner's safety programs, if any. The Supplementary Conditions identify any Owner's safety programs that are applicable to the Work.

D. Contractor shall inform Owner and Engineer of the specific requirements of Contractor's safety program with which Owner's and Engineer's employees and representatives must comply while at the Site.

E. All damage, injury, or loss to any property referred to in Paragraph 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 Drawings or Specifications or to the acts or omissions of Owner or Engineer or anyone employed by any of them, or anyone for whose acts any of them may be liable, and not attributable, directly or indirectly, in whole or in part, to the fault or negligence of Contractor or any Subcontractor, Supplier, or other individual or entity directly or indirectly employed by any of them).

F. Contractor's duties and responsibilities for safety and 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 accepted 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:*

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:

   a. 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;

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

   c. determined and verified the suitability of all materials offered with respect to the indicated application, fabrication, shipping, handling, storage, assembly, and installation pertaining to the performance of the Work; and

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

2. Each submittal shall bear a stamp or specific written certification that Contractor has satisfied Contractor's obligations under the Contract Documents with respect to Contractor's review 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 Drawings 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 officers, directors, members, partners, employees, agents, consultants, and subcontractors 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, members, partners, employees, agents, consultants and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to the performance of the Work, provided that any such claim, cost, loss, or damage is attributable to bodily injury, sickness, disease, or death, or to injury to or destruction of tangible property (other than the Work itself), including the loss of use resulting therefrom but only to the extent caused by any negligent act or omission of Contractor, any Subcontractor, any Supplier, or any individual or entity directly or indirectly employed by any of them to perform any of the Work or anyone for whose acts any of them may be liable .

B. In any and all claims against Owner or Engineer or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors by any employee (or the survivor or personal representative of such employee) of Contractor, any Subcontractor, any Supplier, or any individual or entity directly or indirectly employed by any of them to perform any of the Work, or anyone for whose acts any of them may be liable, the indemnification obligation under Paragraph 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, members, partners, employees, agents, consultants and subcontractors arising out of:

1. the preparation or approval of, or the failure to prepare or approve maps, Drawings, opinions, reports, surveys, Change Orders, designs, or Specifications; or

2. giving directions or instructions, or failing to give them, if that is the primary cause of the injury or damage.

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 through 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, provide a reasonable opportunity for the introduction and storage of materials and equipment and the execution of such other work, and 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 such work; provided, however, that Contractor may cut or alter

others' work with the written consent of Engineer and the others whose work will be affected. 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 wrongful actions or inactions.

C. Contractor shall be liable to Owner and any other contractor under direct contract to Owner for the reasonable direct delay and disruption costs incurred by such other contractor as a result of Contractor's wrongful 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 with respect to 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 relating to existing surface or subsurface structures at the Site.

8.06 *Insurance*

A. Owner's responsibilities, if any, with respect to 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 with 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. Upon request of Contractor, Owner shall furnish Contractor reasonable evidence that financial arrangements have been made to satisfy Owner's obligations under the Contract Documents.

8.12 *Compliance with Safety Program*

A. While at the Site, Owner's employees and representatives shall comply with the

specific applicable requirements of Contractor's safety programs of which Owner has been informed pursuant to Paragraph 6.13.D.

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.

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 believes 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.

9.10 *Compliance with Safety Program*

A. While at the Site, Engineer's employees and representatives shall comply with the specific applicable requirements of Contractor's safety programs of which Engineer has been informed pursuant to Paragraph 6.13.D.

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.D.

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

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 Times 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 not include any of the costs itemized in Paragraph 11.01.B, and shall include only the following items:

1. Payroll costs for employees in the direct employ of Contractor in the performance of the Work under schedules of job classifications agreed upon by Owner and Contractor. Such employees shall include, without limitation, superintendents, foremen, and other personnel employed full time on the Work. Payroll costs for employees not employed full time on the Work shall be apportioned on the basis of their time spent on the Work. Payroll costs shall include, but not be limited to, salaries and wages plus the cost of fringe benefits, which shall include social security contributions, unemployment, excise, and payroll taxes, workers' compensation, health and retirement benefits, bonuses, sick leave, 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, as imposed by Laws and Regulations.

e. Deposits lost for causes other than negligence of Contractor, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable, and royalty payments and fees for permits and licenses.

f. Losses and damages (and related expenses) caused by damage to the Work, not compensated by insurance or otherwise, sustained by Contractor in connection with the performance of the Work (except losses and damages within the deductible amounts of property insurance established in accordance with Paragraph 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, express and courier services, 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, expediters, 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.

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 to 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 Paragraphs 12.01.C.2.a and 12.01.C.2.b 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 their officers, directors, members, partners, employees, agents, consultants, or subcontractors 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. 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, inspection, and testing. Contractor shall provide them proper and safe conditions for such access and advise them of Contractor's safety procedures and programs so that they may comply therewith as applicable.

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 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, Contractor shall, if requested by Engineer, uncover such Work 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 written 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 for 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 of the executed Work as an experienced and qualified design professional, and on Engineer's review of the Application for Payment and the accompanying data and schedules, that to the best of Engineer's knowledge, information and belief:

a. the Work has progressed to the point indicated;

b. the quality of the Work is generally in accordance with the Contract Documents (subject to an evaluation of the Work as a functioning whole prior to or upon Substantial Completion, the results of any subsequent tests called for in the Contract Documents, a final determination of quantities and classifications for Unit Price Work under Paragraph 9.07, and any other qualifications stated in the recommendation); and

c. the conditions precedent to Contractor's being entitled to such payment appear to have been fulfilled in so far as it is Engineer's responsibility to observe the Work.

3. By recommending any such payment Engineer will not thereby be deemed to have represented that:

   a. inspections made to check the quality or the quantity of the Work as it has been performed have been exhaustive, extended to every aspect of the Work in progress, or involved detailed inspections of the Work beyond the responsibilities specifically assigned to Engineer in the Contract Documents; or

   b. there may not be other matters or issues between the parties that might entitle Contractor to be paid additionally by Owner or entitle Owner to withhold payment to Contractor.

4. Neither Engineer's review of Contractor's Work for the purposes of recommending payments nor Engineer's recommendation of any payment, including final payment, will impose responsibility on Engineer:

   a. to supervise, direct, or control the Work, or

   b. for the means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or

   c. for Contractor's failure to comply with Laws and Regulations applicable to Contractor's performance of the Work, or

   d. to make any examination to ascertain how or for what purposes Contractor has used the 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 remedies the reasons for such action.

3. Upon a subsequent determination that Owner's refusal of payment was not justified, the amount wrongfully withheld shall be treated as an amount due as determined by Paragraph 14.02.C.1 and subject to interest as provided in the Agreement.

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 remove its property and 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, Owner, and Engineer will follow the procedures of Paragraph 14.04.A through D 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.6;

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 might in any way be responsible, or which might in any way result in liens or other burdens on Owner's property, have been paid or otherwise satisfied. If any Subcontractor or Supplier fails to furnish such a release or receipt in full, Contractor may furnish a bond or other collateral satisfactory to Owner to indemnify Owner against any Lien.

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 repeated 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 the 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.

END OF SECTION

SECTION 00 73 00

SUPPLEMENTARY CONDITIONS

These Supplementary Conditions amend or supplement the Standard General Conditions of the Construction Contract (EJCDC No. C-700, 2007 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.

SC-1.01 Defined Terms

SC-1.01.A.52 Add the following paragraphs immediate after Paragraph 1.01.A.52:

53. *Engineer's Consultant* — An individual or entity having a contract with Engineer to furnish services as Engineer's independent professional associate or consultant with respect to the Project. Engineer's Consultants are identified as follows:

    a) Parker Engineering

    b) ESAD, LLC

    c) Whitaker Lab & Engineering

SC-1.01.A.9 Amend paragraph 1.01.A.9 of the General conditions to read as follows:

Change Order: A document which is signed by Contractor, Owner, and by Engineer, 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 Effective Date of the Agreement.

SC1.01.A.14 Amend paragraph 1.01.A.14 of the General Conditions by the addition of the following provision:

Execution fo this Agreement by Contractor constitutes an acknowledgement and agreement by Contractor that all Contract Times stated in the Contract Documents are reasonable and are of sufficient duration for the Work required to be performed within such times. Contractor acknowledges that Work on Saturdays, Sundays, or legal holidays requires the prior written consent of Owner and further requires that Contractor shall be responsible for, and shall pay, any and all overtime or extra cost incurred by Owner or Engineer resulting from such Work on Saturdays, Sundays, or legal holidays. Contractor further acknowledges that unless expressly stated otherwise, all days and times set forth in the Contract Documents shall be measured by calendar days.

SC-2.01 Delivery of Bonds and Evidence of Insurance

SC-2.01.B Add the following new paragraph immediately after Paragraph 2.01.B:

1. Provide Owner, at the time Contracts are returned by Owner for execution,

three (3) copies of all insurance certificates. In addition, all coverages held jointly in names of Owner and/or Engineer, three (3) additional copies of policies shall be furnished. Each additional insured identified in the Supplementary Conditions shall be provided one copy of all insurance certificates. Owner reserves the right to request complete copies of policies if deemed necessary to ascertain details of coverage not provided by the certificates. Such policy copies shall be "originally signed copies" and so designated.

SC-2.02 Copies of Documents

SC-2.02 Delete Paragraph 2.02.A in its entirety and insert the following in its place:

A. Owner shall furnish to Contractor up to three (3) printed or hard copies of the Drawings and Project Manual and one (1) set in electronic format. Additional copies will be furnished upon request at the cost of reproduction.

SC-2.03 Commencement of Contract Times; Notice to Proceed

SC-2.03.A Add the following paragraph immediately after Paragraph 2.03.A:

B. Should the Owner require additional time to award a Contract, the time may be extended by the mutual agreement between the Owner and the successful Bidder. If an award of Contract has not been made within 60 days from the Bid date or within the extension mutually agreed upon, the Bidder may withdraw the Bid without further liability on the part of the either party.

SC-2.07 Initial Acceptance of Schedules

SC-2.07.A.3 Add the following language at the end of Paragraph 2.07.A.3:

4. Contractor shall not imbalance their Schedule of Values nor artificially inflates any element thereof. If required by Owner or Engineer, Contractor shall furnish any required documentation to substantiate that the Schedule of Values is balanced and not artificially inflated. Violation of this provision by Contractor may constitute a material breach of this Agreement.

SC-3.01 Intent

SC-3.01.C Add the following language at the end of Paragraph 3.01.C:

In the event of a conflict, discrepancy, contradiction, or inconsistency within the Contract Documents and for the resolution of same, the following order of hierarchy and control shall apply and prevail:

1) Contract; 2) Addenda; 3) Supplementary General Conditions; 4) General Conditions; 5) Specifications; 6) Drawings; 7) Instruction to Bidders; 8) Invitation to Bid; 9) Sample Forms.

If a conflict, discrepancy, contradiction, or inconsistency occurs within or between the Specifications and the Drawings, resolution shall be controlled by the following:

1. As between figures, dimensions, or numbers given on Drawings and any

scaled measurements, the figures, dimensions, or numbers shall govern;

2. As between large scale drawings and small-scale drawings, the larger scale drawings shall govern;

3. As between technical specifications and drawings, the technical specifications shall govern;

4. Shop Drawings and Submittals: Shop drawings and other submittals from the Contractor, subcontractors, or suppliers do not constitute a part of the Contract Documents;

5. In the case of an inconsistency between Drawings and Specifications or within either Document not clarified by addendum, the better quality or greater quantity of Work shall be provided in accordance with the Engineer's interpretation.

SC-4.01 Availability of Lands

SC-4.01.C Add the following new paragraph immediately after Paragraph 4.01.C:

D. Contractor has received a list of Work areas from Owner where some easements necessary to complete this Project may not have been obtained by Owner at Bid time, and may not be available until an undetermined time during the construction period. Owner will notify Contractor when such easements have been secured and when Contractor may proceed with Work in those areas.

1. Contractor may request an extension of Contract Times in accordance with Article 10 of the General Conditions if Owner is unable to secure easements within 30 days after the effective date of the Agreement.

2. Requests for a change in Contract Price for areas that have been identified as unavailable at time of Bid and may impact Contractor's work production will not be considered.

SC-4.02 Subsurface and Physical Conditions,

SC-4.02.A Delete Paragraph 4.02.A and replace it in its entirety with:

A. In the preparation of Drawings and Specifications, Engineer or Engineer's Consultants relied upon those reports of explorations and tests of subsurface conditions at or contiguous to the Site; and those drawings of physical conditions in or relating to existing surface or subsurface structures at or contiguous to the Site (except Underground Facilities). Copies of reports and drawings itemized below that are not included with Bidding Documents may be examined at Integrated Science and Engineering during regular business hours.

1. Report dated _June 25_, 2021, prepared by __Whitaker Lab and Engineering_, _Savannah_, Georgia, entitled: _Geotechnical Engineering Report_, consisting of _36_ pages. The "technical data" contained in such report upon which CONTRACTOR may rely is the soil boring logs.

2. Report dated _May 21_, 2021, prepared by _GPRS_, _Cartersville_, Georgia, entitled: _Job Summary__, consisting of _6_ pages. The "technical data" contained in such report upon which CONTRACTOR may rely is the underground utility locations shown in report and on Drawings.

SC-4.06 Hazardous Environmental Condition at Site

SC-4.06.A Delete Paragraph 4.06.A and replace it in its entirety with:

A. In the preparation of Drawings and Specifications, Engineer or Engineer's Consultants did not rely upon reports of Hazardous Environmental Conditions at the Site, except as noted on Drawings.

SC-5.02 Licensed Sureties and Insurers

SC-5.02.A Add the following language at the end of Paragraph 5.02.A:

In order to determine financial strength and reputation of insurance carriers, all companies providing the coverages required shall be licensed or approved by the Insurance Bureau of the State in which the Work is performed and shall have a financial rating not lower than VI and a policyholder's service rating no lower than A- as listed in A.M. Best's Key Rating Guide, current edition. Certificates of insurance shall note A.M. Best's Rating. All bonds and insurance coverages shall be with sureties or insurance companies that are acceptable to OWNER.

SC-5.03 Certificates of Insurance

SC-5.03.E Add the following new paragraphs at the end of Paragraph 5.03.E:

F. The identity of the additional insureds that are to be included on Contractor's insurance policies are:

1. City of Sylvania and including all elected and appointed officials, all employees and volunteers, all boards, commissions, and/or authorities and their board members, employees, and volunteers.
2. Integrated Science and Engineering
3. Parker Engineering
4. ESAD, LLC
5. Whitaker Lab and Engineering
6. Georgia Environmental Protection Division (EPD).

SC-5.04 Contractor's Liability Insurance

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 (i.e., Longshoreman's): Statutory

c. Employer's Liability:

1) Each Accident: $500,000

2) Disease Employee Limit: $500,000

3) Each Employee: $500,000

2. Contractor's General Liability under Paragraphs 5.04.A.3 through A.5 of the General Conditions which shall include Commercial General Liability, Contractual Liability, and Products/Complete Operations Liability, Owners and Contractors Protective Liability, and Personal Injury Liability Insurance covering all operations required to complete the work, including coverage for damage caused by explosion, collapse or structural injury, and damage to underground utilities with the following minimum limits of liability:

Contract Amount	Insurance Liability
$1,000,000.00 or less	$1,000,000.00 Combined Single Limit Bodily Injury and Property Damage Liability- each occurrence.
Over $1,000,000.00	$5,000,000.00 Combined Single Limit Bodily Injury and Property Damage Liability – each occurrence.

The Products/Completed Operations Liability Insurance shall be provided for a period of at least one year after completion of the work.

The Contractual Liability Insurance Coverage insuring the performance of the contractual obligations assumed by the Contractor by acceptance of this Contract, including specifically, but without limitation thereto, the above-mentioned agreement, included herein.

3. Automobile Liability under Paragraph 5.04.A.6 of the General Conditions: Comprehensive Automobile Liability Insurance with the following minimum limits of liability:

Contract Amount	Insurance Liability
$5,000,000.00 or less	$1,000,000.00 Combined Single Limit Bodily Injury and Property Damage Liability- each occurrence.
Over $5,000,000.00	$3,000,000.00 Combined Single Limit Bodily Injury and Property Damage Liability- each occurrence.

This insurance is to apply to all owned, non-owned, and hired automobiles and other vehicles used by the Contractor in the performance of the work.

4. Contractor's General Liability under Paragraphs 5.04.A.3 through A.5 of the General Conditions which shall include Excess or Umbrella Liability (Occurrence Form):

   General per contract:

   1. Aggregate: $ 3,000,000.00
   2. Each Occurrence: $ 3,000,000.00

5. Flood Insurance for Buildings and Contents in an amount equal to the maximum limit of coverage available under the National Flood Insurance Act of 1968.

SC-5.06 Property Insurance

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 listed in Paragraph SC-5.03.E;
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;
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.

8. Contractor shall be responsible for any deductible or self-insured retention.

9. The policy will not cover Contractor's or its subcontractor's or supplier's equipment, tools or other property that is not consumed during construction or does not become a part of the Project. Contractor shall bear the expense of any additional policy to cover these items.

10. 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.

SC-5.06.B Delete Paragraph 5.06.B of the General Conditions in its entirety and insert the following in its place:

B. Contractor 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, Engineer, Subcontractors and any other individuals or entities identified in the Specific Project Conditions and/or Supplementary Conditions.

SC-5.06.D Supplement Paragraph 5.06.D of the General Conditions as follows:

If deductibles are included in any of the insurance policies described above, Contractor will be responsible for costs not paid because of these deductibles.

SC-5.06.E Delete Paragraph 5.06.E of the General Conditions in its entirety and insert the following in its place:

E. If Owner requests in writing that other special insurance such as "soft cost" for the protection of the Owner, it will be included in the property insurance policies provided under Paragraph 5.06. Contractor shall, if possible, include such insurance, and the cost thereof will be charged to Owner by appropriate Change Order or Written Amendment. Prior to commencement of the Work at the Site, Contractor shall in writing advise Owner whether or not such other insurance has been procured by Contractor. The Contractor may add "soft cost" coverage for the benefit of the Contractor at the Contractor's expense. If the contractor adds such coverage, the Contractor shall advise the Owner.

SC-5.07 Waiver of Rights

SC-5.07.A Delete the last sentence of Paragraph 5.07.A of the General Conditions in its entirety and insert the following in its place:

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 Contractor as trustee or otherwise payable under any policy so issued.

SC-5.07.B Delete Paragraph 5.07.B of the General Conditions in its entirety.

SC-5.07.C Amend Paragraph 5.07.C of the General Conditions to read as follows:

With respect to all insurance required from Contractor by the Contract Documents, Contractor waives any and all rights of subrogation against Owner, Engineer and each additional named insured. Furthermore, all such insurance, and any insurance required by law, shall be maintained in full force and effect by Contractor until full and final completion of the Work and until payment therefore by Owner. Nothing contained in the within and foregoing insurance provisions shall in any way limit or release Contractor from any of its duties, obligations or liabilities arising under or relating to the Contract Documents.

SC-5.07 Add the following new paragraph immediately after Paragraph 5.07.C:

D. Any insurance policy maintained by Contractor 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 Owner, Subcontractors, or Engineer, and the officers, directors, partners, employees, agents, consultants and subcontractors of each and any of them.

SC-5.08 Receipt and Application of Proceeds

SC-5.08.A In the first sentence of Paragraph 5.08.A amend "… Paragraph 5.06 will be adjusted with Owner and …" to read "… Paragraph 5.06 will be adjusted with Contractor and …". The remaining language in Paragraph 5.08.A shall not be altered and remain in effect.

SC-5.08.B Delete Paragraph 5.08.B in its entirety and replace with:

B. Contractor 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 Contractor's exercise of this power. If such objection be made, Contractor 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, Contractor as fiduciary shall adjust and settle the loss with the insurers and, if required in writing by any party in interest, Contractor as fiduciary shall give bond for the proper performance of such duties.

SC-6.01 Supervision and Superintendence

SC-6.01.A Add the following new paragraph immediately after Paragraph 6.01.A:

1. Contractor's resident superintendent shall be dedicated full-time to the project. The superintendent shall have no less than three (3) years experience as a superintendent on one or more projects similar in nature, size and scope of the Project. Contractor shall furnish to Engineer a detailed resume setting forth the qualifications of the superintendent prior to their assignment to the Project.

The qualifications of the superintendent must be acceptable to Owner.

SC-6.08 Permits

SC-6.08 Add the following new paragraphs immediately after Paragraph 6.08.A:

B. OWNER has secured or will secure the following permits, approvals and licenses and has paid or will pay any associated charges and fees. Contractor shall pay all 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.

1. Georgia Environmental Protection Department (EPD) permit.
2. Soil Erosion and Sediment Control Permit.

SC-6.09 Laws and Regulations

SC-6.09.C Add the following new paragraphs immediately after Paragraph 6.09.C:

D. While not intended to be inclusive of all Laws or Regulations for which Contractor may be responsible for under Paragraph 6.09, the following Laws or Regulations are included as mandated by statue or for the convenience of Contractor:

1. In accordance with Section 209 of the Elliott-Larsen Civil Rights Act, a Contract to which the State, a political subdivision, or an agency thereof is a party shall contain a covenant by Contractor and his subcontractors not to discriminate against an Employee or Applicant for employment with respect to hire, tenure, conditions, or privileges of employment, or a matter directly or indirectly related to employment because of race, color, religion, national origin or ancestry, age, sex, height, weight, or marital status. Breach of this covenant may be regarded as a material breach of the Contract.
2. Prevailing Wages: Contractor shall pay not less than the prevailing rate of wages in accordance with Code of Georgia 34-4-3.
3. Hours of Labor: Employees that qualify, per code of Georgia 21-2-404, may take two hours off from work to vote in an election.
4. Discrimination: Per Georgia Code 34-1-2, Contractor, Subcontractor, nor any person on its behalf, shall refuse to hire, employ, or license, nor bar or discharge from employment, any individual between the ages of 40 and 70 years, solely upon the grounds of age, when the reasonable demands of the position do not require such an age distinction, provided that individual is qualified physically, mentally, and by training and experience to perform satisfactorily the labor assigned to them or for which they apply.
5. Notification Requirements for Excavations: Prior to blasting or excavating with mechanized excavating equipment, Contractor shall notify, within 72 hours, the Utilities Protection Center per Code of Georgia 25-9-6.
6. “Georgia Security and Immigration Compliance Act“ of 2006: Senate Bill

529 (The Ga Security and Immigration and Compliance Act) requires contractors to file an affidavit that the contractor and its subcontractors have registered and participate in a federal work authorization program intended to insure that only lawful citizens or lawful immigrants are employed by the contractor or subcontractor. This requirement of SB529 is a phased-in affidavit filing requirement based on the size of the contractor. Contractors with 500 or more employees are required to file an affidavit of compliance beginning 7/1/07. However, because the requirement is set forth in OCGA 13-10-91 which is a part of Chapter 10 of Title 13 governing public works contracts, the affidavit filing requirements of SB529 therefore only apply to public works contracts.

E. Owner will utilize funds from the Coronavirus State and Local Fiscal Recovery Funds (SLFRF) program on the Project. Contractors must comply with:

1. 2 CFR §200
2. Clean Air Act, as amended, 42 U.S.C. § 7401, et seq. Any violation shall be reported to Owner.
3. Federal Water Pollution Control Act, as amended, 33 U.S.C. § 1251, et seq. Any violation shall be reported to Owner.
4. Section 6002 of the Solid Waste Disposal Act, as amended by the Resource Conservation and Recovery Act, which include procuring only items designated in guidelines of the Environmental Protection Agency at 40 CFR § 247 that contain the highest percentage of recovered materials practicable, consistent with maintaining a satisfactory level of competition.
5. 34 CFR § 82. Summarized as:
    a. No federal appropriated funds have been paid or will be paid, by or on behalf of the undersigned, to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with the making of any federal grant, the entering into of any cooperative agreement, and the extension, continuation, renewal, amendment, or modification of any federal grant or cooperative agreement.
    b. If any funds other than federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with this Federal grant or cooperative agreement, the undersigned shall complete and submit Standard Form - LLL, "Disclosure Form to Report Lobbying," in accordance with its instructions.
6. Byrd Anti-Lobbying Amendment (31 U.S.C. 1352) (See attachment A

for certification statement)

7. Equal Opportunity Clause provided under 41 CFR 60-1.4(b) (Executive Order 11246).
8. Contract Work Hours and Safety Standards Act (40 U.S.C. 3702 and 3704).
9. No contract will be awarded to parties listed on the governmentwide exclusions in the System for Award Management (SAM) in accordance with OMB guidelines at 2 CFR 180. (See attachment B for certification statement)
10. Contractor must use the applicable Davis-Bacon wage determination established by the Wage and Hour Division (WHD) of the U.S. Department of Labor. Applicable wage determinations include, but may not be limited to, Davis-Bacon Act WD #GA20240063.

SC-6.11 Use of Site and Other Areas

SC-6.11.A.3 Add a new paragraph immediately after Paragraph 6.11.A.3:

4. Contractor is responsible to ensure that all activities required to perform the Work are confined to the limits of Owner's property and easements established for the Work. Permanent structures placed outside the limits of Owner's property or defined permanent easements shall be relocated as necessary at no additional change in Contract Price.

SC-6.11.E Add a new paragraph 6.11.E immediately following Paragraph 6.11.D of the General Conditions:

Barricades and Warning Signs: Contractor shall provide, erect, maintain and finally remove all barricades and detour signs necessary to properly protect and divert traffic. Such barricades and signs shall be illuminated at night. Contractor will be held responsible for all damage to the Work due to failure of the signs and barricades to properly protect the Work from traffic, pedestrians, animals and from all other sources. Construction of all barricades shall be such as acceptable to Owner and any and all governmental agencies and departments having jurisdiction and control over traffic.

SC-6.17 Shop Drawings and Samples

SC-6.17.E Add the following new paragraphs immediately after Paragraph 6.17.E:

F. Contractor shall furnish required submittals with sufficient information and accuracy in order to obtain required review of an item with no more than three submittals. Engineer will record Engineer's time for reviewing subsequent submittals of Shop Drawings, samples or other items requiring review and Contractor shall reimburse Owner for Engineer's charges for such time.

1. In the event that Contractor requests a substitution for a previously reviewed item, Contractor shall reimburse Owner for Engineer's charges for such time unless the need for such substitution is beyond the control of Contractor.

SC-6.21 Delegation of Professional Design Services

SC-6.21.B Add the following new paragraph immediately after Paragraph 6.21.B:

1. Where Performance Specifications are used, required systems, equipment, and/or materials to be incorporated in the Project are specified in terms of required results, without mandating specific means for achieving the required results. The functional requirements for the systems, equipment, and/or materials are defined together with the operating conditions and/or environment in which they must operate and general standards which must be satisfied. Performance Specifications establish minimum standards that must be met.

SC-6.21.D Add the following new paragraph immediately after Paragraph 6.21.D:

1. Observations or requirements that Engineer may communicate to Contractor or others are for clarification only and shall not alter the responsibility of any party nor be interpreted to impose on Owner or Engineer any liability to Contractor, subcontractors, suppliers, or manufacturers related to systems, equipment, or materials supplied pursuant to a Performance Specification. Neither Contractor nor anyone claiming rights by virtue of this Contract or any subcontract or order placed hereunder shall seek to recover from Owner or Engineer any losses or damages suffered as a result of any deficiency, defect, or performance problem in any systems, equipment, or materials supplied pursuant to a Performance Specification.

SC-9.03 Project Representative

SC-9.03 Add the following new paragraphs immediately after Paragraph 9.03.A:

B. The Resident Project Representative (RPR) will be a member of the Engineer's firm. The responsibilities, authority and limitations of the RPR shall be in accordance with Article 9 of the General Conditions. Additional responsibilities, authority and limitations of the RPR shall be:

1. Review the Work at the Site during the periods as stipulated in the Owner-Engineer Agreement, and in accordance with Paragraph 9.02.
2. Communicate between the Owner, Contractor and Engineer.
3. Retain a copy of shop drawing submittals, testing results, Applications for Payment, Change Orders, Claims, and other correspondence at the Site.
4. Review Contractor's Application for Payment and Change Orders prior to submission to Engineer in accordance with Paragraph 9.06.
5. Perform the preliminary determination of the actual quantities and classifications of Unit Price Work performed by Contractor for the Engineer in accordance with Paragraph 9.07.
6. RPR will not participate in specialized field or laboratory tests or inspections conducted by others, except as specifically authorized by Engineer.

SC-11.01 Cost of the Work

SC-11.01.A.5.c Delete Paragraph 11.01.A.5.c in its entirety and insert the following in its place:

c. Construction Equipment and Machinery:

1) Rentals of all construction equipment and machinery, and the parts thereof 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.

2) Costs for equipment and machinery owned by Contractor will be paid at a rate shown for such equipment in the Blue Book, Building and Construction (Georgia). An hourly rate will be computed by dividing the monthly rates by 176. These computed rates will include all operating costs. Costs will include the time the equipment or machinery is in use on the changed Work and the costs of transportation, loading, unloading, assembly, dismantling, and removal when directly attributable to the changed Work. The cost of any such equipment or machinery, or parts thereof, shall cease to accrue when the use thereof is no longer necessary for the changed Work. Equipment or machinery with a value of less than $1,000 will be considered small tools.

SC-11.03 Unit Price Work

SC-11.03.D Delete Paragraph 11.03.D in its entirety and insert the following in its place:

D. The unit price of an item of Unit Price Work shall be subject to reevaluation and adjustment in the Contract Price under the following conditions:

1. if the Bid price of a particular item of Unit Price Work amounts to five percent or more of the Contract Price and the variation in the quantity of that particular item of Unit Price Work performed by Contractor differs by more than twenty five percent from the estimated quantity of such item indicated in the Agreement; and

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

3. if Contractor believes that Contractor has incurred additional expense as a result thereof or if Owner believes that the quantity variation entitles Owner to an adjustment in the unit price, either Owner or Contractor may make a Claim for an adjustment in the Contract Price in accordance with Paragraph 10.05 if the parties are unable to agree as to the effect of any such variations in the quantity of Unit Price Work performed.

SC-12.01 Change of Contract Price

SC-12.01.C.2.fAdd the following new paragraphs immediately after Paragraph 12.01.C.2.f:

g. An example of how the procedure works is:

Cost of Work Performed or Furnished by Sub-Subcontractor	$10,000.00
Sub-Subcontractor's Fee (15%)	$1,500.00
Total Cost Paid by Subcontractor to Sub-Subcontractor	$11,500.00
Subcontractor's Fee (5%)	575.00
Total Cost Paid by Contractor to Subcontractor	$12,075.00
Contractor's Fee (5%)	603.75
Total Cost of Work Plus Fee	$12,678.75

SC-12.03 Delays

SC-12.03.F Add the following immediately after Paragraph 12.03.E:

Average Number of Days in which precipitation is in excess of 0.10 inches per day is tabulated below for the region in which the project is located. Completion time will not be extended for normal weather conditions. The time for completion as stated in the Contract Documents includes due allowance for calendar days on which work cannot be performed. For the purpose of this Contract, the Contractor agrees that he may expect to lose calendar days due to weather in accordance with the following table:

Jan.	10 days	May	8 days	Sep.	7 days
Feb.	9 days	June	8 days	Oct.	6 days
Mar.	9 days	July	11 days	Nov.	7 days
Apr.	8 days	Aug.	9 days	Dec.	8 days

Also, the Contractor agrees that the measure of extreme weather during the period covered by this Contract shall be the number of days in excess of those shown for each month in the table above, in which precipitation exceeded 0.10 inch and the average temperature failed to exceed 40 degrees F., averaged from the Peachtree City Airport, Georgia. This is the same source of data used to determine normal weather losses. If the total accumulated number of calendar days lost to weather, from the start of work until the completion of project exceeds that total accumulated number to be expected for the same period from the table above, time for completion will be extended by the number of calendar days needed to include the excess number of calendar days lost. Request for extension in contract time shall be done in accordance with the General Conditions.

No change in Contract Sum will be authorized because of adjustments of Contract Time due to Owner's acceptance of Contract Claims for adjustments to Time due to abnormal weather conditions.

SC-14.02 Progress Payments

SC-14.02.A.3 Delete Paragraph 14.02.A.3 in its entirety and insert the following in its place:

3. Owner shall retain ten percent (10%) of the amount of total payment due the Contractor until the Project is at least 50% satisfactorily complete. At the 50%

Project completion point, the Owner, with the recommendation of the Engineer, finds the work to be satisfactory and if construction is on schedule, maintain the retainage at the previous amount will not retain additional amounts on subsequent payment estimates beyond the 10% on the first 50% of the Project payments. If after discontinuing the additional retainage, the Owner or Engineer determines that the work is unsatisfactory or has fallen behind schedule, retainage may be resumed at the previous level. When the Work is Substantially Complete, and upon written notice from Contractor, the retained amount may be further reduced to an amount of 200% of the value of the work remaining for Final Completion as determined by the Engineer.

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

1. Thirty (30) 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; except when funds with which payments are made are provided by a department or agency of the State or Federal government, in which case payment to Contractor shall be made within fifteen (15) days after Owner receives said funds.
2. If Owner fails to make payment as herein provided, interest will accrue to each such payment that is past due in the amount as allowed per Code of Georgia 13-11-17.

SC-16.01 Methods and Procedure

As an alternative to the dispute resolution process set forth in the General Conditions (mediation followed by litigation), the contract could pair final and binding arbitration with mediation. A discussion of the pros and cons of the arbitration process (and there are many advocates on either side) is beyond the scope of this Guide. Consultation with the Owner's legal counsel is highly recommended. Users should also note that they will need to insert the name of an arbitration agency, such as the American Arbitration Association or the CPR Institute for Dispute Resolution, in SC 16.02.A. The mediation/arbitration option requires the following:

SC-16.01 Delete Paragraph 16.01.C in its entirety and insert the following in its place:

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 demand arbitration of the Claim, pursuant to Paragraph SC 16.02; or
2. agrees with the other party to submit the Claim to another dispute resolution process.

SC-16.02 Add the following new paragraph immediately after Paragraph 16.01:

SC-16.02 Arbitration

A. All Claims or counterclaims, disputes, or other matters in question between Owner and Contractor arising out of or relating to the Contract Documents or the breach thereof (except for Claims which have been waived by the making or acceptance of final payment as provided by Paragraph 14.09) including but not limited to those not resolved under the provisions of Paragraphs SC 16.01A and 16.01.B will be decided by arbitration in accordance with the rules of [insert name of selected arbitration agency], subject to the conditions and limitations of this Paragraph SC 16.02. This agreement to arbitrate and any other agreement or consent to arbitrate entered into will be specifically enforceable under the prevailing law of any court having jurisdiction.

B. The demand for arbitration will be filed in writing with the other party to the Contract and with the selected arbitrator or arbitration provider, and a copy will be sent to Engineer for information. The demand for arbitration will be made within the 30 day period specified in Paragraph SC 16.01.C, and in all other cases within a reasonable time after the Claim or counterclaim, dispute, or other matter in question has arisen, and in no event shall any such demand be made after the date when institution of legal or equitable proceedings based on such Claim or other dispute or matter in question would be barred by the applicable statue of limitations.

C. No arbitration arising out of or relating to the Contract Documents shall include by consolidation, joinder, or in any other manner any other individual or entity (including Engineer, and Engineer's consultants and the officers, directors, partners, agents, employees or consultants of any of them) who is not a party to this Contract unless:

   1. the inclusion of such other individual or entity is necessary if complete relief is to be afforded among those who are already parties to the arbitration; and

   2. such other individual or entity is substantially involved in a question of law or fact which is common to those who are already parties to the arbitration and which will arise in such proceedings.

D. The award rendered by the arbitrator(s) shall be consistent with the agreement of the parties, in writing, and include: (i) a concise breakdown of the award; (ii) a written explanation of the award specifically citing the Contract Document provisions deemed applicable and relied on in making the award.

E. The award will be final. Judgment may be entered upon it in any court having jurisdiction thereof, and it will not be subject to modification or appeal, subject to provisions of the Controlling Law relating to vacating or modifying an arbitral award.

F. The fees and expenses of the arbitrators and any arbitration service shall be shared equally by Owner and Contractor.

END OF SECTION

SECTION 00 73 19

DRUG-FREE WORKPLACE CERTIFICATION

The undersigned vendor hereby certifies that it will provide a drug-free workplace program by:

1. Publishing a statement notifying its employees that the unlawful manufacture, distribution, dispensing, possession, or use of a controlled substance is prohibited in the vendor's workplace, and specifying the actions that will be taken against employees for violations of such prohibition;

2. Establishing a continuing drug-free awareness program to inform its employees about:
   A. The dangers of drug abuse in the work place;
   B. The vendor's policy of maintaining a drug-free workplace;
   C. Any available drug counseling, rehabilitation, and employee assistance programs; and
   D. The penalties that may be imposed upon employees for drug abuse violations occurring in the workplace;

3. Giving all employees engaged in performance of the contract a copy of the statement required by subparagraph (1):

4. Notifying all employees, in writing, of the statement required by subparagraph (1), that as a condition of employment on a covered contract, the employee shall:
   A. Abide by the terms of the statement; and
   B. Notify the employer in writing of the employee's conviction under a criminal drug statute for a violation occurring in the workplace no later than five (5) calendar days after such conviction;

5. Notifying Owner in writing within ten (10) calendar days after receiving notice under subdivision (4)(A) above, from an employee or otherwise receiving actual notice of such conviction. The notice shall include name and the position title of the employee;

6. Within thirty (30) calendar days after receiving notice under subparagraph (4) of a conviction, taking one or more of the following actions with respect to an employee who is convicted of a drug abuse violation occurring in the workplace:
   A. Taking appropriate personnel action against such employee, up to and including termination; and/or
   B. Requiring such employee to satisfactorily participate in and complete a drug abuse assistance or rehabilitation program approved for such purposes by a federal, state, or local health, law enforcement, or other appropriate agency; and

7. Making a good faith effort to maintain a drug-free workplace program through implementation of subparagraphs (1) through (6)

As the person authorized to sign this statement, I certify that this firm fully complies with the above requirements.

Signature:_____ Date:_____

Print Name:_____

Company:_____

END OF SECTION

SECTION 00 94 39

FIELD ORDER

No. _____

Date of Issuance:	Effective Date:
Project: Sylvania WPCP Upgrades	Owner's Contract No.: N/A
Owner: City of Sylvania	Date of Contract:
Contractor:	Engineer's Project No.: 1521.2201

Attention:
You are hereby directed to promptly execute this Field Order issued in accordance with General Conditions Paragraph 9.04.A, for minor changes in the Work without changes in Contract Price or Contract Times. If you consider that a change in Contract Price or Contract Times is required, please notify the Engineer immediately and before proceeding with this Work.

Reference: _____ _____
(Specification Section(s)) (Drawing(s) / Detail(s))

Description:

Attachments:

	Engineer:
Receipt Acknowledged by Contractor:	Date:

Copy to Owner

END OF SECTION

SECTION 00 94 49

WORK CHANGE DIRECTIVE

No. _____

Date of Issuance:	Effective Date:
Project: Sylvania WPCP Upgrades	Owner's Contract No.: N/A
Owner: City of Sylvania	Date of Contract:
Contractor:	Engineer's Project No.: 1521.2201

Contractor is directed to proceed promptly with the following change(s):

Item No.	Description

Attachments (list documents supporting change):

Purpose for Work Change Directive:

Authorization for Work described herein to proceed on the basis of Cost of the Work due to:

- ☐ Nonagreement on pricing of proposed change.
- ☐ Necessity to expedite Work described herein prior to agreeing to changes on Contract Price and Contract Time.

Estimated change in Contract Price and Contract Times:

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

Recommended for Approval by Engineer:	Date
Authorized for Owner by:	Date
Received for Contractor by:	Date
Received by Funding Agency (if applicable):	Date:

END OF SECTION

SECTION 00 94 63

CHANGE ORDER

No. _____

Date of Issuance: Effective Date:

Project: Sylvania WPCP Upgrades	Owner's Contract No.: N/A
Owner: City of Sylvania	Date of Contract:
Contractor:	Engineer's Project No.: 1521.2201

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

Description:

Attachments (list documents supporting change):

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

RECOMMENDED:	ACCEPTED:	ACCEPTED:
By: _____	By: _____	By: _____
Engineer (Authorized Signature)	Owner (Authorized Signature)	Contractor (Authorized Signature)
Date: _____	Date: _____	Date: _____

Approved by Funding Agency (if applicable):

_____ Date: _____

END OF SECTION

SECTION 01 10 00

SUMMARY OF WORK

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Location of Work

B. Scope of Work

C. Substantial Completion requirements

D. Final Completion requirements

G. Contractor use of premises

H. Owner Occupancy

I. Protection of Owner, agents of the Owner, workmen, and the public

I. Project Utility Sources

1.02 PROJECT LOCATION

Project is located at the existing Sylvania WPCP at 624 Friendship Rd, Sylvania, GA 30467.

1.03 SCOPE OF WORK

A. Demolition

Completion of the project will require demolition of the existing RAS/WAS pump room located between the two existing secondary clarifiers. Demolition will include the equipment and piping located within the RAS/WAS pump room. Additionally, the existing chlorine contact chamber will be abandoned in place and the existing dewatering equipment will be demolished and removed from site. Numerous sections of buried piping throughout the WPCP shall be removed, or plugged and abandoned in place to allow the installation of proposed work.

B. Major Components New Construction includes: The WPCP upgrades include installation of a new staged reactor basin, sludge collection box, filter system, Parshall flume, chlorine contact chamber, cascade aeration structure, RAS pump station, aerobic digestor, and dewatering system. Additional modifications include enhancements to the existing aeration basins and aerobic digestor, modifications to existing clarifier piping, and replacement of several gates.

1.04 SUBSTANTIAL COMPLETION REQUIREMENTS

Project to be substantially complete within 700 days of the "Notice to Proceed"

1.05 FINAL COMPLETION REQUIREMENTS

Project to be final complete within 30 days beyond Substantial Completion.

Complete with all "punch list" items identified with the establishment of substantial completion, sodding to have been planted, be final complete in all respects, and comply with additional final completion requirements as specified in the General and Supplementary Conditions.

1.06 CONTRACTOR'S USE OF PREMISES

A. Limit the use of the OWNER's property to the areas indicated on the Drawings. Do not disturb the OWNER's or adjacent properties beyond the areas indicated on the Drawings. The CONTRACTOR shall:

1. Allow for OWNER and ENGINEER occupancy.

2. Keep driveways and entrances clear and clean. Do not use these areas for parking and/or material storage. Schedule deliveries to minimize on-site storage of materials and equipment.

B. Coordinate the use of the premises with the ENGINEER.

C. CONTRACTOR shall assume full responsibility for security of all its and all of its subcontractors stored materials and equipment either on or off-site.

D. Immediately move any stored items, which interfere with the operations of the OWNER and other contractors as directed by the OWNER.

E. Obtain and pay for additional storage and/or work areas as needed to complete the Work required by this Contract.

1.07 OWNER OCCUPANCY

A. The Owner will occupy the site during the entire period of construction.

B. Cooperate with Owner to minimize conflict, and to facilitate Owner's operations.

C. Schedule the Work to accommodate this requirement.

1.08 PROTECTION OF THE OWNER, AGENTS OF THE OWNER, WORKMEN AND THE PUBLIC

The Contractor and the Superintendent are requested to carefully read the Articles of the General Conditions relating to protection of the Owner, agents of the Owner, workmen, and the public, such as Insurance, Indemnity, Licenses, Permits, Compliance with Laws, Ordinances and Regulations, Safety Warning Signs and Barricades, Public Conveniences, Sanitary Provisions, etc. This request is made to stress the importance of safe prosecution of the work, and does not imply that the Contractor and his Superintendent should not be completely familiar with all Articles of the General Conditions and all other provisions of the Contract Documents. Under the terms and Conditions of the Contract, the Engineer shall not be required to act as Safety Engineer or Safety Supervisor since such responsibility remains solely with the Contractor, who, in the prosecution of his work, is bound by the requirements of "Safety and Health Regulations for Construction Occupational Safety and Health Administration, U.S. Government Department of Labor" and other authorities having jurisdiction. It is recommended the Contractor seek the advice of the Safety Inspector for his Insurance Carrier in regard to job safety, and that he observe all precautions and safety provisions as outlined in the "Manual of Accident Prevention in Construction"' as published by the Associated General Contractors of America, to the extent that such provisions are not inconsistent with applicable laws or regulations.

PART 2 EQUIPMENT - (NOT USED)

PART 3 EXECUTION - (NOT USED)

END OF SECTION

SECTION 01 20 00

PRICE AND PAYMENT PROCEDURES

PART 1 GENERAL

1.01 SUMMARY

This section contains procedures for measuring work performed by the contractor and subsequent payment of that work. It also contains descriptions related to measurement and payment.

1.02 SECTION INCLUDES

A. Descriptions

B. Unit Price Items

C. Cash Allowances

D. Additive Alternates

E. Deductive Alternates

F. Schedule of Values

G. Existing Conditions Photographs and Video

H. Application for Payment

I. Change Procedures

J. Defect Assessment

1.03 DESCRIPTIONS

A. The Bid lists each item of the Project for which payment will be made. No payment will be made for any items other than those listed in the Bid.

B. Required items of work and incidentals necessary for the satisfactory completion of the work which are not specifically listed in the Bid, and which are not specified in this Section to be measured or to be included in one of the items listed in the Bid, shall be considered as incidental to the work. All costs thereof, including Contractor's overhead costs and profit, shall be considered as included in the lump sum or unit prices bid for the various Bid items. The Contractor shall prepare the Bid accordingly.

C. Work includes furnishing all plant, labor, equipment, tools and materials, which are not furnished by the Owner and performing all operations required to complete the work satisfactorily, in place, as specified and as indicated on the Drawings.

D. Measurement of an item of work will be by the unit indicated in the Bid.

E. Final payment quantities shall be determined from in-place quantities. The precision of final payment quantities shall match the precision shown for that item in the Bid.

F. Payment will include all necessary and incidental related work not specified to be included in any other item of work listed in the Bid.

G. Unless otherwise stated in individual sections of the Specifications or in the Bid, no separate payment will be made for any item of work, materials, parts, equipment, supplies or related items required to perform and complete the work. The costs for all such items required shall be included in the price bid for item of which it is a part.

H. Payment of lump sum items shall be based upon progress of the Work as developed through proper updating of the construction Schedule. Estimates of percent complete established by the Engineer and Contractor shall be the basis by which earned value will be calculated and payments will be authorized.

I. Payment of unit price items will be made by extending unit prices multiplied by quantities provided and then summing the extended prices to reflect actual work. Such price and payment shall constitute full compensation to the Contractor for furnishing all plant, labor, equipment, tools and materials not furnished by the Owner and for performing all operations required to provide to the Owner the entire Project, complete in place, as specified and as indicated on the Drawings.

J. Payment of lump sum and unit price items shall be less retainage, as required by the Contract Documents.

K. Cash allowances include the cost of product (less applicable trade discounts), delivery to site, and applicable taxes, unless stated otherwise. Costs for product handling at site including unloading, uncrating, and storage; protection of products from elements and damage; installation costs; and overhead and profit should be included in the Contract Sum/Price, unless stated otherwise.

L. Alternates quoted on the Bid Form will be reviewed and accepted or rejected at the Owner's option. Accepted Alternates will be identified in the Owner-Contractor Agreement. The Agreement may identify certain Alternates to remain an Owner option for a stipulated period of time. All work related to the Alternate items should be coordinated, and the bid price for the Alternate shall reflect any and all changes to related tasks. Descriptions for each Alternate are recognized to be abbreviated, but requires that each change shall be complete for the scope of work affected.

   i. Coordinate related requirements among Specification sections as required.

   ii. Include as part of each Alternate: Miscellaneous devices, appurtenances, and similar items incidental to or necessary for complete installation.

   iii. Coordinate Alternate with adjacent work and modify or adjust as necessary to ensure integration.

1.04 UNIT PRICE ITEMS

Miscellaneous Construction Items

1. General Conditions. Shall include but is not limited to; Payment & Performance Bonds, Builders Risk Insurance, Owners/Contractors Protective Insurance, Workers Comprehensive Insurance, Pre and Post-Construction Photographs & Video, Project Mobilization, Permit Fees, Stake Out Surveying, Construction Meetings, Contractor's Field Office with necessary temporary utility connections, Schedule of Values, Project Schedule, NPDES permit compliance, and Initiation of Shop Drawings.

    A. Measurement: Shall be by demonstration to Owner and Engineer that above items have been accomplished.

    B. Payment: Shall be in full when measurement has been demonstrated, less retainage as required by the contract documents. Amount may not exceed 6% of the total contract amount.

2. Demolition Complete. Shall include all equipment, labor, and incidentals required to complete demolition and removal of structures, items, and equipment as shown in the Construction Drawings or deemed necessary to complete the Work, and not specifically included under a separate line item. This item shall include proper and lawful disposal of removed material off site. Such items include, but are not limited to, reinforced concrete structures; buried piping including fittings, valves, and thrust blocks; and mechanical and electrical equipment and assemblies. This line item also includes the removal of mechanical equipment that is to be salvaged and delivered to the owner or re-installed on site as shown in the Construction Drawings.

    A. Measurement: Shall be by demonstration to the Owner and Engineer that the above items have been accomplished.

    B. Payment: Progress payments shall be based on the actual percentage of work satisfactorily completed during the progress payment period in accordance with the accepted Schedule of Values. Final Payment shall be the balance of the stated Lump Sum as adjusted by approved Change Orders.

3. Bypass Pumping. Shall include all equipment, labor, and incidentals required to bypass pump process flows at the facility so that changeovers from existing to new systems can be made without process interruptions; to block, divert, or impound flows as needed in upstream structures to provide adequate suction reservoirs from which the pumps can draw; to safely convey pumped flows to downstream systems, preventing accidental discharges to the environment or damage to existing structures; to provide a backup bypass pump system at the facility in case the primary system fails; and to provide necessary fuel, parts, and materials to maintain uninterrupted bypass pumping for the duration of the changeovers.

    A. Measurement: Shall be in accordance with the accepted Schedule of Values.

    B. Payment: Progress payments shall be based on the actual percentage of work satisfactorily completed during the progress payment period in accordance with the accepted Schedule of Values. Final Payment shall be the balance of the stated

Lump Sum as adjusted by approved Change Orders.

4. Electrical Complete. Shall include all equipment, labor, and incidentals required to furnish and install power and control features for the new and existing mechanical and electrical systems of the facility, as shown in the Construction Drawings. This shall include, but not be limited to, re-routing existing duct banks, conduit, and conductors as needed to permit construction of new structures and piping; maintaining electrical service to existing systems to prevent process upsets; providing backup power as deemed necessary by the Owner to keep existing systems fully operational during extended power disconnections; and providing testing and startup of all affected electrical and control systems. This item does not include equipment controls, electrical wiring, or other components specifically listed under other line items of this Section.

    A. Measurement: Shall be in accordance with the accepted Schedule of Values.

    B. Payment: Progress payments shall be based on the actual percentage of work satisfactorily completed during the progress payment period in accordance with the accepted Schedule of Values. Final Payment shall be the balance of the stated Lump Sum as adjusted by approved Change Orders.

5. SCADA System. Shall include the complete installation of SCADA components as shown on the Construction Drawings. This shall include all conduit, power and control wiring interconnections, as well as testing, startup, and one year's service from the SCADA provider.

    A. Measurement: Shall be in accordance with the accepted Schedule of Values

    B. Payment: Shall be in full when the SCADA system has been completed.

6. WPCP Construction Complete. Shall include all material, labor, and incidentals required to complete the WPCP upgrades that are not specifically included in other line items below.

    A. Measurement: Shall be in accordance with the accepted Schedule of Values

    B. Payment: Progress payments shall be based on the actual percentage of work satisfactorily completed during the progress payment period in accordance with the accepted Schedule of Values. Final Payment shall be the balance of the stated Lump Sum as adjusted by approved Change Orders.

7. Light Duty Asphalt Paving. Shall include all material, labor, and incidentals required to demolish and remove existing paving, prepare subgrade, and provide the Light Duty Asphalt Paving section where shown on the Construction Drawings, or as directed by the Engineer.

    A. Measurement: Shall be the actual number of square yards of Light Duty Asphalt Paving installed.

    B. Payment: Shall be made by multiplying the actual number of square yards of pavement installed times the unit price identified in the Bid Schedule.

Phased Activated Sludge System

8. Phased Activated Sludge System Complete. Shall include all material, labor, and incidentals required to furnish and install a complete operational Phased Activated Sludge System as shown on the Construction Drawings, whether specifically listed herein or not. This includes, but is not limited to site work for the installation of precast Staged Reactor concrete tank components as specified in Section 43 41 63, cast-in-place Influent Splitter Box structure, excavation of all materials for the Staged Reactor structure installation, subgrade material and preparation, backfill of proposed structures, borrow pits and/or fill/spoil material hauled to or from the site (if required), formation of embankments, and finished grading to the elevations shown on the Construction Drawings. This item includes installation of, aerators, mixers, pumps, baffles, controls, and other components to be provided by the system manufacturer as outlined in Section 46 53 00 and paid by line item 30. This item also includes the provision and installation of all miscellaneous metal assemblies, including aluminum handrails, floor grating, support beams, stairs, weirs, davit cranes, mooring posts, downward opening weir gates, and pipe supports. This item includes provision and installation of associated process piping, including, but not limited to, wall pipes and sleeves for wall and slab penetrations, trench excavation, bedding, thrust blocking, pipe joint and fittings, valves and other appurtenances, 3-Inch WAS and 12-Inch Influent Magnetic Flow Meters with all necessary components, connection to new or existing structures or pipes, trench backfill and compaction, and testing for the WAS force main, transfer piping, and influent force main. Not included in Phased Activated Sludge System Complete is electrical supply to the system controls, SCADA system, Phased Activated Sludge System Components, and precast concrete tank components and installation by others, which is included in items 4, 5, 30, and 32, respectively.

   A. Measurement: Shall be in accordance with the accepted Schedule of Values.

   B. Payment: Progress payments shall be based on the actual percentage of work satisfactorily completed during the progress payment period in accordance with the accepted Schedule of Values. Final Payment shall be the balance of the stated Lump Sum as adjusted by approved Change Orders.

Clarifier Modifications and Sludge Collection Box

9. Clarifier Misc. Metal Assemblies. Shall include all equipment, labor, and incidentals required to furnish and install Telescoping Valves in the Sludge Collection Box, replace the Clarifier Splitter Box Aluminum Slide Gates, and replace the Clarifier Influent Overflow Weir Gates as shown on the Construction Drawings. This item shall also include any other metal assemblies required to complete the Clarifier Modifications.

   A. Measurement: Shall be in accordance with the accepted Schedule of Values.

   B. Payment: Progress payments shall be based on the actual percentage of work satisfactorily completed during the progress payment period in accordance with the accepted Schedule of Values. Final Payment shall be the balance of the stated Lump Sum as adjusted by approved Change Orders.

10. Clarifier Process Piping and Structures. Shall include all materials, labor, and incidentals

required to furnish and install all process piping, valves, and associated structures as shown on the Construction Drawings for the Clarifier Modifications and Sludge Collection Box. This item includes, but is not limited to, trench excavation, bedding, pipe joint and fittings, connection to valves and other appurtenances, connection to new or existing structures or pipes, the Sludge Collection Box and other manhole structures, trench backfill and compaction, and testing for the scum and sludge piping. This item also includes excavation of all materials for structure installation, subgrade material and preparation, backfill of proposed structures, borrow pits and/or fill/spoil material hauled to or from the site (if required), formation of embankments, and finished grading to the elevations shown on the Construction Drawings.

A. Measurement: Shall be in accordance with the accepted Schedule of Values.

B. Payment: Progress payments shall be based on the actual percentage of work satisfactorily completed during the progress payment period in accordance with the accepted Schedule of Values. Final Payment shall be the balance of the stated Lump Sum as adjusted by approved Change Orders.

11. Clarifier #3 Cleaning. Shall include all material, labor, and incidentals required for the cleaning of clarifier #3, as directed by the Engineer, in order return the clarifier to an operable state. At minimum, this item shall include removing all liquids and solids from the clarifier, cleaning clarifier mechanical assemblies of any solids buildup or corrosion, and cleaning all influent, scum, sludge draw, and tank drain piping of the clarifier.

    A. Measurement: Shall be in accordance with the accepted Schedule of Values.

    B. Payment: Shall be in full when the Clarifier #3 Cleaning is complete.

Filter System

12. Filter Concrete Structure: Shall include all equipment, material, labor, and incidentals required to construct a reinforced concrete structure for the Filter System, and to provision the structure with necessary features to permit installation of mechanical assemblies; connection of external and internal piping and electrical systems; and installation of aluminum grating, handrails, ladders, and accessories. This includes wall pipes and wall sleeves with associated incidentals required for wall or slab penetrations. This item also includes excavation of all materials for Filter structure installation, subgrade material and preparation, backfill of proposed structure, borrow pits and/or fill/spoil material hauled to or from the site (if required), formation of embankments, and finished grading to the elevations shown on the Construction Drawings.

    A. Measurement: Shall be in accordance with the accepted Schedule of Values.

    B. Payment: Progress payments shall be based on the actual percentage of work satisfactorily completed during the progress payment period in accordance with the accepted Schedule of Values. Final Payment shall be the balance of the stated Lump Sum as adjusted by approved Change Orders.

13. Filter System Complete. Shall include all material, labor, and incidentals required to furnish and install a complete operational Filter System as shown on the Construction Drawings, or

directed by the Engineer, including, but not limited to, installation of associated process piping, valves, and associated appurtenances, including trench excavation, bedding, thrust blocking, pipe joint and fittings, connection to valves and other appurtenances, connection to new or existing structures or pipes, trench backfill and compaction, testing for the filter backwash, drain, overflow, influent, and effluent piping; and installation of aluminum handrails, floor grating, ladder assembly, and effluent weirs. This item also includes the installation of mechanical filter assemblies and drives, filter media, pumps, controls, and other components to be provided by the system manufacturer, as outlined in Section 46 61 00 and paid by line item 31. In addition, all items shown on the Construction Drawings for the installation of the Filter System not specifically itemized within the Bid Form shall also be considered part of this line item. Not included in Filter System Complete is electrical supply to the system controls and Filter System Components, which is included in item 4 and 31.

A. Measurement: Shall be in accordance with the accepted Schedule of Values.

B. Payment: Progress payments shall be based on the actual percentage of work satisfactorily completed during the progress payment period in accordance with the accepted Schedule of Values. Final Payment shall be the balance of the stated Lump Sum as adjusted by approved Change Orders.

Parshall Flume / Chlorine Contact Chamber / Cascade Aeration Structure

14. Parshall Flume, Chlorine Contact Chamber, Cascade Aeration Concrete Structure: Shall include all equipment, material, labor, and incidentals required to construct a reinforced concrete structure for the Parshall Flume/Chlorine Contact Chamber/Cascade Aeration Structure, and to provision the structure with necessary features to permit installation of mechanical assemblies and hydraulic gates; connection of external and internal piping and electrical systems; and installation of aluminum grating and accessories. This includes wall pipes and wall sleeves with associated incidentals required for wall or slab penetrations. This item also includes excavation of all materials for structure installation, subgrade material and preparation, backfill of proposed structure, borrow pits and/or fill/spoil material hauled to or from the site (if required), formation of embankments, and finished grading to the elevations shown on the Construction Drawings.

    A. Measurement: Shall be in accordance with the accepted Schedule of Values.

    B. Payment: Progress payments shall be based on the actual percentage of work satisfactorily completed during the progress payment period in accordance with the accepted Schedule of Values. Final Payment shall be the balance of the stated Lump Sum as adjusted by approved Change Orders.

15. Parshall Flume, Chlorine Contact Chamber, Cascade Aeration Structure Complete. Shall include all equipment, material, labor, and incidentals required to install a complete operational Parshall Flume/Chlorine Contact Chamber/Cascade Aeration as shown on the Construction Drawings, or directed by the Engineer, including, but not limited to, installation of associated process piping, valves, and associated appurtenances, including trench excavation, bedding, thrust blocking, pipe joint and fittings, connection to valves and other appurtenances, connection to new or existing structures or pipes, trench backfill and compaction, and testing for the chemical diffuser assemblies, chemical feed lines, tank

drains, and effluent piping; manhole structures for the Cascade Aeration Structure effluent piping; installation of a prefabricated Parshall Flume insert along with an Ultrasonic Level Transducer for flow measurement in the parshall flume channel; installation of miscellaneous metal assemblies, including aluminum grating and aluminum stop gates; and relocation of the existing Effluent Autosampler as shown on the Construction Drawings. In addition, all items shown on the Construction Drawings for the installation of the Parshall Flume, Chlorine Contact Chamber, and Cascade Aeration Structure not specifically itemized within the Bid Form shall also be considered part of this line item. Not included in this line item is electrical supply or SCADA for the Parshall Flume, which is included in items 4 and 5.

A. Measurement: Shall be in accordance with the accepted Schedule of Values.

B. Payment: Progress payments shall be based on the actual percentage of work satisfactorily completed during the progress payment period in accordance with the accepted Schedule of Values. Final Payment shall be the balance of the stated Lump Sum as adjusted by approved Change Orders.

RAS Pump Station & Force Main

16. RAS Pump Station and Force Main. Shall include all materials, labor, equipment, and incidentals required to furnish and install an 8-foot diameter RAS wetwell and valve vault with associated RAS piping, including excavation and backfill, subgrade preparation, foundation, riser sections, pipe connection features, lid and hatch assemblies, and complete Davit Crane Assembly as shown on the Construction Drawings. This item includes borrow pits and/or fill/spoil material hauled to or from the site (if required), forming embankments, as well as top soil to prepare finished grade for seeding as detailed in the Erosion Control Plans. This item also includes the RAS force main and associated valves, structures, and appurtenances from connection with the RAS pumps to its termination in the Staged Reactor, as shown on the Construction Drawings. Also included in this item is the RAS gravity sewer overflow from the RAS Wetwell to an existing manhole as shown on the plans, and the 8-Inch Electromagnetic Flow Meter, including all necessary sensors, signal convertors, and wiring for incorporation with the controls. This item includes trench excavation, bedding, thrust blocking, pipe joint and fittings, connection to new and existing structures and piping, trench backfill and compaction, and testing. In addition, all items shown on the Construction Drawings for the installation of the RAS Pump Station and Force Main not specifically itemized within the Bid Form shall also be considered part of this line item.

    A. Measurement: Shall be in accordance with the accepted Schedule of Values.

    B. Payment: Progress payments shall be based on the actual percentage of work satisfactorily completed during the progress payment period in accordance with the accepted Schedule of Values. Final Payment shall be the balance of the stated Lump Sum as adjusted by approved Change Orders.

17. RAS Pumps and Control Panel. Shall include all equipment, labor, and incidentals required to furnish and install three (3) RAS Pumps. This item includes, but is not limited to RAS Pumps, pump base elbows, Control Panel, float switches, pressure transducer, guide rails, lifting chain, and control and power cables. Electrical supply to the Control Panel and

connection to SCADA are not included in this item, but is included in line items 4 and 5, respectively.

A. Measurement: Shall be in accordance with the accepted schedule of values.

B. Payment: Progress payments shall be based on the actual percentage of work satisfactorily completed during the progress payment period in accordance with the accepted Schedule of Values. Final Payment shall be the balance of the stated Lump Sum as adjusted by approved Change Orders.

Aerobic Digestor

18. Aerobic Digestor Complete. Shall include all material, labor, and incidentals required to furnish and install a complete operational Aerobic Digestor and to retrofit the existing Aerobic Digestor with new mechanical equipment, whether specifically listed herein or not. This includes, but is not limited to, site work for the installation of precast Aerobic Digestor concrete tank components as specified in Section 43 41 63, excavation of all materials for Aerobic Digestor structure installation, subgrade material and preparation, backfill of the proposed structure, borrow pits and/or fill/spoil material hauled to or from the site (if required), formation of embankments, and finished grading to the elevations shown on the Construction Drawings. This item also includes installation of mechanical components in the new and existing digestor, including, but not limited to, mixers, controls, components for the existing floating aerators to be repurposed, and other components to be provided as outlined in Section 46 73 21 and shown on the Construction Drawings. This item also includes all miscellaneous metal assemblies and process piping, including telescoping valves, aluminum stairs and handrails, trench excavation, bedding, thrust blocking, pipe joint and fittings, valves and other appurtenances, connection to new or existing structures or pipes, trench backfill and compaction, and testing for the WAS supply, supernatant, and sludge drain piping for the Aerobic Digestor. Not included in Aerobic Digestor Components is electrical supply to the system controls or provision and installation of precast concrete tank components, which is included in items 4 and 32.

    A. Measurement: Shall be in accordance with the accepted Schedule of Values.

    B. Payment: Progress payments shall be based on the actual percentage of work satisfactorily completed during the progress payment period in accordance with the accepted Schedule of Values. Final Payment shall be the balance of the stated Lump Sum as adjusted by approved Change Orders.

19. Rehab of Ex. Digestor. Shall include all materials, labor, and incidentals required to clean and rehabilitate the existing Aerobic Digestor as directed by the Engineer. This includes, but is not limited to cleaning the mechanical assemblies and interior walls to be free from solids buildup, making any concrete repairs necessary to maintain structural integrity of the digestor, and preparing the existing digestor for installation of the components listed in item 18.

    A. Measurement: Shall be in accordance with the accepted Schedule of Values.

    B. Payment: Shall be in full when the Rehab of Existing Digestor has been completed.

Dewatering Building

20. Belt Press Installation. Shall include all materials, labor, and incidentals required to install a complete operational Belt Press Dewatering System as outlined in Section 46 76 00 and shown on the Construction Drawings. The Belt Press, Polymer Feed equipment, and necessary chemicals for operation will be provided by the City. The Contractor will be responsible for equipment installation, construction of a wooden platform, and any other components required for the system as show on the Construction Drawings and not provided by the manufacturer as specified in Section 46 76 00. Not included in this item is electrical supply to the controls, which is included in line item 4.

    A. Measurement: Shall be in accordance with the accepted Schedule of Values.

    B. Payment: Progress payments shall be based on the actual percentage of work satisfactorily completed during the progress payment period in accordance with the accepted Schedule of Values. Final Payment shall be the balance of the stated Lump Sum as adjusted by approved Change Orders.

Influent / Headworks Modifications

21. Influent Gravity Sewer Modifications. Shall include all materials, labor, and incidentals required to furnish and install gravity sewer and manholes as shown on the Construction Drawings to make the Influent Gravity Sewer Modifications. This item also includes relocation of the Influent Autosampler Intake as shown on the Construction Drawings or directed by the Engineer, including flexible tubing, PVC conduit, anchoring components, trench excavation, concrete coring and grouting, and backfill.

    A. Measurement: Shall be in accordance with the accepted Schedule of Values.

    B. Payment: Shall be in full when Influent Gravity Sewer Modifications is completed.

22. Chemical Feed System. Shall include all materials, labor, and incidentals required to furnish a Chemical Feed System for Magnesium Hydroxide. This item includes, but is not limited to, the chemical storage tank, chemical feed pump skid, and chemical feed piping as shown on the Construction Drawings.

    A. Measurement: Shall be in accordance with the accepted Schedule of Values.

    B. Payment: Shall be in full when the Chemical Feed System is completed.

Erosion Control Items

23. Silt Fence (Sd1-S). Shall include all materials, labor, and incidentals required for the installation of Silt Fence as shown on the Construction Drawings or as directed by the Engineer. This includes proper maintenance of the installed fence, as well as removal of fence and accumulated sediment material upon project completion.

    A. Measurement: Shall be the actual number of linear feet of Silt Fence installed.

    B. Payment: Shall be made by multiplying the actual number of linear feet of Silt Fence installed times the unit price identified in the Bid Schedule.

24. Construction Exit (Co). Shall include all materials, labor, and incidentals required for the installation of a Construction Exit as shown on the Construction Drawings or as directed by the Engineer. This includes proper maintenance of the exit, as well as removal of exit and accumulated sediment material upon project completion.

    A. Measurement: Shall be the actual number of Construction Exits installed.

    B. Payment: Shall be made by multiplying the actual number of Construction Exits installed times the unit price identified in the Bid Schedule.

25. Disturbed Area Stabilization (Ds1, Ds2, Ds3). Shall include all materials, labor, and incidentals required to provide Disturbed Area Stabilization by mulching and temporary seeding for the duration of the project as shown on the Erosion Control Plans. This item also includes the establishment of a hearty stand of grass over all disturbed areas by project closeout.

    A. Measurement: Shall be the actual number of square yards of Disturbed Area Stabilized.

    B. Payment: Shall be made by multiplying the actual number of square yards of Disturbed Area Stabilized times the unit price identified in the Bid Schedule.

1.05 ALLOWANCES

26. Mass Unsuitable Soils. Shall include equipment, material, labor, and incidentals required for excavation of unsuitable soils below existing grade or proposed subgrade elevation at time of construction to the limits as directed by the Engineer, in excess of that required for the construction of the structures or pipes as shown on the Construction Drawings, and the placement of stabilization filter fabric and compaction of structural fill material.

    A. Measurement: Shall be the actual number of cubic yards of unsuitable soil removed for construction of the structures and pipes.

    B. Payment: Shall be made by multiplying the actual number of cubic yards of unsuitable soil removed times the unit price identified in the Bid Schedule. Payment will include proper disposal of the excavated material elsewhere on-site by the Contractor, and supply of structural fill material.

27. Testing and Inspection Allowance.

    A. Costs Included in Testing and Inspecting Allowances:

        i. Cost of engaging testing and inspecting agency.

        ii. Costs of testing services used by Contractor separate from Contract Document requirements.

        iii. Execution of tests and inspecting.

        iv. Reporting results.

    B. Costs Not Included in Testing and Inspecting Allowance but Included in Contract Sum/Price:

i. Costs of incidental labor and facilities required to assist testing or inspecting agency.

ii. Costs of retesting upon failure of previous tests as determined by Architect/Engineer.

C. Payment Procedures:

i. Submit one copy of inspecting or testing firm's invoice with next Application for Payment.

ii. Pay invoice upon approval by Engineer.

D. Testing and Inspecting Allowance Schedule:

i. Include sum of $< 20,000 > for payment of testing laboratory services specified in Section 01 45 29 - Testing Laboratory Services.

E. Differences in cost will be adjusted by Change Order.

28. Utility Relocation Allowance. This item will be an allowance used to pay for utility relocations necessary for completion of the proposed work, not a part of an existing City Franchise Agreement, as directed by the Engineer during the project. This allowance shall not include minor relocations and adjustments to grade of utility services.

A. Measurement: Mutually agreed upon price via itemized summary used to pay for necessary utility relocations as directed by the Engineer.

B. Payment: Shall be made at conclusion of work by Change Order.

C. At closeout of Contract, funds remaining in this allowance will be credited to Owner by Change Order.

29. Engineer Directed Changes. This item will be an allowance used to pay for changes made by the Engineer or Owner during the project. This item may also be used as a contingency allowance for unanticipated costs, such as relocating existing equipment or controls to complete work.

A. Contractor's costs for products, delivery, installation, labor, insurance, payroll, taxes, bonding, equipment rental, overhead and profit will be included in Change Orders authorizing expenditure of funds from this allowance.

B. Measurement: Mutually agreed upon price via itemized summary used to pay for changes made by the Owner/Engineer during the project.

C. Payment will be made at conclusion of work for proposed changes by Change Order.

D. At closeout of Contract, funds remaining in this allowance will be credited to Owner by Change Order.

30. Phased Activated Sludge System Components.

A. General

i. All components of the Phased Activated Sludge System shall be provided by Aqua-Aerobic Systems, Inc. 6306 North Alpine Road, Loves Park Illinois, 61111; or by its sales representative, Templeton & Associates, 4324 Brogdon Exchange, Suwanee, Georgia, 30024. Contact Jordan Longoria with Templeton & Associates at 770-614-8550.

ii. The Phased Activated Sludge System Components shall include all equipment and incidentals required to furnish a functioning Phased Activated Sludge System as outlined in Section 46 53 00, including but not limited to: mixer assemblies, aerator assemblies, level sensor assemblies, low load recycle pump assembly, WAS pump assembly, transfer pump assemblies, scum removal assembly, weir and baffle assemblies, miscellaneous spare parts, AquaPASS instrumentation, and AquaPASS controls. The Contractor shall coordinate component installation accordingly to test, troubleshoot, and place into service a fully functional treatment system.

iii. The listed allowance is inclusive of tax and delivery to the project site.

B. Should the final net cost be more or less than the specified amount of the Phased Activated Sludge System Components allowance, the Contract will be adjusted accordingly by Change Order. The amount of change will not recognize any changes in handling costs at the site, labor, overhead, profit and other expenses caused by the adjustment to the allowance.

C. Documentation

i. Submit two (2) copies of Phased Activated Sludge System Components invoices with each periodic payment request.

D. Payment Procedure

i. Upon agreement by the parties for the cost of completed Phased Activated Sludge System work to be paid by allowance, payment shall be made for the progress payment period of the month in which the work has been completed.

31. <u>Filter System Components</u>

A. General:

i. All components of the filter system shall be provided by Aqua-Aerobic Systems, Inc. 6306 North Alpine Road, Loves Park Illinois, 61111; or by its sales representative, Templeton & Associates, 4324 Brogdon Exchange, Suwanee, Georgia, 30024. Contact Jordan Longoria with Templeton & Associates at 770-614-8550.

ii. The filter system components shall include all equipment and incidentals required to furnish a complete filter system as outlined in Section 46 61 00, including, but not limited to: AquaDisc Centertube Assemblies; AquaDisc Drive Assemblies, AquaDisc Backwash/Sludge Assemblies; Influent Weir Assemblies, AquaDisc Instrumentation; AquaDisc Valves; AquaDisc Miscellaneous/Spare Parts; and AquaDisc Controls with Starters. The

Contractor shall coordinate component installation accordingly to test, troubleshoot, and place into service a fully functional filter system.

iii. The listed allowance is inclusive of tax and delivery to the project site.

B. Should the final net cost be more or less than the specified amount of the Filter System Components allowance, the Contract will be adjusted accordingly by Change Order. The amount of change will not recognize any changes in handling costs at the site, labor, overhead, profit and other expenses caused by the adjustment to the allowance.

C. Documentation

i. Submit two (2) copies of Filter System Components invoices with each periodic payment request.

D. Payment Procedure

i. Upon agreement by the parties for the cost of completed Filter System work to be paid by allowance, payment shall be made for the progress payment period of the month in which the work has been completed.

32. Precast Concrete Tank Structures.

E. General:

i. All components of the Precast Concrete Tank Structures for the Staged Reactor and Aerobic Digestor shall be provided by Dutchland LLC 160 Route 41, Gap, Pennsylvania, 17527; or by its sales representative, Templeton & Associates, 4324 Brogdon Exchange, Suwanee, Georgia, 30024. Contact Jordan Longoria with Templeton & Associates at 770-614-8550.

ii. This item shall include all equipment, material, and labor required to furnish and install precast concrete tank structures as outlined in section 43 41 63, including, but not limited to: design, manufacture, delivery, and installation of Staged Reactor and Aerobic Digestor concrete tank structures, including cast-in-place reinforced concrete base slabs. The Contractor shall coordinate installation and related site work with the supplier. Contractor expenses related with this task, including site preparation, shall be included in line items 8 and 18.

iii. The listed allowance is inclusive of tax, delivery to the project site, and installation services provided by Dutchland, LLC.

F. Should the final net cost be more or less than the specified amount of the Filter System Components allowance, the Contract will be adjusted accordingly by Change Order. The amount of change will not recognize any changes in handling costs at the site, labor, overhead, profit and other expenses caused by the adjustment to the allowance.

G. Documentation

i. Submit two (2) copies of Precast Concrete Tank Structures invoices with

each periodic payment request.

H. Payment Procedure

i. Upon agreement by the parties for the cost of completed Precast Concrete Tank work to be paid by allowance, payment shall be made for the progress payment period of the month in which the work has been completed.

33. Components Allowance.

A. General:

i. The components allowance shall be used to compensate for surcharges in quoted equipment and material pricing due to market variability and supply chain issues brought on by the COVID-19 pandemic.

ii. Should the final net cost be more or less than the specified amount of the allowance, the Contract will be adjusted accordingly by Change Order. The amount of change will not recognize any changes in handling costs at the site, labor, overhead, profit and other expenses caused by the adjustment to the allowance. The amount of change will not recognize any changes in material or equipment quantity due to variance from the Construction Drawings or quantity take off discrepancies. This allowance may only be used for material and equipment surcharges.

iii. Unforeseen material/equipment surcharges which may be paid by cash allowance shall be at the discretion of the Engineer and Owner.

B. Documentation

i. Submit two (2) copies of invoices with each periodic payment request for material surcharges, and include dated original equipment/material quotes from Bid Date along with itemized invoices to justify additional compensation.

C. Payment Procedure

i. Upon agreement by the parties for the cost of material and equipment surcharges to be paid for by allowance, payment shall be made for the progress payment period of the month in which the work has been completed.

ii. At closeout of Contract, funds remaining in this allowance will be credited to Owner by Change Order.

1.06 ADDITIVE ALTERNATES

Additive Alternates will be added to the Base Bid Total and included in the total Contract Price at the option of the Owner.

34. Clarifier Trough Brush System. Shall include all equipment, labor, and incidentals required to furnish and install a Clarifier Trough Brush Cleaning System, as specified in Section 46 43 21, in each of the three (3) clarifiers, along with testing and startup services.

A. Measurement: Shall be the actual number of Clarifier Trough Brush Systems installed for the Clarifier Modifications.

B. Payment: Shall be made by multiplying the actual number of Clarifier Trough Brush Systems installed for the Clarifier Modifications times the unit price identified in the Bid Schedule.

35. Dewatering Building Demolition Complete. Shall include all equipment, labor, and incidentals required to completely remove existing sludge dewatering equipment and other items shown for demolition in the Construction Drawings from the Dewatering Building, including proper disposal of the equipment and material off-site, following start-up of the new belt press.

    A. Measurement: Shall be in accordance with the accepted Schedule of Values.

    B. Payment: Shall be in full when Dewatering Building Demolition is completed.

36. Cast-in-Place Concrete Staged Aeration Reactor Structure. Shall include all equipment, labor, material, and incidentals required to provide a cast-in-place concrete structure for the Staged Aeration Reactor, as shown on the Construction Drawings, in lieu of the pre-cast structure included on the Bid Form. The structure shall include all cast-in components required for mechanical installations, including but not limited to pipe sleeves and anchoring systems. This additive alternate will be used in conjunction with line item 38 below.

    A. Measurement: Shall be in accordance with the accepted Schedule of Values.

    B. Payment: Progress payments shall be based on the actual percentage of work satisfactorily completed during the progress payment period in accordance with the accepted Schedule of Values. Final Payment shall be the balance of the stated Lump Sum as adjusted by approved Change Orders.

37. Cast-in-Place Concrete Aerobic Digestor Structure. Shall include all equipment, labor, material, and incidentals required to provide a cast-in-place concrete structure for the Aerobic Digestor, as shown on the Construction Drawings, in lieu of the pre-cast structure included on the Bid Form. The structure shall include all cast-in components required for mechanical installations, including but not limited to pipe sleeves and anchoring systems. This additive alternate will be used in conjunction with line item 39 below.

    A. Measurement: Shall be in accordance with the accepted Schedule of Values.

    B. Payment: Progress payments shall be based on the actual percentage of work satisfactorily completed during the progress payment period in accordance with the accepted Schedule of Values. Final Payment shall be the balance of the stated Lump Sum as adjusted by approved Change Orders.

1.07 DEDUCTIVE ALTERNATES

At the option of the Owner, Deductive Alternates will be removed from the Base Bid Total and will reduce the total Contract Price by the amount listed on the Bid Form.

38. Pre-Cast Concrete Staged Reactor Structure. Shall include the costs for all equipment, labor, material, and incidentals associated with the provision and installation of the Pre-Cast Concrete Staged Reactor Structure as described in line items 8 and 32 above. This deductive alternate will be used in conjunction with line item 36 above.

    A. Measurement: Shall be in accordance with the accepted Schedule of Values.

39. Pre-Cast Concrete Aerobic Digestor Structure. Shall include the costs for all equipment, labor, material, and incidentals associated with the provision and installation of the Pre-Cast Concrete Aerobic Digestor Structure as described in line items 18 and 32 above. This deductive alternate will be used in conjunction with line item 37 above.

    A. Measurement: Shall be in accordance with the accepted Schedule of Values.

40. Aerobic Digestor Complete. Shall include the costs for all equipment, labor, material, and incidentals associated with the provision and installation of the Aerobic Digestor and rehab of the existing digestor as described in line items 18 and 19 above, including electrical work, associated piping, grading, and demolition. This deductive item shall also include all costs associated with the Pre-Cast Concrete Aerobic Digestor Structure as described in line item 32, and shall be used at the Owner's option to remove the Aerobic Digestor completely from the Scope of Work.

    A. Measurement: Shall be in accordance with the accepted Schedule of Values.

1.08 SCHEDULE OF VALUES

A. Submit printed schedule on EJCDC C-620 or Contractor's standard form or electronic media printout will be considered for this use.

B. Submit Schedule of Values within 20 days after date established in Notice to Proceed.

C. Format: Use Table of Contents of this Project Manual. Identify each line item with number and title of major Specification Section. Also identify site mobilization, and bonds and insurance.

D. Include in each line item amount of allowances as specified in this Section. For unit cost allowances, identify quantities taken from Contract Documents multiplied by unit cost to achieve total for each item.

E. Include within each line item, direct proportional amount of Contractor's overhead and profit.

F. Revise schedule to list approved Change Orders with each Application for Payment.

1.09 EXISTING CONDITIONS PHOTOGRAPHS AND VIDEO

A. Contractor shall provide to Owner complete and detailed photographs and video of entire project site, indicating existing site conditions. Contractor to submit with Schedule of Values.

1.10 APPLICATION FOR PAYMENT

A. For each item, provide a column for listing each of the following:

1. Item Number.
2. Description of work
3. Scheduled Values.
4. Previous Applications.
5. Work in Place and Stored Material under this Application.
6. Authorized Change Orders.
7. Total Completed and Stored to Date of Application.
8. Percentage of Completion.
9. Balance to Finish.
10. Retainage.
11. Construction Photographs.

B. Submittal Procedures

1. Submit six (6) copies of each Application for Payment.
2. Submit and updated construction schedule with each application for Payment.
3. Payment Period: Submit on the 25th of each month.
4. Submit with transmittal letter as specified for Submittals in Section 01 33 00.
5. Submit waivers showing that suppliers and sub-contractors have been paid the amount due from the previous invoice.
6. The first application will be processed after owner agreement with the construction schedule.

C. Substantiating Data for Progress Payments

1. When the Engineer requires substantiating data, submit suitable information with a cover letter identifying:
    a. Project.
    b. Application for Payment number and date.

c. Detailed list of enclosures.

d. For stored products:

1) Item number and identification as shown on the Application for Payment.

2) Description of specific material

3) Invoices for stored products

2. Submit one copy of data and cover letter for each copy of the Application for Payment.

3. Maintain an updated set of drawings to be used as record drawings in accordance with Section 01 70 00. Exhibit the updated record drawings for review by the Engineer.

1.11 CHANGE PROCEDURES

A. Submittals: Submit name of individual who is authorized to receive change documents and is responsible for informing others in Contractor's employ or Subcontractors of changes to the Work.

B. Carefully study and compare Contract Documents before proceeding with fabrication and installation of Work. Promptly advise Engineer of any error, inconsistency, omission, or apparent discrepancy.

C. Requests for Interpretation (RFI) and Clarifications: Allot time in construction scheduling for liaison with Engineer; establish procedures for handling queries and clarifications.

1. Use CSI Form 13.2A - Request for Interpretation or Contractor’s standard for requesting interpretations.

2. Engineer may respond with a direct answer on the Request for Interpretation form.

D. Engineer will advise of minor changes in the Work not involving adjustment to Contract Sum/Price or Contract Time by issuing supplemental instructions in Section 00 94 39 Field Order.

E. Engineer may issue Notice of Change in Section 00 94 49 Work Change Directive including a detailed description of proposed change with supplementary or revised Drawings and Specifications, a change in Contract Time for executing the change. Contractor will prepare and submit estimate within 7 days.

F. Contractor may propose changes by submitting a request for change to Engineer, describing proposed change and its full effect on the Work. Include a statement describing reason for the change and the effect on Contract Sum/Price and Contract Time with full documentation.

G. Execution of Change Orders: Engineer will issue Change Orders for signatures of parties as provided in Conditions of the Contract in Section 00 94 63 Change Order.

H. Correlation of Contractor Submittals:

1. Promptly revise Schedule of Values and Application for Payment forms to record each authorized Change Order as separate line item and adjust Contract Sum/Price.

2. Promptly revise Progress Schedules to reflect change in Contract Time, revise subschedules to adjust times for other items of Work affected by the change, and resubmit.

3. Promptly enter changes in Record Documents.

1.12 DEFECT ASSESSMENT

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

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

C. The defective Work may remain, but unit sum/price will be adjusted to new sum/price at discretion of Engineer and Owner.

D. Defective Work will be partially repaired according to instructions of Engineer and Owner, and unit sum/price will be adjusted to new sum/price at discretion of Engineer and Owner.

E. Individual Specification Sections may modify these options or may identify specific formula or percentage sum/price reduction.

F. Authority of Engineer and Owner to assess defects and identify payment adjustments is final.

G. Nonpayment for Rejected Products: Payment will not be made for rejected products for any of the following reasons:

1. Products wasted or disposed of in a manner that is not acceptable.

2. Products determined as unacceptable before or after placement.

3. Products not completely unloaded from transporting vehicle.

4. Products placed beyond lines and levels of the required Work.

5. Products remaining on hand after completion of the Work.

6. Loading, hauling, and disposing of rejected products.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01 30 00

ADMINISTRATIVE REQUIREMENTS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Contractor coordination requirements.

B. Preconstruction meeting.

C. Progress meetings.

D. Preinstallation meetings.

E. Closeout meeting.

F. Alteration procedures.

1.2 CONTRACTOR COORDINATION REQUIREMENTS

A. Coordinate scheduling, submittals, and Work of various Sections of Project Manual to ensure efficient and orderly sequence of installation of interdependent construction elements, with provisions for accommodating items installed later.

B. Verify that utility requirements and characteristics of operating equipment are compatible with building utilities. Coordinate Work of various Sections having interdependent responsibilities for installing, connecting to, and placing operating equipment in service.

C. Coordinate space requirements, supports, and installation of mechanical and electrical Work indicated diagrammatically on Drawings. Follow routing shown for pipes, ducts, and conduit as closely as practical; place runs parallel with lines of building. Use spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs.

1. Coordination Drawings: Prepare as required to coordinate all portions of Work. Show relationship and integration of different construction elements that require coordination during fabrication or installation to fit in space provided or to function as intended. Indicate locations where space is limited for installation and access and where sequencing and coordination of installations are important.

D. Coordination Meetings: In addition to other meetings specified in this Section, hold coordination meetings with personnel and Subcontractors to ensure coordination of Work.

E. Coordinate completion and clean-up of Work of separate Sections in preparation for Substantial Completion.

F. After Owner's occupancy of premises, coordinate access to Site for correction of defective Work and Work not complying with Contract Documents, to minimize disruption of Owner's activities.

1.3 PRECONSTRUCTION MEETING

A. **Owner/Engineer** will schedule and preside over meeting after Notice of Award.

B. Attendance Required: Engineer, Owner, Resident Project Representative, appropriate governmental agency representatives, Construction Manager, major Subcontractors, and Contractor.

C. Minimum Agenda:

1. Execution of Owner-Contractor Agreement.
2. Submission of executed bonds and insurance certificates.
3. Distribution of Contract Documents.
4. Submission of list of Subcontractors, list of products, schedule of values, and Progress Schedule.
5. Designation of personnel representing parties in Contract.
6. Communication procedures.
7. Procedures and processing of requests for interpretations, field decisions, submittals, substitutions, Applications for Payments, proposal request, Change Orders, and Contract closeout procedures.
8. Scheduling.
9. Critical Work sequencing.
10. Scheduling activities of Geotechnical Engineer, testing agencies, utilities verification, etc.

D. Owner will: Record minutes and email to participants within [**ten**] days after meeting.

1.4 PROGRESS MEETINGS

A. Contractor to schedule and administer meetings throughout progress of the Work at monthly intervals, unless directed otherwise by Engineer.

B. Attendance Required: Job superintendent, major Subcontractors, suppliers, Engineer, and Owner, as appropriate to agenda topics for each meeting.

C. Minimum Agenda:

1. Review minutes of previous meetings.
2. Review of Work progress.
3. Field observations, problems, and decisions.

4. Identification of problems impeding planned progress.
5. Review of submittal schedule and status of submittals.
6. Review of off-Site fabrication and delivery schedules.
7. Maintenance of Progress Schedule.
8. Corrective measures to regain projected schedules.
9. Planned progress during succeeding work period.
10. Coordination of projected progress.
11. Maintenance of quality and work standards.
12. Effect of proposed changes on Progress Schedule and coordination.
13. Other business relating to Work.

D. Contractor: Will record minutes and email to participants within five days after meeting.

1.5 PREINSTALLATION MEETINGS

A. When required in individual Specification Sections, convene preinstallation meetings at Project Site before starting Work of specific Section.

B. Require attendance of parties directly affecting, or affected by, Work of specific Section.

C. Notify Engineer five days in advance of meeting date.

D. Prepare agenda and preside over meeting:

1. Review conditions of installation, preparation, and installation procedures.
2. Review coordination with related Work.

1.6 CLOSEOUT MEETING

A. Contractor will schedule Project closeout meeting with sufficient time to prepare for requesting Substantial Completion. Preside over meeting and be responsible for minutes.

B. Attendance Required: Contractor, Subcontractors, Engineer, Owner, and others appropriate to agenda.

C. Notify Engineer five days in advance of meeting date.

D. Minimum Agenda:

1. Start-up of facilities and systems.
2. Operations and maintenance manuals.
3. Testing, adjusting, and balancing.

4. System demonstration and observation.
5. Operation and maintenance instructions for Owner's personnel.
6. Contractor's inspection of Work.
7. Contractor's preparation of an initial "punch list."
8. Procedure to request Engineer inspection to determine date of Substantial Completion.
9. Completion time for correcting deficiencies.
10. Inspections by authorities having jurisdiction.
11. Certificate of Occupancy and transfer of insurance responsibilities.
12. Partial release of retainage.
13. Final cleaning.
14. Preparation for final inspection.
15. Closeout Submittals:
    a. Project record documents.
    b. Operating and maintenance documents.
    c. Operating and maintenance materials.
    d. Affidavits.
16. Final Application for Payment.
17. Contractor's demobilization of Site.
18. Maintenance.

E. Engineer to record minutes and email to participants within five days after meeting.

PART 2 PRODUCTS (Not Used)

PART 3 EXECUTION

3.1 ALTERATION PROCEDURES

A. Entire facility will be occupied for normal operations during progress of construction. Cooperate with Owner in scheduling operations to minimize conflict and to permit continuous usage.

1. Perform Work not to interfere with operations of occupied areas.
2. Keep utility and service outages to a minimum and perform only after written approval of Owner.

3. Clean Owner-occupied areas daily. Clean spillage, mud, and heavy collection of dust in Owner-occupied areas immediately.

B. Materials: As specified in product Sections; match existing products with new and salvaged products for patching and extending Work.

C. Employ skilled and experienced installer to perform alteration and renovation Work.

D. Cut, move, or remove items as necessary for access to alterations and renovation Work. Replace and restore at completion. Comply with Section 01 70 00 - Execution and Closeout Requirements.

E. Remove unsuitable material not marked for salvage, including rotted wood, corroded metals, and deteriorated masonry and concrete. Replace materials as specified for finished Work.

F. Remove debris and abandoned items from area and from concealed spaces.

G. Prepare surface and remove surface finishes to permit installation of new Work and finishes.

H. Remove, cut, and patch Work to minimize damage and to permit restoring products and finishes to original or specified condition.

I. Where new Work abuts or aligns with existing Work, provide smooth and even transition. Patch Work to match existing adjacent Work in texture and appearance.

J. When finished surfaces are cut so that smooth transition with new Work is not possible, terminate existing surface along straight line at natural line of division and submit recommendation to Engineer for review.

K. Finish surfaces as specified in individual product Sections.

END OF SECTION

SECTION 01 33 00

SUBMITTAL PROCEDURES

PART 1 GENERAL

1.01 SCOPE

General procedures and requirements for submittals during the course of construction.

1.02 SECTION INCLUDES

A. Submittal Procedures.

B. Construction progress schedules.

C. Shop drawings.

D. Product data.

E. Samples

F. Miscellaneous Submittals.

G. Construction photographs / videos.

H. Resubmission requirements.

1.03 SUBMITTAL PROCEDURES

A. Sequentially number the transmittal forms. Resubmittals to have original number with an alphabetic suffix. (Example 1-A, 1-B, etc.)

B. Identify Project, Contractor, Subcontractor or supplier, pertinent Drawing sheet and detail number, and specification Section number, as appropriate.

C. Apply Contractor's stamp, signed or initialed certifying that review, verification of products required, field dimensions, adjacent construction work, and coordination of information, is in accordance with the requirements of the work and Contract Documents.

D. Submit submittal to Engineer.

E. Identify variations from Contract Documents and Product or system limitations which may be detrimental to successful performance of the completed work.

F. Make all submittals far enough in advance of scheduled dates for installation to provide all required time for reviews, for securing necessary approvals, for possible revision and resubmittal, and for placing orders and securing delivery.

G. In scheduling, allow sufficient time for the Engineer’s review following the receipt of the submittal.

1.04 CONSTRUCTION PROGRESS SCHEDULES

A. Submit 3 copies of initial progress schedule within 20 days after date of Owner-Contractor Agreement established in Notice to Proceed for Engineer review.

B. Revise and resubmit as required.

C. Submit revised schedules with each Application for Payment, identifying changes since previous version.

D. Show complete sequence of construction by activity, identifying work of separate stages and other logically grouped activities. Indicate the early and late start, early and late finish, float dates, and duration.

E. Indicate estimated percentage of completion for each item of work at each submission.

F. Indicate submittal dates required for shop drawings, product data, samples, and product delivery including those furnished by Owner and under Allowances.

1.05 SHOP DRAWINGS

A. Shop drawings shall include technical data, drawings, diagrams, procedure and methodology, performance curves, schedules, templates, patterns, test reports, calculations, instructions, measurements and similar information as applicable to the specific item for which the shop drawing is prepared. In addition to the number of copies required for return by the contractor submit 5 additional copies for Engineer.

B Drawings shall be presented in a clear and thorough manner. Details shall be identified by reference to sheet and detail, specification section, schedule or room numbers shown on the Contract Drawings.

C. Engineer Review

1. Allow a minimum of 30 days for the Engineer's initial processing of each submittal requiring review and response, except allow longer periods where Shop Drawings, Product Data and Samples processing must be delayed for coordination with subsequent submittals. The Engineer will advise the Contractor promptly when it is determined that a submittal being processed must be delayed for coordination. Allow a minimum of two weeks for reprocessing each submittal. Advise the Engineer on each submittal as to whether processing time is critical to progress of the Work, and therefore the Work would be expedited if processing time could be foreshortened.

2. Acceptable submittals will be marked "**No Exceptions Taken**". A minimum of five copies will be retained by the Engineer for Engineer's and the Owner's use and the remaining copies will be returned to the Contractor.

3. Submittals requiring minor corrections before the product is acceptable will be marked "**Make Corrections Noted**", The Contractor may order, fabricate and ship the items included in the submittals, provided the indicated

corrections are made. Drawings must be resubmitted for review and marked "No Exceptions Taken" prior to installation or use of products,

4. Submittals marked "**Revise and Resubmit**" must be revised to reflect required changes and the initial review procedure repeated.

5. The "**Rejected**" notation is used to indicate products which are not Acceptable. Upon return of a submittal so marked, the Contractor shall repeat the initial review procedure utilizing acceptable products.

6. Only two copies of items marked "Revise and Resubmit" and "Rejected" will be reviewed and marked. One copy will be retained by the Engineer and the other copy with all remaining unmarked copies will be returned to the Contractor for resubmittal.

D. No work or products shall be installed without a drawing or submittal bearing the "No Exceptions Taken" notation. The Contractor shall maintain at the job site a complete set of shop drawings bearing the Engineer's stamp.

E Substitutions: In the event the Contractor obtains the Engineer's approval for the use of products other than those which are listed first in the Contract Documents, the Contractor shall, at the Contractor's own expense and using methods approved by the Engineer, make any changes to structures, piping and electrical work that may be necessary to accommodate these products.

F Use of the "No Exceptions Taken" notation on shop drawings or other submittals is general and shall not relieve the Contractor of the responsibility of furnishing products of the proper dimension, size, quality, quantity, materials and all performance characteristics, to efficiently perform the requirements and intent of the Contract Documents. The Engineer's review shall not relieve the Contractor of responsibility for errors of any kind on the shop drawings. Review is intended only to assure conformance with the design concept of the Project and compliance with the information given in the Contract Documents. The Contractor is responsible for dimensions to be confirmed and correlated at the job site. The Contractor is also responsible for information that pertains solely to the fabrication processes or to the technique of construction and for the coordination of the work of all trades.

1.06 PRODUCT DATA

A. Product data includes standard printed information on materials, products and systems, not specially prepared for this Project, other than the designation of selections from among available choices printed therein.

B. Collect required data into one submittal for each unit of work or system, and mark each copy to show which choices and options are applicable to the Project. Include manufacturer's standard printed recommendations for application and use, compliance with standards, application of labels and seals, notation of field measurements which have been checked and special coordination requirements.

1.07 SAMPLES

A. Samples include both fabricated and un-fabricated physical examples of materials, products and units of work, both as complete units and as smaller portions of units of work, either for limited visual inspection or, where indicated, for more detailed testing and analysis.

B. Provide units identical with final condition of proposed materials or products for the work. Include "range" samples, not less than three units, where unavoidable variations must be expected, and describe or identify variations between units of each set. Provide full set of optional samples where the Engineer's selection is required. Prepare samples to match the Engineer's sample where indicated. Include information with each sample to show generic description, source or product name and manufacturer, limitations and compliance with standards. Samples are submitted for review and confirmation of color, pattern, texture and "kind" by the Engineer. Engineer will note "test" samples, except as otherwise indicated, for other requirements, which are the exclusive responsibility of the Contractor.

1.08 MISCELLANEOUS SUBMITTALS

Miscellaneous submittals related directly to the Work (non-administrative) include warranties, maintenance agreements, workmanship bonds, project photographs, survey data and reports, physical work records, statements of applicability, quality testing and certifying reports, copies of industry standards, record drawings, field measurement data, operating and maintenance materials, overrun stock, security/protection/safety keys and similar information, devices and materials applicable to the Work but not processed as shop drawings, product data or samples.

1.09 PROGRESS PHOTOGRAPHS / VIDEOS

A. Provide photographs and video of entire site depicting existing conditions as indicated in 01 20 00 Price and Payment Procedures.

B. Provide photographs of site and construction throughout progress of Work produced by an experienced photographer, acceptable to the Engineer and Owner.

C. Construction Photographs: Take construction photographs prior to each application for payment of the work accomplished for that payment period and as follows:

1. Site clearing.
2. Excavations and installed underground utilities.
3. Foundations/subgrade.
4. Infrastructure installations.
5. Paving
6. Erosion control measures.
7. Equipment installations.

8. Final completion.

D. Aerial Photographs: Required

1. Provide aerial photographs from four cardinal views at project completion.

2. Provide correct exposure and focus, high resolution and sharpness, maximum depth of field, and minimum distortion.

E. Deliver photographs with each Application for Payment with transmittal letter specified in this Section. Final completion photographs are to be delivered with request for final payment. Delivery of photographs may be in printed or digital format. If printed, each photograph shall be a minimum of 4-inches by 6-inches in dimension and shall be labeled to describe the photograph subject, location and date. If provided digitally, the photographs shall be provided in JPEG format and accompanied with a PDF format document describing each photograph with subject, location and date.

F. Deliver prints with each Application for Payment with transmittal letter specified in this Section. Final prints are to be delivered with request for final payment.

1.10 RESUBMISSION REQUIREMENTS

A. Shop Drawings

1. Revise initial drawings as required and resubmit as specified for initial submittal, with the resubmittal number shown.

2. Indicate on drawings all changes which have been made other than those requested by the Engineer.

B. Project Data and Samples: Resubmit new data and samples as specified for initial submittal with the resubmittal number shown.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01 40 00

QUALITY REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Regulatory requirements.

B. Quality control.

C. Tolerances.

D. References standards.

E. Labeling.

F. Mock-up requirements.

G. Manufacturer's field services.

1.02 REGULATORY REQUIREMENTS

A. Permits: Unless otherwise noted in the bidding documents or specification section 01 10 00 Summary, the Contractor shall, without additional expense to the Owner, be responsible for obtaining all necessary licenses and permits, including building permits, etc.

B. The contractor shall take proper safety and health precautions to protect the Work, the workers, the public and the property of others.

C. The Contractor shall also be responsible for all materials delivered and work performed until completion and acceptance of the Work.

1.03 QUALITY CONTROL

A. Monitor quality control over suppliers, manufacturers, products, services, Site conditions, and workmanship, to produce Work of specified quality.

B. Comply with specified standards as the minimum quality for the Work except where more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.

C. Perform Work using persons qualified to produce required and specified quality.

D. Products, materials, and equipment may be subject to inspection by Engineer and Owner at place of manufacture or fabrication. Such inspections shall not relieve Contractor of complying with requirements of Contract Documents.

E. Supervise performance of Work in such manner and by such means to ensure that

Work, whether completed or in progress, will not be subjected to harmful, dangerous, damaging, or otherwise deleterious exposure during construction period.

1.04 TOLERANCES

A. Monitor fabrication and installation tolerance control of products to produce acceptable Work. Do not permit tolerances to accumulate.

B. Comply with manufacturers' recommended tolerances and tolerance requirements in reference standards. When such tolerances conflict with Contract Documents, request clarification from Engineer before proceeding.

C. Adjust products to appropriate dimensions; position before securing products in place.

1.05 REFERENCE STANDARDS

A. Whenever reference is made to conforming to the standards of any technical society, organization, body, code or standard, it shall be construed to mean the latest standard, code, specification or tentative specification adopted and published at the time of advertisement for Bids. This shall include the furnishing of materials, testing of materials, fabrication and installation practices. In those cases where the Contractor's quality standards establish more stringent quality requirements, the more stringent requirement shall prevail. Such standards are made a part hereof to the extent which is indicated or intended.

B. The inclusion of an organization under one category does not preclude that organizations' standards from applying to another category

C. In addition, all work shall comply with the applicable requirements of local codes, utilities and other authorities having jurisdiction.

D. All material and equipment, for which a UL standard, and AGA or NSF approval or and ASME requirements is established, shall be so approved and labeled or stamped. The label or stamp shall be conspicuous and not covered, painted, or otherwise obscured from visual inspection.

E. The standards which apply to this Project are not necessarily restricted to those organizations which are listed below.

F. STANDARD ORGANIZATIONS

1. Piping and Valves

ACPA	American Concrete Pipe Association
ANSI	American National Standards Institute
API	American Petroleum Institute
ASME	American Society of Mechanical Engineers
AWWA	American Water Works Association
CISPI	Cast Iron Soil Pipe Institute

DIPRA	Ductile Iron Pipe Research Association
FCI	Fluid Controls Institute
MSS	Manufacturers Standardization Society
NCWPB	National Certified Pipe Welding Bureau
NCPI	National Clay Pipe Institute
NSF	National Sanitation Foundation
PPI	Plastic Pipe Institute
Uni-Bell PVC	Pipe Association

2. Materials

AASHTO	American Association of State Highway and Transportation Officials
ANSI	American National Standards Institute
ASTM	American Society for Testing and Materials

3. Painting and Surface Preparation

NACE	National Association of Corrosion Engineers
SSPC	Steel Structures Painting Council

4. Electrical and Instrumentation

AEIC	Association of Edison Illuminating Companies
AIEE	American Institute of Electrical Engineers
EIA	Electronic Industries Association
ICEA	Insulated Cable Engineers Association
IEEE	Institute of Electrical and Electronic Engineers
IES	Illuminating Engineering Society
IPC	Institute of Printed Circuits
IPCEA	Insulated Power Cable Engineers Association
ISA	Instrument Society of America
NEC	National Electric Code
NEMA	National Electrical Manufacturers Association
NFPA	National Fire Protection Association
TIA	Telecommunications Industries Association
UL	Underwriter's Laboratories
VRCI	Variable Resistive Components Institute
IEC	International Electrotechnical Commission
IESNA	Illuminating Engineering Society of North America
LPI	Lighting Protection Institute
NECA	National Electrical Contractors Association
NETA	International Electrical Testing Association

5. Aluminum

AA	Aluminum Association
AAMA	American Architectural Manufacturers Association

6. Steel and Concrete

ACI	American Concrete Institute

AISC	American Institute of Steel Construction, Inc.
AISI	American Iron and Steel Institute
CRSI	Concrete Reinforcing Steel Institute
NRMA	National Ready-Mix Association
PCA	Portland Cement Association
PCI	Prestressed Concrete Institute

7. Welding

ASME	American Society of Mechanical Engineers
AWS	American Welding Society

8. Government and Technical Organizations

AIA	American Institute of Architects
APHA	American Public Health Association
APWA	American Public Works Association
ASA	American Standards Association
ASAE	American Society of Agricultural Engineers
ASCE	American Society of Civil Engineers
ASQC	American Society of Quality Control
ASSE	American Society of Sanitary Engineers
CFR	Code of Federal Regulations
CSI	Construction Specifications Institute
EDA	Economic Development Administration
EPA	Environmental Protection Agency
FCC	Federal Communications Commission
FmHA	Farmers Home Administration
FS	Federal Specifications
IAI	International Association of Identification
ISEA	Industrial Safety Equipment Association
ISO	International Organization for Standardization
ITE	Institute of Traffic Engineers
NBFU	National Board of Fire Underwriters
NFPA	National Fluid Power Association
NBS	National Bureau of Standards
NISO	National Information Standards Organization
OSHA	Occupational Safety and Health Administration
SI	Salt Institute
SPI	The Society of the Plastics Industry, Inc.
USDC	United States Department of Commerce
WEF	Water Environment Federation

9. General Building Construction

AHA	American Hardboard Association
AHAM	Association of Home Appliance Manufacturers
AITC	American Institute of Timber Construction
APA	American Parquet Association, Inc.
APA	American Plywood Association

BHMA	Builders Hardware Manufacturers Association
BIFMA	Business and Institutional Furniture Manufacturers Association
DHI	Door and Hardware Institute
FM	Factory Mutual Fire Insurance Company
HPMA	Hardwood Plywood Manufacturers Association
HTI	Hand Tools Institute
IME	Institute of Makers of Explosives
ISNATA	International Staple, Nail and Tool Association
ISDSI	Insulated Steel Door Systems Institute
IWS	Insect Screening Weavers Association
MBMA	Metal Building Manufacturers Association
NAAMM	National Association of Architectural Metal Manufacturers
NAGDM	National Association of Garage Door Manufacturers
NCCLS	National Committee for Clinical Laboratory Standards
NFPA	National Fire Protection Association
NFSA	National Fertilizer Solutions Association
NKCA	National Kitchen Cabinet Association
NWMA	National Woodwork Manufacturers Association
NWWDA	National Wood Window and Door Association
RMA	Rubber Manufacturers Association
SBC	SBCCI Standard Building Code
SDI	Steel Door Institute
SIA	Scaffold Industry Association
SMA	Screen Manufacturers Association
SPRI	Single-Ply Roofing Institute
TCA	Tile Council of America
UBC	Uniform Building Code

10. Roadways

AREA	American Railway Engineering Association
DOT	Department of Transportation
SSRBC	Standard Specifications for Road and Bridge Construction, Georgia Department of Transportation

11. Plumbing

AGA	American Gas Association
NSF	National Sanitation Foundation
PDI	Plumbing Drainage Institute
SPC	SBCCI Standard Plumbing Code

12. Refrigeration, Heating, and Air Conditioning

AMCA	Air Movement and Control Association
ARI	American Refrigeration Institute
ASHRAE	American Society of Heating, Refrigeration, and Air Conditioning Engineers
ASME	American Society of Mechanical Engineers

CGA	Compressed Gas Association
CTI	Cooling Tower Institute
HEI	Heat Exchange Institute
IIAR	International Institute of Ammonia Refrigeration
NB	National Board of Boilers and Pressure Vessel Inspectors
PFMA	Power Fan Manufacturers Association
SAE	Society of Automotive Engineers
SMACNA	Sheet Metal and Air Conditioning Contractors National Association
SMC	SBCCI Standard Mechanical Code
TEMA	Tubular Exchangers Manufacturers Association

13. Equipment

AFBMA	Anti-Friction Bearing Manufacturers Association, Inc.
AGMA	American Gear Manufacturers Association
ALI	Automotive Lift Institute
CEMA	Conveyor Equipment Manufacturers Association
CMAA	Crane Manufacturers Association of America
DEMA	Diesel Engine Manufacturers Association
MMA	Monorail Manufacturers Association
OPEI	Outdoor Power Equipment Institute, Inc.
PTI	Power Tool Institute, Inc.
RIA	Robotic Industries Association
SAMA	Scientific Apparatus Makers Association

1.06 LABELING

A. Attach label from agency approved by authorities having jurisdiction for products, assemblies, and systems required to be labeled by applicable code.

B. Label Information: Include manufacturer's or fabricator's identification, approved agency identification, and the following information, as applicable, on each label:

1. Model number.

2. Serial number.

3. Performance characteristics.

C. Manufacturer's Nameplates, Trademarks, Logos, and Other Identifying Marks on Products: Not allowed on surfaces exposed to view in public areas, interior or exterior.

1.07 MOCK-UP REQUIREMENTS

A. Tests will be performed under provisions identified in this Section and identified in individual product Specification Sections.

B. Assemble and erect specified or indicated items with specified or indicated

attachment and anchorage devices, flashings, seals, and finishes.

C. Accepted mockups shall be comparison standard for remaining Work.

D. Where mockup has been accepted by Engineer and is specified in product Specification Sections to be removed, remove mockup and clear area when directed to do so by Architect/Engineer.

1.08 MANUFACTURER'S FIELD SERVICES

A. When specified in individual Specification Sections, require material or product suppliers or manufacturers to provide qualified staff personnel to observe Site conditions, conditions of surfaces and installation, quality of workmanship, startup of equipment, testing, adjusting, and balancing of equipment, commissioning, etc. as applicable, and to initiate instructions when necessary.

B. Report observations and Site decisions or instructions given to applicators or installers that are supplemental or contrary to manufacturer's written instructions.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01 45 29

TESTING LABORATORY SERVICES

PART 1 GENERAL

1.01 SCOPE

A. This Section includes testing which the Owner may require, beyond that testing required of the manufacturer, to determine if materials provided for the Project meet the requirements of these Specifications.

B. This work also includes all testing required by the Owner to verify work performed by the Contractor is in accordance with the requirements of these Specifications, i.e., concrete strength and slump testing, soil compaction, etc.

C. This work does not include materials testing required in various sections of these Specifications to be performed by the manufacturer, e.g., testing of pipe.

1.02 SECTION INCLUDES

A. Selection of Testing Laboratory.

B. Laboratory Duties.

C. Payment for Testing Services.

D. Contractor Responsibilities.

E. Schedules for Testing.

F. Transporting Samples.

1.03 SELECTION OF TESTING LABORATORY

The testing laboratory or laboratories will be selected by the owner. The testing laboratory or laboratories will work for the owner.

1.04 LABORATORY DUTIES

A. Cooperate with the Owner, Engineer and Contractor.

B. Provide qualified personnel promptly on notice.

C. Perform specified inspections, sampling and testing of materials.

1. Comply with specified standards, ASTM, other recognized authorities, and as specified.

2. Ascertain compliance with requirements of the Contract Documents.

D. Promptly notify the Engineer and Contractor of irregularity or deficiency of work which are observed during performance of services.

E. Promptly submit three copies (two copies to the Engineer and one copy to the Contractor) of report of inspections and tests in addition to those additional copies required by the Contractor with the following information included:

1. Date issued
2. Project title and number
3. Testing laboratory name and address
4. Name and signature of inspector
5. Date of inspection or sampling
6. Record of temperature and weather
7. Date of test
8. Identification of product and Specification section
9. Location of Project
10. Type of inspection or test
11. Results of test
12. Observations regarding compliance with the Contract Documents

F. Perform additional services as required.

G. The laboratory is not authorized to release, revoke, alter or enlarge on requirements of the Contract Documents, or approve or accept any portion of the Work.

1.05 PAYMENT FOR TESTING SERVICES

A. The cost of testing services required by the Contract shall be paid for by the Owner. This includes concrete, soil, and asphalt. This cost may or may not be provided for as an allowance in the Bid Schedule.

B. The cost of additional testing services not specifically required in the Specifications, but requested by the Owner or Engineer, shall be paid for by the Owner.

C. The cost of material testing described in various sections of these Specifications or as required in referenced standards to be provided by a material manufacturer, shall be included in the price bid for that item and shall not be paid for by the Owner.

D. The cost of retesting any item that fails to meet the requirements of these Specifications shall be paid for by the Contractor. Retesting shall be performed by the testing laboratory working for the Owner.

1.06 CONTRACTOR RESPONSIBILITIES

A. Contractor will be furnished contact information for the selected laboratory. Contractor will be required to schedule ALL testing.

B. Cooperate with laboratory personnel, provide access to Work and/or manufacturer's requirements.

C. Provide to the laboratory, representative samples, in required quantities, of materials to be tested.

D. Furnish copies of mill test reports.

E. Furnish required labor and facilities to:

1. Provide access to Work to be tested;

2. Obtain and handle samples at the site (if certified to do so);

3. Facilitate inspections and tests;

4. Build or furnish a holding box for concrete cylinders or other samples as required by the laboratory.

F. Notify the laboratory sufficiently in advance of operation to allow for the assignment of personnel and schedules of tests.

G. Laboratory Tests: Where such inspection and testing are to be conducted by an independent laboratory agency, the sample(s) shall be selected by such laboratory or agency, or the Engineer, and shipped to the laboratory by the Contractor at Contractor's expense.

H. Copies of all correspondence between the Contractor and testing agencies shall be provided to the Engineer.

I. If the Contractor disagrees with the approved Engineers testing agency's methods or results during an onsite test, the Contractor may have another testing agency conduct an independent evaluation at the Contractor’s expense. After an independent evaluation is performed, the contractor will submit their results to the engineer for review.

1.07 SCHEDULES FOR TESTING

A. Establishing Schedule

1. The Contractor shall, by advance discussion with the testing laboratory selected by the Owner, determine the time required for the laboratory to perform its tests and to issue each of its findings, and make all arrangements for the testing laboratory to be on site to provide the required testing.

2. Provide all required time within the construction schedule.

B. When changes of construction schedule are necessary during construction, coordinate all such changes of schedule with the testing laboratory as required.

C. When the testing laboratory is ready to test according to the determined schedule, but is prevented from testing or taking specimens due to incompleteness of the Work, all extra costs for testing attributable to the delay will be back-charged to the Contractor and shall not be borne by the Owner.

1.08 TRANSPORTING SAMPLES

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

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01 50 00

TEMPORARY FACILITIES AND CONTROLS

PART 1 GENERAL

1.01 SCOPE

Section includes requirements for installation, maintenance, and removal of temporary utilities, controls, facilities, and construction aids during construction.

1.02 SECTION INCLUDES

A. Temporary facilities which may be necessary for this work include, but are not necessarily limited to:

   A. Temporary utilities (such as water, sewer, electricity, telephone, and internet).

   B. First aid facilities.

   C. Construction offices.

   D. Parking facilities.

   E. Traffic regulation.

   F. Dust control.

   G. Progress cleaning and waste removal.

   H. Environmental protection.

   I. Security.

   J. Project Sign.

   K. Removal of utilities, facilities, and controls.

1.03 TEMPORARY UTILITIES

A. Potable Water: Available from the Owner. Owner shall cover costs to tap existing water pipeline and connect the pipeline to the designated water source. Potable water can be used for construction and for drinking. Potable water must be available to the workers for their consumption during any construction activities. However, the water for worker consumption can be from a cooler.

B. Sanitary Sewer: Available from the Owner. Contractor must provide portable toilets or portable septic facilities during and construction activities. The contractor shall pay all costs for sanitary facilities. Contractor's personnel may not use Owner's or Engineer's rest rooms.

C. Electricity: Electricity available at site. Contractor shall pay all costs to connect temporary facilities for both contractor and engineer to electricity. Contractor may also desire second temporary pole mounted transformer to be set in area of raw water pump station. Contractor shall be responsible for this cost. Any costs associated with establishment of final power to site for Owner shall be paid for by owner.

D. Internet/Camera: Contractor shall not be required to provide a high speed Cable/DSL internet connection for use by the Engineer. Contractor will not be required to provide a security camera on site.

1.04 FIRST AID FACILITIES

The Contractor shall provide a suitable first aid station, equipped with all facilities and medical supplies necessary to administer emergency first aid treatment. The Contractor shall have standing arrangements for the removal and hospital treatment of any injured person. All first aid facilities and emergency ambulance service shall be made available by the Contractor to the Owner and Engineer's personnel.

1.05 CONSTRUCTION OFFICES: REQUIRED

Contractor must supply the following office facilities at the project site. The Engineer's and the contractor's offices may be in the same building or modular unit.

A. For the Engineer/Contractor:

1. Size – 128 square feet minimum with rest room. Sink with hot and cold water to be available in rest room.
2. Door to the outside with heavy duty security lock.
3. Air conditioned and heated.
4. 1 - desk.
5. 1 - layout table.
6. 2 - chairs.
7. Interior/Exterior Lights.
8. Electrical outlets.
9. 1 – Indoor/Outdoor thermometer. Unit shall display indoor temperature and humidity, outdoor temperature and humidity, barometric pressure and time. Unit shall also display minimum and maximum temperature and humidity.
10. 1 – Rain Gauge. Gauge shall be made of glass or plastic and capable of measuring six (6) inches or more of rainfall.

B. General

1. Locate offices per owner's requirements
2. Sweep and remove refuse from offices at least once per week

3. Post and enforce no smoking signs inside offices

1.06 PARKING FACILITIES

A. Parking facilities off-site for the Contractor's and Contractor's Subcontractors' personnel shall be the Contractor's responsibility. Storage and work facilities provided by the Owner will not be used for parking by the Contractor's or subcontractor's personnel.

B. The Contractor shall maintain the gravel parking area in the vicinity of the Construction Offices throughout the duration of the contract through periodic restoration (including regrading and dressing the surface with fresh graded aggregate base GAB) of the gravel surface to lines and grades existing at the time of contract award. Deterioration of the areas due to erosion or intrusion of other material (such as mud, dirt, silt, etc.) shall be repaired as necessary or determined by the Engineer.

C. Provide unimpeded access for emergency vehicles.

D. Provide and maintain access to fire hydrants free of obstructions.

E. Provide means of removing mud from vehicle wheels before entering streets.

1.07 TRAFFIC REGULATION

A. Signs, Signals, and Devices:

1. Post-Mounted and Wall-Mounted Traffic Control and Informational Signs: As approved by authorities having jurisdiction.

2. [Automatic] Traffic Control Signals: As approved by local jurisdictions.

3. Traffic Cones, Drums, Flares, and Lights: As approved by authorities having jurisdiction.

4. Flag Person Equipment: As required by authorities having jurisdiction.

B. Flag Persons: Provide trained and equipped flag persons to regulate traffic when construction operations or traffic encroach on public traffic lanes.

C. Flares and Lights: Use flares and lights during hours of low visibility to delineate traffic lanes and to guide traffic.

D. Haul Routes:

1. Consult with authorities having jurisdiction and establish public thoroughfares to be used for haul routes and Site access.

2. Drawings indicate haul routes designated by authorities having jurisdiction for use by construction traffic.

3. Confine construction traffic to designated haul routes.

4. Provide traffic control at critical areas of haul routes to regulate traffic and to minimize interference with public traffic.

E. Traffic Signs and Signals:

1. Provide signs at approaches to Site and on Site, at crossroads, detours, parking areas, and elsewhere as needed to direct construction and affected public traffic.

2. Provide, operate, and maintain traffic control signals to direct and maintain orderly flow of traffic in areas under Contractor's control and areas affected by Contractor's operations.

3. Relocate signs and signals as Work progresses, to maintain effective traffic control.

F. Removal:

1. Remove equipment and devices when no longer required.

2. Repair damage caused by installation.

3. Remove post settings to depth of two feet.

1.08 DUST CONTROL

Limit blowing dust caused by construction operations by applying water or employing other appropriate means or methods to maintain dust control, subject to the approval of the Owner. As a minimum, this may require the use of a water wagon twice a day to suppress dusty conditions.

1.09 PROGRESS CLEANING AND WASTE REMOVAL

A. Maintain areas free of waste materials, debris, and rubbish. Maintain Site in clean and orderly condition.

B. Remove debris and rubbish from construction activities and other closed or remote spaces, before enclosing spaces.

C. Broom and vacuum clean interior areas before starting surface finishing, and continue cleaning to eliminate dust.

D. Collect and remove waste materials, debris, and rubbish from Site periodically and dispose of off-Site.

1.10 ENVIRONMENTAL PROTECTION

The Contractor shall provide and maintain environmental protection of the site during the life of the contract as defined herein. Environmental protection shall be provided to correct conditions that develop during the construction of permanent environmental protection features, or that are required to control pollution that develops during normal construction activities but are not associated with the permanent control structures included in the Project. The Contractor’s activities shall comply with all applicable federal, state and local regulations pertaining to water, air, solid waste, hazardous and oily substances, fish and

wildlife, historical and Archaeological Resources, and noise pollution.

1.11 SECURITY

Provide security and facilities to protect Work, and existing facilities, and Owner's operations from unauthorized entry, vandalism, or theft.

1.12 PROJECT SIGN: REQUIRED

A. Structure and Framing: New, wood, and structurally adequate. To be located in a conspicuous position along a main road indicating access to site.

B. Sign Surfaces: Exterior grade plywood with medium density overlay, minimum ¾ inch.

C. Rough Hardware: Galvanized.

D. Paint and Primers: Exterior quality, two coats; sign background of white color.

E. Lettering: Pre-Cut vinyl self-adhesive products contrasting colors.

F. One painted sign, 32 sq ft area, bottom 6 feet above ground

G. Content

1. Project number, title, logo and name of as indicated on Contract Documents.
2. Name of Owner
3. Name of Contractor
4. Name of Consultants
5. Name of major Subcontractors

1.13 REMOVAL OF UTILITIES, FACILITIES, AND CONTROLS

A. Remove temporary utilities, equipment, facilities, and materials before Final Application for Payment inspection.

B. Remove underground installations to minimum depth of two feet.

C. Clean and repair damage caused by installation or use of temporary Work.

D. Restore existing and permanent facilities used during construction to original condition. Restore permanent facilities used during construction to specified condition.

END OF SECTION

SECTION 01 60 00

PRODUCT REQUIREMENTS

PART 1 GENERAL

1.01 DESCRIPTION

These general equipment stipulations apply, in general, to all equipment and piping. They supplement the detailed equipment Specifications, but in case of conflict, the detailed equipment Specifications shall govern.

1.02 SECTION INCLUDES

A. Basic Product Requirements

B. Product Delivery Requirements

C. Product Storage and Handling Requirements

D. Adaptation and Location of Equipment.

E. Patent Royalties.

F. Workmanship and Materials

G. Lubrication and Lubrication Fittings.

H. Safety Gaurds.

I. Equipment Bases.

J. Seal Water Requirements.

K. Grouting Equipment Bases.

L. Control and Instrumentation Components.

M. Alignment of Motors and Equipment.

N. Welding and Brazing.

O. Special Tools and Accessories.

P. Spare Parts.

Q. Shop Priming.

R. Galvanizing.

S. Installation Check.

1.03 BASIC PRODUCT REQUIREMENTS

A. Provided Products

1. Provide products that comply with the Contract Documents which are undamaged and, unless otherwise indicated, new at the time of installation complete with accessories, trim, finish, safety guards and other devices and details needed for a complete installation and the intended use and effect.

B. Identification of Piping and Equipment

1. General: All equipment and piping specified to be painted shall be color coded as specified in Section 09 90 00 of these Specifications.

2. Equipment: All major items of equipment shall have an identification nameplate and dataplate.

a. Nameplates: The Contractor shall submit a suitable list of all items of major equipment to the Engineer, who will furnish the Contractor with an identification numbering system. The nameplates shall be of Type 304 stainless steel, No.6 finish, and not less than No. 16 gauge with indented stamped lettering. Nameplates shall be attached to equipment bases in easily visible and accessible locations. Nameplates shall be fastened in a permanent manner, arranged not to damage the equipment, with not less than four stainless steel fasteners.

b. Dataplates: Each item of mechanical equipment shall be provided with a stainless steel dataplate. Separate dataplates shall be provided for motors, engines and driven equipment. Dataplates shall include the following minimum information:

1. Name of equipment (from equipment specifications)

2 Manufacturer

3. Model designation

4. Serial number

5. Rated horsepower

6. Service factor

7. Electrical and insulation data

8 Speed (rpm)

9. Capacity and head (discharge pressure)

10 Net weight

11. Lettering shall be upper case, block style in size and spacing to suit the nameplate. The identification nameplates shall not be painted.

3. Valves: All valves shall be identified with a round brass disc, approximately 1-1/2-inches in diameter and not less than No. 14 gauge, coated with a clear lacquer. Discs shall be fastened to valves in a

permanent manner; attachment by chain to handwheels or other operators shall not be acceptable. Discs shall be stamped using indented numerals and/or letters with a valve number corresponding to its identification number in the valve schedule to be included in the operation and maintenance manual.

4. All pushbutton stations, switches, motor controllers, transmitters and other control equipment shall have identification nameplates of the engraved, laminated plastic type affixed to or adjacent to the switch, pushbutton station, etc.

5. All manufacturer's nameplates, identification nameplates and ASME code plates located on areas of equipment to be insulated shall be removed and reattached on uninsulated areas in a manner acceptable to the Engineer.

C. SAFETY SIGNS

1. Permanent safety signs shall be furnished and installed on all mechanical and electrical equipment where a hazard may exist. Signs shall be made in accordance with current OSHA requirements and shall be suitable for exterior use. Mounting details shall be in accordance with manufacturer's recommendations; location in accordance with governing agency regulations. Fasteners shall be stainless steel.

2. Safety signs shall be Safety signs shall be approximately 7-inches high by 10-inches wide, colored yellow 2 and black on minimum 0.080-inch aluminum stock.

3. Safety signs shall be furnished and will include, but not be limited to, the following:

a. The following sign shall be affixed to all equipment which may be started ~ automatically from a remote location:

CAUTION THIS EQUIPMENT MAY START AUTOMATICALLY BY REMOTE CONTROL

b. The following sign shall be affixed to all electrical equipment or instrument panels, as applicable:

CAUTION - SHOCK HAZARD THIS EQUIPMENT IS POWERED BY MULTIPLE SOURCES CONTACTS MAY BE ENERGIZED AFTER LOCAL POWER IS DISCONNECTED

c. The following sign shall- be provided at all areas where oxygen or flammable materials are stored or used (colored red, white and black):

DANGER

NO SMOKING, MATCHES, OR OPEN FLAMES

d. The following sign shall be affixed to all entrance hatches or access manways on covered tanks and vessels:

CAUTION OXYGEN DEFICIENT OR TOXIC CONDITIONS MAY EXIST FOLLOW PRESCRIBED PROCEDURES BEFORE ENTRY

e. The following sign shall be provided at all compressor, vent, equipment blowoffs, blower room, etc.

CAUTION NOISE AREA MAY CAUSE HEARING LOSS USE PROPER EAR PROTECTION

f. The following sign shall be provided in chemical feed rooms or storage areas.

CAUTION CHEMICAL STORAGE AREA

1.04 PRODUCT DELIVERY REQUIRMENTS

A. Arrange deliveries of Products in accordance with construction schedules, coordinate to avoid conflict with work and conditions at the site.

1. Deliver products to the site in undamaged condition, in manufacturer's original sealed containers or packaging, with identifying labels intact and legible, complete with instructions for handling, storing, unpacking, protecting, and installing.

2. Schedule delivery to reduce long term on-site storage prior to installation and/or operation. Under no circumstances shall equipment be delivered to the site more than one month prior to installation without written authorization from the Engineer.

3. Coordinate delivery with installation to ensure minimum holding time for items that are hazardous, flammable, easily damaged, or sensitive to deterioration.

4. Products delivered to the site shall be unloaded and placed in a manner that will not hamper the Contractor's normal construction operations, nor those of other contractors and subcontractors. Unloading shall not interfere with normal traffic flow.

5. 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.

1.05 PRODUCT STORAGE AND HANDLING REQUIREMENTS

A. Store and protect products in accordance with manufacturers' Instructions.

B. Store with seals and labels intact and legible.

C. Store sensitive products in weather tight, climate controlled, enclosures in an environment favorable to product.

D. For exterior storage of fabricated products, place on sloped supports above ground.

E. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to prevent condensation and degradation of products.

F. Provide equipment and personnel to store products by methods to prevent soiling, disfigurement, or damage.

G. Arrange storage of products to permit access for inspection. Periodically inspect to verify products are undamaged and are maintained in acceptable condition.

1.06 ADAPTATION AND LOCATION OF EQUIPMENT

No responsibility for alteration of a planned structure to accommodate other types of equipment will be assumed by the Owner. Equipment, which requires alteration of a structure or structures, will be considered only if the Contractor assumes all responsibility for making and coordinating all necessary alterations. Any and all such alterations, and associated engineering, drafting, detailing, and/or coordinating, shall be done at no additional cost to the Owner.

1.07 PATENT ROYALTIES

All royalties and fees for patents covering processes, materials, articles, apparatus, devices, or equipment shall be included in the Contract Prices Bid by the Contractor.

1.08 WORKMANSHIP AND MATERIALS

A. All equipment shall be designed, fabricated and assembled in accordance with the most modern engineering and shop practice. Individual parts shall be manufactured to standard sizes and gauges so that repair parts, furnished at any time, can be installed in the field. Like parts of duplicate units shall be interchangeable. Equipment shall be new and shall not have been in service at any time prior to delivery, except as required by tests.

B. Materials shall be suitable for service conditions. Iron castings shall be tough, close grained, gray iron free from blowholes, flaws or excessive shrinkage and shall conform to ASTM A 48, Class 30 minimum. Plugging of defective castings

shall not be permitted. Castings shall be annealed to remove internal stresses prior to machining and shall have the mark number and heat number cast on them.

C. Except where otherwise specified, structural and miscellaneous fabricated steel used in items of equipment shall conform to the Standards of the American Institute of Steel Construction. All structural members shall be considered as subject to shock or vibratory loads.

D. All replaceable or expendable elements such as filters, screens, drive belts, fuses, lamps, etc., shall be easily accessible and replaceable without need of dismantling equipment or piping. All such items shall be of a standard type that is readily available from multiple suppliers.

E. Threaded openings for drains or vents in pump volutes, compressor or fan scrolls, air receivers, and heat exchangers which are plugged during normal operation shall be provided with stainless steel plugs.

F. Except where otherwise specified, the Contractor shall, to the greatest extent practicable, purchase, acquire, and use, goods, equipment, products, and materials produced in the United States (including but not limited to iron, aluminum, steel, cement, and other manufactured products). The requirements of this section shall be included in all subcontracts.

For the purposes of this section:

1) "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.

2) "Manufactured Products" means 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.

G. All products and materials must comply with GEFA American Iron and Steel Special Conditions and Information and Build America, Buy America Act Special Conditions and Information.

1.09 LUBRICATION AND LUBRICATION FITTINGS

A. Equipment shall be adequately lubricated by systems which require attention no more frequently than weekly during continuous operation. Lubrication systems shall not require attention during start-up or shutdown and shall not waste lubricants.

B. Lubricants of the type recommended by the equipment manufacturer shall be provided in sufficient quantity by the Contractor to fill all lubricant reservoirs and to replace all lubricants consumed during testing, start-up and initial operation. The Contractor shall provide to the Owner prior to Substantial Completion sufficient quantities of lubricants to lubricate all equipment for one year of normal

service.

C. Where special run-in oil or storage lubricants are used, they shall be flushed out and replaced with the required service lubricant by the Manufacturer's Technical Representative.

D. Tag each piece of equipment with a cloth tag showing proper type lubricant, period between lubrications, date of lubrication and worker's initials. Have space for 10 lubrication notations.

E. Except for rotating shaft couplings, all lubrication fittings shall be brought to the outside of all equipment so that they are readily accessible from the outside without the necessity of removing covers, plates, housings or guards. Fittings shall be accessible from safe, permanent platforms or walk areas. Fittings shall be of the bull-neck, check type for use with a portable high pressure grease gun. Connection from a remote fitting to the point of use shall be with minimum 3/16-inch Type 316 stainless steel tubing, securely mounted parallel to equipment lines and protected where exposed to damage.

1.10 SAFETY GUARDS

All belt or chain drives, fan blades, couplings and other moving or rotating parts shall be covered on all sides by a safety guard. Safety guards shall be fabricated from 16 USS gauge or heavier galvanized or aluminum-clad sheet steel or 1/2-inch mesh galvanized expanded metal. Each guard shall be designed for easy installation and removal. All supports and accessories shall be provided for each guard. Supports and accessories, including bolts, shall be galvanized. All safety guards in outdoor locations shall be designed to prevent the entrance of rain and dripping water. All safety guards shall comply with OSHA General Industry Standards, Part 1910, Subpart O, Machinery and Machine Guarding. Provide tachometer access on shaft ends.

1.11 EQUIPMENT BASES

A. Where shown on the Drawings, equipment shall be installed on a raised, reinforced concrete base. The base shall be a minimum of 4-inches in height and shall extend beyond the equipment baseplate a minimum of 2-inches on all sides.

B. Unless otherwise specified, a cast iron or welded steel baseplate shall be provided for each pump, fan and any other item of equipment which is to be installed on a concrete base. Each unit and drive assembly shall be supported on a single baseplate of neat design. Baseplates shall have pads for anchoring all components and adequate grout holes. Baseplates for pumps shall have a raised lip all around and a threaded drain connection. Baseplates shall be anchored to the concrete base with suitable anchor bolts and the space beneath filled with grout as specified in the grouting section.

C. On direct coupled equipment, motor and driven equipment shall be doweled to a common base with a minimum of two dowels each.

1.12 SEAL WATER REQUIREMENTS

Where seal water is provided for flushing of mechanical shaft sleeves or sealing of shaft seal packing, provide equipment with drip pans fitted with drains to contain the leakage and convey it to the nearest suitable floor drain. Route drain piping to minimize obstructions to the movement of personnel.

1.13 GROUTING EQUIPMENT BASES

After equipment installation and alignment is complete, grout all baseplates and pads full with non-shrink grout as specified in these Specifications.

1.14 CONTROL AND INSTRUMENTATION COMPONENTS

Control and instrumentation equipment furnished by the mechanical equipment manufacturer shall conform to the applicable requirements of Division 26.

1.15 ALIGNMENT OF MOTORS AND EQUIPMENT

A. In every case where a drive motor is connected to a driven piece of equipment by a flexible coupling, the coupling halves shall be disconnected and the alignment between the motor and the equipment checked and corrected. Machinery shall first be properly aligned and leveled by means of steel wedges and shims or jacking screws near anchor bolts. Anchor bolts shall be tightened against the shims on wedges or jacking screws and the equipment shall again be checked for level and alignment before placing grout. Wedges shall not be placed between machined surfaces.

B. In general, checking and correcting the alignment shall follow the procedures set up in the Standards of the Hydraulic Institute, Instructions for Installation, Operation, and Maintenance of Centrifugal Pumps. Equipment shall be properly leveled and brought into angular and parallel alignment.

C. Equipment and piping shall be installed in such a way that no strain is transmitted to the equipment by piping systems or adjacent equipment.

1.16 WELDING AND BRAZING

A. All welds shall be sound and free from embedded scale and slag. All butt welds shall be continuous, and where exposed to view, shall be ground smooth. All continuous welds shall be gas and liquid-tight. Welds in piping shall have full penetration and shall be smooth on the inside of the pipe. Intermittent welds shall have an effective length of at least 2-inches and shall be spaced not more than 6-inches apart.

B. All welding of steel and aluminum, including materials, welding techniques,

general safety practices, appearance and quality of welds, and methods of correcting defective work, shall conform to the latest requirements of AWS Specifications. Structural steel welding shall conform to the requirements of the AWS Structural Welding Code. The general recommendations and requirements of the AWS Structural Welding Code shall also apply to welded aluminum structures. The welding process and welding operators shall meet qualification tests and welding performance tests in accordance with the latest provisions of ASME Boiler and Pressure Vessel Code, Section IX, Welding and Brazing Qualifications. Welding process and qualification procedures for welding of pipe shall conform to the latest requirements of ANSI B31.1, Section 327, Welding, and Section 328, Brazing and Soldering. The Contractor shall provide a Certified Welding Inspector (CWI), on-site, whenever welding operations are taking place.

C. Field welding practices shall conform to OSHA construction standards, Part 1926, Subpart J, Welding and Cutting. Shop welding practices shall conform to OSHA General Industry Standards, Part 1910, Subpart Q, Welding, Cutting, and Brazing.

D. Welding electrodes for structural steel shall conform to the standard recommendations of the AISC. Welding electrodes for stainless steel shall conform to applicable AWS Specifications and shall be as recommended by "Welded Austenitic Chromium-Nickel Stainless Steels, Techniques and Properties", published by the International Nickel Company, New York, New York. Welding electrodes for aluminum shall conform to applicable AWS Specifications.

E. Each welder and welding operator must identify all welds with welder's assigned symbol.

F. Welders performing unsatisfactory work shall be removed from the welding process.

G. The Owner may inspect any weld by radiographic or other means. Welds not in accordance with the requirements specified herein shall be repaired or replaced at the Contractor's expense. Excessive porosity, nonmetallic inclusions, lack of fusion, incomplete penetration and cracking shall constitute grounds for rejection of welds.

1.17 SPECIAL TOOLS AND ACCESSORIES

Equipment requiring periodic repair and adjustment shall be furnished complete with all special tools, instruments and accessories required for proper maintenance. Special tools and accessories shall include those tools and accessories not normally available in an industrial hardware or mill supply house. Equipment requiring special devices for lifting or handling shall be furnished complete with those devices.

1.18 SPARE PARTS

A. Provide all spare parts as specified in the technical specifications and as recommended by the manufacturer.

B. Provide transportation, handling, storage, and protection of spare parts as required.

C. Tag spare parts and their containers to clearly identify them. Cross-reference all spare parts with their applicable specification section under which they are being provided.

D. All spare parts are to be interchangeable with and identical to the original parts incorporated into the Work.

E. Spare parts shall be identified and scheduled in Operation and Maintenance data.

F. An itemized and complete list of spare parts provided pursuant to the Contract Documents shall be prepared and submitted to the Engineer for review. The list shall be indexed sequentially by specification section.

G. Spare parts shall not be used or incorporated into the Work, and shall be provided to the Owner prior to substantial completion, when directed by the Engineer.

H. Contractor shall submit copies of the completed and signed Spare Parts Transfer Forms to the Engineer.

1.19 SHOP PRIMING

All equipment shall receive shop painting as specified in the technical specifications.

1.20 GALVANIZING

A. All galvanizing shall be done by the hot-dip process after fabrication in conformity with requirements of ASTM A 123, A 153, A 384 and A 385. Articles to be galvanized shall be pickled before galvanizing.

B. Where galvanized bolts are specified or required by the Drawings, cadmium or zinc plated bolts will be acceptable provided cadmium plating conforms to ASTM A 165, Type NS and zinc plating conforms to ASTM A 164, Type GS.

C. Areas of galvanizing damaged by welding or burning or otherwise damaged shall be thoroughly stripped and cleaned and recoated with zinc to the required thickness by the hot dip process.

D. Galvanized articles shall be free from uncoated spots, blisters, flux, black spots, dross, projections and other defects not consistent with acceptable galvanizing practice.

E. Zinc and cadmium plating shall be subject to visual examination to determine uniformity of coating. The Engineer may require that the coating uniformity be tested in accordance with ASTM A 239.

1.21 INSTALLATION CHECK

A. An experienced, competent and authorized manufacturer's technical representative shall visit the site of the Work and inspect, check and adjust, if necessary, and approve the equipment installation. In each case, the manufacturer's technical representative shall be present when the equipment is placed in operation and shall revisit the jobsite as often as necessary until all operations troubleshooting is complete and the equipment installation and operation are satisfactory in the opinion of the Engineer.

B. During this initial inspection, each piece of equipment is to be evaluated for non-dynamic, non-operational concerns. The focus shall be to confirm the readiness of a unit or system for initial operation of the equipment in a normal duty cycle for a period of 24 hours. To the maximum extent practical, the full capabilities of each piece of equipment, including remote operation, instrumented control schemes, alternate modes of operation, and emergency operation, should be available prior to physical checkout in order to facilitate and expedite the transition from physical checkout to functional testing.

C. Each manufacturer's technical representative shall perform the installation check and furnish to the Owner, through the Engineer, a Certificate of Proper Installation (CPI). The CPI is to be submitted in writing, on either the form provided by the Engineer or on the Manufacturer's letterhead, certifying the following:

1. The equipment has been properly installed and lubricated.
2. The equipment is in accurate alignment.
3. The equipment is free from any undue stress imposed by connecting piping or anchor bolts.
4. External wire terminations have been made correctly.
5. All safety devices to protect workers are properly installed.
6. All devices designed and intended to protect the equipment from damage due to system or component failure or problem (e.g., overload sensors, overcurrent sensors, vibration sensors) are properly installed, connected, and functioning.
7. The equipment is ready to be operated under full load conditions without violation of or voiding any aspect or detail of the manufacturer's warranty.

The Work described under these Specifications will not be accepted as complete until satisfactory installation certifications have been submitted in accordance with the requirements of this Section.

C. The Contractor shall properly coordinate the visits by the various manufacturer's technical representatives, particularly when a specific equipment item's operation is dependent upon the operation of other equipment.

D. All costs for this work shall be included in the Contractor's bid price, and no separate payment will be made.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01 70 00

EXECUTION AND CLOSEOUT REQUIREMENTS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Field engineering.

B. Closeout procedures.

C. Starting of systems.

D. Project record documents.

E. Operation and maintenance data.

F. Spare parts and maintenance products.

G. Product warranties and product bonds.

H. Examination.

I. Execution.

J. Cutting and patching.

K. Protecting installed construction.

L. Final cleaning.

1.2 FIELD ENGINEERING

A. Construction staking shall include all of the surveying work required to layout the work and control the location of the finished Project. The Contractor shall have the full responsibility for constructing the Project to the correct horizontal and vertical alignment, as shown on the Drawings, as specified, or as ordered by the Owner. The Contractor shall assume all costs associated with rectifying work constructed in the wrong location.

B. Owner will locate and Contractor shall protect survey control and reference points. Promptly notify Engineer of discrepancies discovered.

C. Control datum for survey is established by Owner-provided survey indicated on Drawings.

D. Prior to beginning Work, verify and establish elevations of existing facilities to ensure that new Work will meet existing elevations in smooth and level alignment except where specifically detailed or indicated otherwise.

E. Verify setbacks and easements; confirm Drawing dimensions and elevations.

F. Provide field engineering services. Establish elevations, lines, and levels using recognized engineering survey practices.

G. Maintain complete and accurate log of control and survey Work as Work progresses.

H. Protect survey control points prior to starting Site Work; preserve permanent reference points during construction.

I. Promptly report to Engineer loss or destruction of reference point or relocation required because of changes in grades or other reasons.

J. Replace dislocated survey control points based on original survey control. Make no changes without prior written notice to Engineer.

1.3 CLOSEOUT PROCEDURES

A. Prerequisites to Substantial Completion: Complete following items before requesting Certification of Substantial Completion, either for entire Work or for portions of Work:

1. Submit maintenance manuals, Project record documents, digital images of construction photographs, videos made during construction**,** and other similar final record data in compliance with this Section.

2. Complete facility startup, testing, adjusting, balancing of systems and equipment, demonstrations, and instructions to Owner's operating and maintenance personnel as specified in compliance with this Section.

3. Conduct inspection to establish basis for request that Work is substantially complete. Create comprehensive list (initial punch list) indicating items to be completed or corrected, value of incomplete or nonconforming Work, reason for being incomplete, and date of anticipated completion for each item. Include copy of list with request for Certificate of Substantial Completion.

4. Obtain and submit releases enabling Owner's full, unrestricted use of Project and access to services and utilities. Include certificate of occupancy, operating certificates, and similar releases from authorities having jurisdiction and utility companies.

5. Deliver tools, spare parts, extra stocks of material, and similar physical items to Owner.

6. Discontinue or change over and remove temporary facilities and services from Project Site, along with construction tools, mockups, and similar elements.

7. Perform final cleaning according to this Section.

B. Substantial Completion Inspection:

1. When Contractor considers Work to be substantially complete, submit to Engineer and/or Owner:

a. Written certificate that Work, or designated portion, is substantially complete.

b. List of items to be completed or corrected (initial punch list).

2. Within **seven** days after receipt of request for Substantial Completion, Engineer and/or Owner will make inspection to determine whether Work or designated portion is substantially complete.

3. Should Engineer and/or Owner determine that Work is not substantially complete:

a. Engineer and/or Owner will promptly notify Contractor in writing, stating reasons for its opinion.

b. Contractor shall remedy deficiencies in Work and send second written request for Substantial Completion to Engineer and/or Owner.

c. Engineer and/or Owner will reinspect Work.

d. Redo and Inspection of Deficient Work: Repeated until Work passes Engineer's and/or Owner's inspection.

4. When Engineer and/or Owner finds that Work is substantially complete, Engineer and/or Owner will:

a. Prepare Certificate of Substantial Completion on **EJCDC C-625 - Certificate of Substantial Completion** (Section 00 65 16), accompanied by Contractor's list of items to be completed or corrected as verified and amended by Engineer and Owner (final punch list).

b. Submit Certificate to Owner and Contractor for their written acceptance of responsibilities assigned to them in Certificate.

5. After Work is substantially complete, Contractor shall:

a. Allow Owner occupancy of Project under provisions stated in Certificate of Substantial Completion.

b. Complete Work listed for completion or correction within time period stipulated.

6. Owner will occupy all of the Work as specified in Section 01 10 00 - Summary.

C. Prerequisites for Final Completion: Complete following items before requesting final acceptance and final payment.

1. When Contractor considers Work to be complete, submit written certification that:

a. Contract Documents have been reviewed.

b. Work has been examined for compliance with Contract Documents.

c. Work has been completed according to Contract Documents.

d. Work is completed and ready for final inspection.

2. Submittals: Submit following:

a. Final punch list indicating all items have been completed or corrected.

b. Final payment request with final releases and supporting documentation not previously submitted and accepted. Include certificates of insurance for products and completed operations where required.

c. Specified warranties, workmanship/maintenance bonds, maintenance agreements, and other similar documents.

d. Accounting statement for final changes to Contract Sum.

e. Operating and maintenance data, instructions to Owner's personnel: according to this Section.

f. Spare Parts and Maintenance Materials: according to this Section.

g. Record Drawings with annotations made by the contractor during construction of the work, and including As-Built coordinates and elevations on all structures, pipe inverts and key locations as required by Engineer.

h. The Contractor shall furnish the Owner with certified copies of paid invoices (or other proof) indicating Georgia Sales Tax paid on items for which the Owner is eligible for tax refunds. Tax refunded will be to the Owner, with none credited to the Contractor.

i. Retainage will not be paid until the above documents have been submitted and are satisfactory and acceptable to the Owner.

j. Contractor's affidavit of payment of debts and claims per Section 00 65 19.

k. Contractor affidavit of release of liens per Section 00 65 20.

l. Consent of surety to final payment per Section 00 65 21.

3. Perform final cleaning for Contractor-soiled areas according to this Section.

D. Final Completion Inspection:

1. Within **seven** days after receipt of request for final inspection, Engineer and/or Owner will make inspection to determine whether Work or designated portion is complete.

2. Should Engineer and/or Owner consider Work to be incomplete or defective:

a. Engineer and/or Owner will promptly notify Contractor in writing, listing incomplete or defective Work.

b. Contractor shall remedy stated deficiencies and send second written request to Engineer and/or Owner that Work is complete.

c. Engineer and/or Owner will reinspect Work.

d. Redo and Inspection of Deficient Work: Repeated until Work passes **Engineer's** inspection.

3. Final Payment: Upon Final Completion of the Work in accordance with the Contract Documents, the Contractor will be authorized to prepare a final estimate of the work and a Final Payment request. The Engineer will review the final payment request and will, if all items are satisfactory, recommend approval to the Owner. The Engineer will submit to the Owner the final estimate and the final payment request, together with a certification stating that the work is complete and in substantial conformance with these Contract Documents. The entire balance found to be due the Contractor including any retainages, except such sums as may be lawfully retained by the Owner, will be paid to the Contractor.

1.4 STARTING OF SYSTEMS

A. Coordinate schedule for startup of various equipment and systems.

B. Notify Engineer and/or Owner **seven** days prior to startup of each item.

C. Verify that each piece of equipment or system has been checked for proper lubrication, drive rotation, belt tension, control sequence, and for conditions which may cause damage.

D. Verify that tests, meter readings, and electrical characteristics agree with those required by equipment or system manufacturer.

E. Verify that wiring and support components for equipment are complete and tested.

F. Execute startup under supervision of manufacturer's representative or Contractors' personnel according to manufacturer's instructions.

G. When specified in individual Specification Sections, require manufacturer to provide authorized representative who will be present at Site to inspect, check, and approve equipment or system installation prior to startup and will supervise placing equipment or system in operation.

H. Submit a written report according to Section 01 33 00 - Submittal Procedures that equipment or system has been properly installed and is functioning correctly.

1.5 PROJECT RECORD DOCUMENTS

A. Maintain on Site one set of the following record documents; record actual revisions to the Work:

1. Drawings.
2. Specifications.
3. Addenda.
4. Change Orders and other modifications to the Contract.
5. Reviewed Shop Drawings, product data, and Samples.
6. Manufacturer's instruction for assembly, installation, and adjusting.

B. Ensure entries are complete and accurate, enabling future reference by Owner.

C. Store record documents separate from documents used for construction.

D. Record information concurrent with construction progress, not less than weekly.

E. Specifications: Legibly mark and record, at each product Section, description of actual products installed, including the following:

1. Manufacturer's name and product model and number.
2. Product substitutions or alternates used.
3. Changes made by Addenda and modifications.

F. Record Drawings: Legibly mark each item to record actual construction as follows:

1. Include Contract modifications such as Addenda, supplementary instructions, change directives, field orders, minor changes in the Work, and change orders.
2. Include locations of concealed elements of the Work.
3. Identify depth of buried utility lines and provide dimensions showing distances from permanent facility components that are parallel to utilities.
4. Identify and locate existing buried or concealed items encountered during Project.
5. Field changes of dimension and detail.
6. Details not on original Drawings.

G. Submit marked-up paper copy documents to Engineer with claim for final Application for Payment.

H. Submit PDF electronic files of marked-up documents to Engineer with claim for final Application for Payment.

1.6 OPERATION AND MAINTENANCE DATA

A. Submit in PDF composite electronic indexed file.

B. Submit data bound in 8-1/2 x 11-inch text pages, three D side ring binders with durable covers.

C. Prepare binder cover with printed title "OPERATION AND MAINTENANCE INSTRUCTIONS," title of Project**,** and subject matter of binder when multiple binders are required.

D. Internally subdivide binder contents with permanent page dividers, logically organized as described below; with tab titling clearly printed under reinforced laminated plastic tabs.

E. Drawings: Provide with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.

F. Contents: Prepare table of contents for each volume, with each product or system description identified, typed on white paper, in three parts as follows:

1. Part 1: Directory, listing names, addresses, and telephone numbers of Engineer, Contractor, Subcontractors, and major equipment suppliers.

2. Part 2: Operation and maintenance instructions, arranged by Specification Section. For each category, identify names, addresses, and telephone numbers of Subcontractors and suppliers. Include the following:

    a. Significant design criteria.

    b. List of equipment.

    c. Parts list for each component.

    d. Operating instructions.

    e. Maintenance instructions for equipment and systems.

    f. Maintenance instructions for finishes, including recommended cleaning methods and materials, and special precautions identifying detrimental agents.

    g. Safety precautions to be taken when operating and maintaining or working near equipment.

3. Part 3: Project documents and certificates, including the following:

    a. Shop Drawings and product data.

    b. Air and water balance reports.

    c. Certificates.

    d. Copies of warranties and bonds.

1.7 SPARE PARTS AND MAINTENANCE PRODUCTS

A. Furnish spare parts, maintenance, and extra products in quantities specified in individual Specification Sections.

1.8 PRODUCT WARRANTIES AND PRODUCT BONDS

A. Obtain warranties and bonds executed by responsible Subcontractors, suppliers, and manufacturers within ten days after completion of applicable item of Work.

B. Execute and assemble transferable warranty documents and bonds from Subcontractors, suppliers, and manufacturers.

C. Verify documents are in proper form, contain full information, and are notarized.

D. Co-execute submittals when required.

E. Include table of contents and assemble in three D side ring binder with durable cover.

F. Submit prior to final Application for Payment.

G. Time of Submittals:

1. For equipment or component parts of equipment put into service during construction with Owner's permission, submit documents within **ten** days after acceptance.

2. Make other submittals within **ten** days after date of Substantial Completion, prior to final Application for Payment.

3. For items of Work for which acceptance is delayed beyond Substantial Completion, submit within **ten** days after acceptance, listing date of acceptance as beginning of warranty or bond period.

H. The Contractor shall warrant and guarantee for a period of one year from the date of Substantial Completion of the Work, that the completed Work is free from all defects due to faulty products or workmanship. The Contractor shall promptly make such corrections as may be necessary by reason of such defects. The Owner will give notice of observed defects with reasonable promptness. In the event that the Contractor should fail to make such repairs, adjustments or other work that may be made necessary by such defects, the Owner may do so and charge the Contractor the cost thereby incurred. The Performance Bond shall remain in full force and effect throughout the warranty period.

I. The Contractor shall not be obligated to make replacements which become necessary because of ordinary wear and tear, or as a result of gross negligence operation or maintenance, or as a result of improper work or damage by another Contractor or the Owner, or to perform any work which is normally performed by a maintenance crew during operation.

J. The Contractor shall, at Contractor's own expense, furnish all labor, materials, tools and equipment required and shall make such repairs and removals and shall perform such work or reconstruction as may be made necessary by any structural or functional defect or failure resulting from neglect, faulty workmanship or faulty materials, in any part of the Work performed by the Contractor. Such repair shall also include refilling of trenches, excavations or embankments which show settlement or erosion after backfilling or placement.

K. Except as noted on the Drawings or as specified, all structures such as embankments and fences shall be returned to their original condition prior to the completion of the Contract. Any and all damage to any facility not designated for removal, resulting from the Contractor's operations, shall be promptly repaired by the Contractor at no cost to the Owner.

L. The Contractor shall be responsible for all road and entrance reconstruction and repairs and maintenance of same for a period of one year from the date of Substantial Completion. In the event the repairs and maintenance are not made immediately and it becomes necessary for the owner of the road to make such repairs, the Contractor shall reimburse the owner of the road for the cost of such repairs.

M. In the event the Contractor fails to proceed to remedy the defects upon notification within 15 days of the date of such notice, the Owner reserves the right to cause the required materials to be procured and the work to be done, and to hold the Contractor and the sureties on Contractor's bond liable for the cost and expense thereof.

N. Notice to Contractor for repairs and reconstruction will be made in the form of a registered letter addressed to the Contractor at Contractor's home office.

O. Neither the foregoing paragraphs nor any provision in the Contract Documents, nor any special guarantee time limit implies any limitation of the Contractor's liability within the law of the place of construction.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that existing Site conditions and substrate surfaces are acceptable for subsequent Work. Beginning new Work means acceptance of existing conditions.

B. Verify that existing substrate is capable of structural support or attachment of new Work being applied or attached.

C. Examine and verify specific conditions described in individual Specification Sections.

D. Verify that utility services are available with correct characteristics and in correct locations.

3.2 EXECUTION

A. Comply with manufacturer's installation instructions, performing each step-in sequence. Maintain one set of manufacturer's installation instructions at Project Site during installation and until completion of construction.

B. When manufacturer's installation instructions conflict with Contract Documents, request clarification from Engineer before proceeding.

C. Verify that field measurements are as indicated on approved Shop Drawings or as instructed by manufacturer.

D. Secure Work true to line and level and within specified tolerances, or if not specified, industry-recognized tolerances.

E. Climatic Conditions and Project Status: Install each unit of Work under conditions to ensure best possible results in coordination with entire Project.

1. Isolate each unit of Work from incompatible Work as necessary to prevent deterioration.

2. Coordinate enclosure of Work with required inspections and tests to minimize necessity of uncovering Work for those purposes.

F. Adjust operating products and equipment to ensure smooth and unhindered operation.

G. Clean and perform maintenance on installed Work as frequently as necessary through remainder of construction period. Lubricate operable components as recommended by manufacturer.

3.4 CUTTING AND PATCHING

A. Employ skilled installers to perform cutting and patching.

B. Execute cutting, fitting, and patching including excavation and fill to complete Work and to:

1. Fit the several parts together, to integrate with other Work.

2. Uncover Work to install or correct ill-timed Work.

3. Remove and replace defective and nonconforming Work.

4. Remove samples of installed Work for testing.

5. Provide openings in elements of Work for penetrations of mechanical and electrical Work.

C. Execute Work by methods to avoid damage to other Work and to provide proper surfaces to receive patching and finishing.

D. Cut masonry and concrete materials using masonry saw or core drill.

E. Restore Work with new products according to requirements of Contract Documents.

F. Fit Work tight to pipes, sleeves, ducts, conduits, and other penetrations through surfaces.

G. Refinish surfaces to match adjacent finishes. For continuous surfaces, refinish to nearest intersection; for assembly, refinish entire unit.

H. Identify hazardous substances or conditions exposed during the Work to Engineer for decision or remedy.

3.5 PROTECTING INSTALLED CONSTRUCTION

A. Protect installed Work and provide special protection where specified in individual Specification Sections.

B. Provide temporary and removable protection for installed products. Control activity in immediate Work area to prevent damage.

C. Prohibit traffic or storage upon waterproofed or roofed surfaces. When traffic or activity is necessary, obtain recommendations for protection from waterproofing or roofing material manufacturer.

D. Prohibit traffic from landscaped areas.

3.6 FINAL CLEANING

A. In addition to the standards described in this Section, comply with all pertinent requirements of governmental agencies having Jurisdiction.

B. The Contractor shall handle hazardous waste and materials in accordance with applicable local, state, and federal regulations. Waste shall also be disposed of in approved landfills as applicable.

C. Burning or burying rubbish and waste materials on the site shall not be allowed,

D. Disposal of hazardous wastes or materials into sanitary or storm sewers shall not be allowed.

E. Unless otherwise shown on the Drawings, specified or directed, the Contractor shall legally dispose off the site all surplus materials and equipment from demolition and shall provide suitable off-site disposal site, or utilize a site designated by the Owner.

F. At least each week, and more often if necessary, completely remove all scrap, debris and waste material from the job site.

G. Hose down all paved areas on the site and all public sidewalks directly adjacent to the site; rake clean other surfaces of the grounds. Completely remove all resultant debris.

H. Cleanup all evidence of temporary construction facilities, haul roads, work areas, structures, foundations of temporary structures, stockpiles of excess or waste materials, or any other evidence of construction, as directed by the Engineer.

E. Any landscape feature damaged by the Contractor shall be restored as nearly as possible to its original condition at the Contractor's expense. The Engineer will decide what method of restoration shall be used.

J. Should the Owner occupy the Work or any portion thereof prior to its completion by the Contractor and acceptance by the Owner, responsibilities for interim and final cleaning of the occupied spaces shall remain with the Contractor.

END OF SECTION

SECTION 01 75 16

START-UP PROCEDURES

PART 1 GENERAL

1.01 DESCRIPTION

A. Refer to Contract Provisions as well as Section 01 60 00, “Product Requirements.”

B. The inspection and testing requirements in this Section are in addition to those requirements defined in the technical specifications. At a minimum, provide the following startup and testing activities:

1. Installation check and inspection of equipment and materials as specified in section 01 60 00, Product Requirements, and as specified herein.

2. Shop test of equipment as specified in these sections.

3. Functional test of equipment as specified in these sections.

4. Performance test of equipment and systems as specified herein.

5. Operational test of equipment and systems as specified herein.

C. The exact sequence of start-up will depend upon a start-up schedule proposed by the Contractor and reviewed by the Engineer. The facility start-up schedule will be based upon the schedule information generated via the Project Schedule and a priority list of the equipment and systems developed by the Engineer, which are critical and required for start-up. The start-up schedule will be updated on a monthly basis, or as directed by the Engineer.

D. It is the Contractor's responsibility to make sure that all Work is completed in time to support functional, performance and operational tests. The Contractor is further responsible for advising the Engineer no less than two weeks prior to the Work being ready to begin testing. Functional testing of the systems may begin only after the Engineer has received full documentation and certification by the manufacturer and Contractor of the complete and correct installation of equipment associated with the Work. The Contractor shall also certify to the Engineer that all ancillary systems and components associated with testing have been correctly installed/constructed, completed and tested. For example, prior to beginning a functional test for a pump, the Contractor must certify to the Engineer that all associated pipes, tanks, electrical equipment, and instrumentation have been tested according to the applicable specification section(s).

1.02 DEFINITIONS

A. Shop Test: A test performed by the Supplier either at the place of manufacture, the place of assembly, or at another location where the required testing apparatus is

located, for the purpose of proving that the Products meet the requirements of the pertinent technical specification(s).

B. Installation Check: See Section 01 60 00, "Product Requirements."

C. Functional Test: A test or series of tests performed by the Contractor in the presence of the Engineer for the purpose of demonstrating that equipment operates in prescribed manner without overheating, jamming, excessive noise or vibration, or evidence of excessive wear. Tests are performed using clean water or air as appropriate.

D. Vibration Test: A test performed on specified motors by an independent agency in the presence of the Engineer and Manufacturers Representative, for the purpose of demonstrating that equipment operates without excessive vibration.

E. Performance Test: A specified test or series of tests performed by the Contractor in the presence of the Engineer, and Owner after the functional test. The test/tests are performed using process fluid (e.g. wastewater, chemical, digester gas, etc.) with the intent to demonstrate and confirm that the equipment and/or system meets the specified performance requirements.

F. Operational Test: The effort which follows successful functional and performance testing, and includes the process of putting the facility or any separately functioning and usable part of the work in operating order, with the intent to demonstrate and verify the operation of the completed facility as a unit.

G. Operational Period: A 30-day period of time in which the operational test is performed and final cleaning, adjusting and balancing of equipment is completed. This period is prior to Final Completion.

H. Significant Interruption of Operational Test may include, but is not limited to, any of the following events:

1. Failure of Contractor to maintain qualified on-site operational testing personnel as scheduled.
2. Failure to meet specified performance criteria for more than 2 consecutive hours.
3. Failure of any critical equipment unit, system, or subsystem that is not satisfactorily corrected within 5 hours after failure.
4. Failure of non-critical unit, system, or subsystem that is not satisfactorily corrected within 8 hours after failure.
5. As may be determined by Engineer.

I. System: The overall process, or a portion thereof, that performs a specific function. A system may consist of two or more subsystems as well as two or more types of equipment.

J. Manufacturer's technical representative: that person, or persons, provided by the Manufacturer who is qualified, by having the training and experience, to provide technical and/or process related advice, and/or assistance, relating to the installation

or utilization of the Products provided by that same manufacturer, for installation and utilization in the Work. Such training and experience shall include a minimum of three years participation in similar work including no less than three similar projects during this three-year period.

1.03 SUBMITTALS

A. Functional and performance test schedules and plan for equipment, units, and systems. Include test plan, procedures, and log format.

B. Schedule and plan of operational test activities.

C. Qualifications of manufacturer's technical representatives.

D. Manufacturer's Certificate of Proper Installation as required in Section 01 60 00, "Product Requirements."

E. Manufacturer's Test Reports: Functional and performance tests;

1. In a format appropriate for equipment and testing performed.

2. Acceptable to Engineer.

3. Submitted for each piece of equipment or system tested.

F. Summary log of all testing and training activities, by specification section and specific equipment item, as applicable.

G. Operation and maintenance data as specified in Section 01 70 00, "Execution and Closeout Requirements."

1.04 TESTING AND START-UP COORDINATION MEETINGS

A. Coordination meetings will be conducted by the Engineer to discuss the overall testing and startup program associated with the equipment being provided under this contract. The Engineer will notify the Contractor of the time and place of the meetings. The purpose of these meetings will be to:

1. Review the testing and startup requirements of both the Contractor and manufacturer's technical representative(s).

2. Develop a testing and startup plan based upon Owner, Contractor, manufacturer's technical representative, and Engineer input on the:

a. Status of equipment installation and readiness for testing and operation.

b. Status of required testing and startup deliverables.

c. Requirements of the Contract Documents for Owner personnel training, testing and startup involvement.

3. Incorporate the above into the Project Schedule for testing and startup of the equipment/sub-system/system/facility.

4. Coordinate activities among the Contractor, Engineer, and Owner during start-up testing.

B. Attended by: Contractor, Engineer, and Owner

PART 2 PRODUCTS

2.01 DOCUMENTS

A. The Contractor shall prepare and maintain certain records, reports, and logs to manage and report on the testing and startup proceedings as they occur during the course of the project.

B. Forms:

1. Equipment Start-up and Testing Log – The Log consists of information pertaining to specific equipment items and the testing and starting information relative to the equipment.

2. Equipment Start-up/Testing Report – This report documents that the particular equipment has been properly and successfully tested and started.

PART 3 EXECUTION

3.01 EQUIPMENT AND SYSTEM TESTING PREPARATION

A. The Contractor shall:

1. Complete Work associated with the unit and related processes, to include but not be limited to:

   a. Pressure testing of associated piping

   b. Leak testing of associated tanks

   c. Testing of associated electrical equipment, wire, and cable.

   d. Testing of associated instrumentation and controls

2. Provide and coordinate qualified manufacturer’s technical representative services.

3. Furnish related documentation to include but not be limited to:

   a. Manufacturer's Certificate of Proper Installation per Section 01 60 00, “Product Requirements.”

   b. Approved testing plan.

   c. Equipment operation and maintenance manuals

   d. Electrical testing documentation

4. Coordinate all testing with ENGINEER and OWNER. With the exception of physical inspection and bumping of motors to determine proper rotation, all testing must be approved by ENGINNER.

5. Designate and furnish one or more persons to be responsible for coordinating and expediting Contractor's facility startup and testing duties. The person or persons shall be present during facility startup meetings and shall be available at all times during the facility startup period.

6. Provide and have on hand temporary valves, gauges, and piping, as well as any test equipment, spare parts, and special tools before testing any unit or system.

7. Provide all labor required to aid the manufacturer's technical representatives with their inspection and in making required adjustments to all equipment installed under this contract.

8. Installation check: Prior to starting functional and performance testing the Contractor shall complete the requirements of Installation check per section 01 60 00, "Product Requirements".

B. Ready-to-test determination will be by the Engineer based at least on the following:

1. Notification by Contractor of equipment and system readiness for testing.

2. Acceptable testing plan.

3. Acceptable operation and maintenance manuals, loop drawings and other related test documentation.

4. Receipt of Manufacturer's Certificate of Proper Installation.

5. Adequate completion of Work adjacent to, or interfacing with, equipment to be tested.

6. Availability and acceptability of manufacturer's technical representative to assist in testing of respective equipment, and satisfactory fulfillment of other specified manufacturers' responsibilities.

7. Equipment and electrical tagging and identification complete

8. Necessary testing devices, spare parts, and special tools on hand.

3.02 SHOP TEST

In accordance with the requirements of the individual equipment specifications.

3.03 FUNCTIONAL TEST

A. Contractor shall coordinate the date and time for the functional test of equipment with the Owner and the Engineer. Test plans must be approved at least 14 days prior to date of test.

B. After installation and checkout, all equipment shall be tested in the presence of the Engineer and in accordance with the testing requirements specified in the applicable technical Specifications. During the field tests, the equipment shall be subjected to various full load and partial load conditions and emergency operating and shutdown conditions. The ability of the equipment to operate in the manner prescribed in the technical specifications without overheating, jamming, excessive noise or vibration, or evidence of excessive wear shall be demonstrated to the Engineer. Equipment with package controls shall include as a part of the test, operation in AUTOMATIC mode.

C. All equipment shall be tested before it is covered or insulated. All accessory equipment, which may be damaged by conditions during the test, shall be isolated or otherwise protected.

D. The Contractor in conjunction with the Manufacturer's technical representative's guidance and recommendations shall furnish all testing instruments and gauges necessary for conducting the tests. Installed instruments and gauges shall be used whenever possible if calibrated and approved for the purpose. Calibrate all installed instruments and gauges and attach a cloth tag showing date of calibration. Portable test equipment used in field-testing shall be calibrated in the presence of the Engineer or suitable written evidence attesting to the accuracy of the equipment shall be submitted.

E. A record shall be made of each field test showing operating temperatures and pressures, motor current and voltage, speed, flow rate and other pertinent data. Information recorded for fans, blowers, compressors and pumps shall include static pressures entering and leaving the equipment, fluid temperature entering and leaving the equipment, ambient temperature, barometric pressure and relative humidity, rpm and discharge flow rate. Four copies of all recorded test data and information shall be submitted to the Engineer.

F. Test fluid shall be potable water, plant effluent, or air as applicable unless the Engineer approves other fluids in writing.

G. Should the results of the tests indicate that the equipment has failed to perform in accordance with the requirements of the applicable Specifications, the manufacturer's technical representative shall make such modifications or adjustments as required for satisfactory operation, including replacement of any or all components, at no additional cost to the Owner. Following the modifications or adjustments, the manufacturer's technical representative shall repeat the field tests as specified herein. This procedure shall be repeated until the results of the field tests indicate that the equipment has satisfied the requirements of the applicable Specification section.

H. If, in Engineer's opinion, each system meets the functional requirements specified, such system will be identified and acknowledged as conforming for purposes of advancing to performance testing phase. If, in Engineer's opinion, functional test results do not meet requirements specified, the system(s) will be considered as nonconforming. Additional testing will be conducted as required to achieve conformance, and will be accomplished at no additional cost to the Owner.

I. Separate items of equipment demonstrated to function properly during subsystem testing may require no further acceptance test if documentation of subsystem testing is acceptable to Engineer.

J. Performance testing shall not commence until the equipment or system meets functional tests specified herein and required by the manufacturer.

3.04 OPERATIONAL TEST

A. Prior to initiation of the operation test, the Contractor shall certify in writing that:

1. Hydraulic structures, piping systems, and valves have been successfully tested. Include copies of pertinent test reports/results.

2. Equipment systems and subsystems have been checked for proper installation, started, and successfully tested to indicate that they are operational. Include copies of pertinent test reports/results.

3. Systems and subsystems are capable of performing their intended functions. Include a copy of the signed Manufacturer's Certificate of Proper Installation.

4. Facilities and systems are ready for intended operation.

B. Operational test shall demonstrate proper installation, adjustment, function, performance, and operation of equipment, systems, control devices, and required interfaces individually and in conjunction with process instrumentation and control system. Unless otherwise specified, operational testing shall be considered complete when, in the opinion of the Engineer, the facility has operated in the manner intended for 14 continuous days without a significant interruption. This period is in addition to any training, functional, or performance test periods specified elsewhere. A significant interruption will require the startup then in progress to be stopped and restarted (i.e. the14 continuous days requirement starts over at day 1) after corrections are made.

C. When operational testing has commenced, the Contractor shall schedule remaining Work so as not to interfere with or delay the completion of facility startup. Support operational testing activities with adequate staff to prevent delays and process upset. This staff shall include, but not be limited to, major equipment and system manufacturer's technical representatives, Subcontractors, electricians, instrumentation personnel, millwrights, pipe fitters, plumbers, and others as appropriate.

D. Any and all adjustments, repairs, and corrections necessary to complete operational testing shall be coordinated and completed by the Contractor.

3.05 SUBSTANTIAL COMPLETION

In accordance with the requirements of the Contract Provisions.

3.06 FINAL ACCEPTANCE

In accordance with the requirements of the Contract Provisions.

3.07 CONTINUOUS OPERATIONS

Owner will accept equipment and systems as substantially complete and ready for continuous operation only after successful operational test is completed, documented, and reports submitted, disinfections complete, all required spare parts and special tools are turned over by the Contractor, and manufacturers' services completed for training of Owner's personnel.

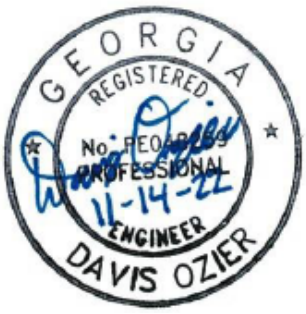
END OF SECTION

TECHNICAL SPECIFICATIONS

FOR

SYLVANIA WPCP UPGRADES

Prepared For:



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SECTION 00 01 10

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SECTION 02 41 00

DEMOLITION

PART 1 GENERAL

1.01 RELATED DOCUMENTS

Construction Plans and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.

1.02 DESCRIPTION OF WORK

A. Extent of demolition work is indicated on the Construction Plans.

B. Demolition includes all operations necessary for demolition of the existing structures, foundations and utilities as shown.

C. Remove debris, rubbish and other materials resulting from demolition operations from the site. Transport and legally dispose of materials off site.

1.03 SUBMITTALS

A. Schedule: Submit schedule indicating proposed methods and sequence of operations for demolition work to Owner's Representative for review prior to commencement of work. Include coordination for shut-off, capping, and continuation of utility services as required, together with details for dust and noise control protection. The procedures shall provide for safe conduct of the work, careful removal and disposition of materials specified to be salvaged, protection of property which is to remain undisturbed, coordination with other work in progress, and timely disconnection of utility services. The submittal shall include a detailed description of the methods and equipment to be used for each operation, and the sequence of operation.

B. Provide detailed sequence of demolition and removal work to ensure uninterrupted progress of Owner's on-site operations.

C. Coordinate with Owner's continuing occupation of portions of existing building/site, with Owner's partial occupancy of completed new addition/site.

1.04 JOB CONDITIONS

A. Occupancy: Owner will be continuously occupying areas of the building/site immediately adjacent to areas of selective demolition. Conduct selective demolition work in manner that will minimize need for disruption of Owner's normal operations. Provide minimum of 72 hours advance notice to Owner of

demolition activities which will severely impact Owner's normal operations.

B. Condition of Structures: Owner assumes no responsibility for actual condition of items or structures to be demolished.

C. Conditions existing at time of commencement of contract will be maintained by Owner insofar as practicable. However, variations within structure may occur by Owner's removal and salvage operations prior to start of selective demolition work.

D. Partial Demolition and Removal: Items indicated to be removed but of salvable value to Contractor may be removed from structure as work progresses. Transport salvaged items from site as they are removed.

E. Storage or sale of removed items on site will not be permitted.

F. Protection: Provide temporary barricades and other forms of protection as required to protect Owner's personnel and general public from injury due to selective demolition work.

G. Provide protective measures as required to provide free and safe passage of Owner's personnel and general public to and from occupied portions of building/site.

H. Erect temporary covered passageways as required by authorities having jurisdiction.

I. Provide interior and exterior shoring, bracing, or support to prevent movement, settlement, or collapse of structure or element to be demolished, and adjacent facilities or work to remain.

J. Protect from damage existing finish work that is to remain in place and becomes exposed during demolition operations.

K. Protect floors with suitable coverings when necessary.

L. Construct temporary insulated solid dustproof partitions where required to separate areas where noisy or extensive dirt or dust operations are performed. Equip partitions with dustproof doors and security locks if required.

M. Provide temporary weather protection during interval between demolition and removal of existing construction on exterior surfaces, and installation of new construction to insure that no water leakage or damage occurs to structure or interior areas of existing building.

N. Remove protections at completion of work.

O. Damages: Promptly repair damages caused to adjacent facilities by demolition work at no cost to Owner.

P. Traffic: Conduct selective demolition operations and debris removal in a manner to ensure minimum interference with roads, streets, walks, and other adjacent occupied or used facilities.

Q. Do not close, block or otherwise obstruct streets, walks or other occupied or used facilities without written permission from authorities having jurisdiction. Provide

alternate routes around closed or obstructed traffic ways if required by governing regulations.

R. Explosives: Use of explosives will not be permitted unless otherwise noted.

S. Utility Services: Maintain existing utilities indicated to remain, keep in service, and protect against damage during demolition operations.

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

U. Environmental Controls: Use water sprinkling, temporary enclosures, and other suitable methods to limit dust and dirt rising and scattering in air to lowest practical level. Comply with governing regulations pertaining to environmental protection.

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

W. NESHAP Compliance: The Contractor is responsible for being aware of and complying with the National Emission Standard for Hazardous Air Pollutants (NESHAP) Section 112 of the Federal Clean Air Act regarding asbestos.

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION

3.01 INSPECTION

Prior to commencement of demolition work, inspect areas in which work will be performed. Photograph existing conditions to structure surfaces, equipment or to surrounding properties which could be misconstrued as damage resulting from selective demolition work; file with Owner's Representative prior to starting work.

3.02 PREPARATION

A. Provide interior and exterior shoring, bracing, or support to prevent movement, settlement or collapse of structures to be demolished and adjacent facilities to remain.

B. Cease operations and notify the Owner's Representative immediately if safety of structure appears to be endangered. Take precautions to support structure until determination is made for continuing operations.

C. Cover and protect furniture, equipment and fixtures to remain from soiling or damage when demolition work is performed in rooms or areas from which such

item have not been removed.

D. Erect and maintain dust-proof partitions and closures as required to prevent spread of dust or fumes to occupied portions of the building.

E. Where selective demolition occurs immediately adjacent to occupied portions of the building, construct dust-proof partitions of minimum 4" studs, 5/8" drywall (joints taped) on occupied side 1/2" fire-retardant plywood on demolition side, and fill partition cavity with sound-deadening insulation.

F. Provide weatherproof closures for exterior openings resulting from demolition work.

G. Locate, identify, stub off and disconnect utility services that are not indicated to remain.

H. Provide by-pass connections as necessary to maintain continuity of service to occupied areas of building. Provide minimum of 72 hours advance notice to Owner if shut-down of service is necessary during change-over.

3.03 DEMOLITION

A. Perform selective demolition work in a systematic manner. Use such methods as required to complete work indicated on the Plans in accordance with demolition schedule and governing regulations.

B. Demolish concrete and masonry in small sections. Cut concrete and masonry at junctures with construction to remain using power-driven masonry saw or hand tools; do not use power-driven impact tools.

C. Locate demolition equipment throughout structure and promptly remove debris to avoid imposing excessive loads on supporting walls, floors or framing.

D. All existing structures shall be completely removed where denoted on the Plans. All foundations and slabs shall be broken up and removed from the site. Sidewalks, curbs, gutters, streets and street light bases shall be completely removed. It is not anticipated that piling will be encountered under any of the structures to be removed; however, where piling are encountered they shall be removed to a point three feet below existing ground.

E. When approved in writing by the Engineer and when authorized by the proper authorities, the Contractor may dispose of such debris by burning on the Project site provided all requirements set forth by the governing authorities are met. The authorization to burn shall not relieve the Contractor in any way from damages which result from the Contractor's operations. On easements through private property, the Contractor shall not burn on the site unless written consent is also secured from the property owner, in addition to authorization from the proper authorities.

F. Demolish foundation walls to a depth of not less than 12" below existing ground surface. Demolish and remove below-grade wood or metal construction. Break up below-grade concrete slabs.

G. For interior slabs on grade, use removal methods that will not crack or structurally disturb adjacent slabs or partitions. Use power saw where possible.

H. Completely fill below-grade areas and voids resulting from demolition work. Provide fill consisting of approved earth, gravel or sand, free of trash and debris, stones over 6" diameter, roots or other organic matter.

I. If anticipated mechanical, electrical or structural elements which conflict with intended function or design are encountered, investigate and measure both nature and extent of the conflict. Submit report to Owner's Representative in written, accurate detail. Pending receipt of directive form Owner's Representative rearrange selective demolition schedule as necessary to continue overall job progress without delay.

3.04 SALVAGE MATERIALS

A. Salvage Items: Where indicated on the Plans as "Salvage-Deliver to Owner", carefully remove indicated items, clean, store and turn over to Owner and obtain receipt.

B. Historic artifacts, including cornerstones and their contents, commemorative plaques and tables, antiques, and other articles of historic significance remain the property of the Owner. Notify Owner's Representative if such items are encountered and obtain acceptance regarding method of removal and salvage for Owner.

3.05 DISPOSAL OF DEMOLISHED MATERIALS

A. Remove debris, rubbish and other materials resulting from demolition operations from the site. Transport and legally dispose of materials off site.

B. If hazardous materials are encountered during demolition operations, comply with applicable regulations, laws, and ordinances concerning removal, handling and protection against exposure or environmental pollution.

1. Burning of removed materials is not permitted on project site.

3.06 DEMOLITION AND REPAIR

A. Upon completion of demolition work, remove tools, equipment and demolished materials from site. Remove protections and leave interior areas broom clean.

B. Repair demolition performed in excess of that required. Return structures and surfaces to remain to condition existing prior to commencement of selective demolition work. Repair adjacent construction or surfaces soiled or damaged by selective demolition work.

END OF SECTION

SECTION 03 10 00

CONCRETE FORMING AND ACCESSORIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Formwork for cast-in place concrete, with shoring, bracing and anchorage.

B. Form Accessories.

C. Expansion and Contraction Joints with Accessories.

D. Water Stops

1.02 RELATED SECTIONS

A. Section 03 20 00 - Concrete Reinforcement.

B. Section 03 31 00 - Cast-In-Place Concrete.

1.03 REFERENCES

C. ACI 301 - Specifications for Structural Concrete for Buildings; American Concrete Institute International; 1996.

D. ACI 318 - Building Code Requirements for Reinforced Concrete and Commentary; American Concrete Institute International; 1999.

E. ACI 347R - Guide to Formwork for Concrete; American Concrete Institute International; 1994.

F. ACI350R – Environmental engineering Concrete Structures; American Concrete institute International; 1989.

G. ASME A17.1 - Safety Code for Elevators and Escalators; The American Society of Mechanical Engineers; 1996, '97, '98, '99 Addenda.

H. PS 1 - Construction and Industrial Plywood; National Institute of Standards and Technology (Department of Commerce); 1995.

I. AHA A135.4 (1995) Basic Hardboard

J. ASTM A 1011/A 1011M (2003a) Steel, Sheet and Stip, Hot-Rolled, Carbon, Structural, High Strength Low-Alloy and High-Strength Low-Alloy With Improved Formability

K. ASTM A 109/A 109M (2003) Steel, Strip, Carbon (0.25 Maximum Percent), Cold-Rolled

L. ASTM A 167 (1999) Stainless and Heat-Resisting Chromium-Nickel Steel Plate,

Sheet, and Strip

M. ASTM A 480/A 480M (2003b) General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet, and Strip

N. ASTM C 919 (2002) Use of Sealants in Acoustical Applications

O. ASTM C 920 (2002) Elastomeric Joint Sealants

P. ASTM D 1751 (1999) Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)

Q. ASTM D 1752 (1984; R 1996e1) Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction

R. ASTM D 2628 (1991; R 1998) Preformed Polychloroprene Elastomeric Joint Seals for Concrete Pavements

S. ASTM D 2835 (1989; R 1998) Lubricant for Installation of Preformed Compression Seals in Concrete Pavements

T. ASTM D 4 (1986; R 1998) Bitumen Content

U. ASTM D 412 (1998a; R 2002e1) Vulcanized Rubber and Thermoplastic Elastomers – Tension

V. ASTM D 471 (1998e1) Rubber Property - Effect of Liquids

W. ASTM D 5249 (1995; R 2000) Backer Material for Use with Cold-and Hot-Applied Joint Sealants in Portland-Cement Concrete and Asphalt Joints

X. ASTM D 5329 (1996) Sealants and Fillers, Hot-Applied, for Joints and Cracks in Asphaltic and Portland Cement Concrete Pavements

Y. COE CRD-C 513 (1974) Specifications for Rubber Waterstops

Z. COE CRD-C 572 (1974) Specifications for Polyvinylchloride Waterstops

1.03 DESIGN REQUIREMENTS

1. Formwork shall be designed in accordance with methodology of ACI 347 for anticipated loads, lateral pressures, and stresses. Forms shall be capable of producing a surface, which meets the requirements of the class of finish specified in Section 03 30 00 CAST-IN-PLACE CONCRETE. Forms shall be capable of withstanding the pressures resulting from placement and vibration of concrete.
2. This contract is partially funded by the GEFA CWSRF and the equipment manufacturer shall meet the requirements identified in the SRF Supplemental General conditions.

1.05 SUBMITTALS

A. See Section 01 33 00 – Submittal Requirements

B. Formwork - Drawings showing details of formwork, including dimensions of panel joints, supports, studding and shoring, and sequence of form and shoring

removal. Manufacturers recommendation on method and rate of application of form release agents.

C. Samples of form ties and method of sealing form tie hole from transmition of water in hydraulic structures.

D. Construction and Control Joints: Layout and location for each type.

E. Manufacturer's literature, including safety data sheets, for preformed fillers and the lubricants used in their installation; field-molded sealants and primers (when required by sealant manufacturer); preformed compression seals and preformed control joints.

F. Water Stops - Details of splices, method of securing and supporting water stop in forms to maintain proper orientation and location during concrete placement.

G. Samples of all proposed waterstops this includes both PVC and hydrophilic waterstops

1.06 QUALITY ASSURANCE

Design formwork under direct supervision of a Professional Structural Engineer experienced in design of concrete formwork and licensed in the State of Georgia.

1.07 DELIVERY, STORAGE, AND HANDLING

Material delivered and placed in storage shall be stored off the ground and protected from moisture, dirt, and other contaminates. Sealants shall be delivered in the manufacturer's original unopened containers. Sealants whose shelf life has expired shall be removed from the site.

PART 2 PRODUCTS

2.01 WOOD FORM MATERIALS

A. Form Materials: At the discretion of the Contractor.

B. Softwood Plywood: PS 1, C Grade, Group 2.

C. Softwood Plywood: PS 1, B-B High Density Concrete Form Overlay, Class I.

D. Plywood: Douglas Fir species; solid one side grade; sound undamaged sheets with clean, true edges.

E. Lumber: Straight, dressed on all sides, uniforms width and thickness, free from knots, offsets, holes, dents, and other surface defects; with grade stamp clearly visible.

2.02 PREFABRICATED FORMS

A. Manufacturers:

1. Alabama Metal Industries Corporation; www.amico-online.com.
2. Molded Fiber Glass Concrete Forms Co.
3. Reward Wall Systems.
4. SureVoid Products, Inc.
5. Substitutions: See Section 01 60 00 - Product Requirements.

B. Preformed Steel Forms: Minimum 16 gage matched, tight fitting, stiffened to support weight of concrete without deflection detrimental to tolerances and appearance of finished surfaces.

C. Preformed Plastic Forms: Thermoplastic polystyrene form liner, tight fitting, stiffened to support weight of concrete without deflection detrimental to tolerances and appearance of finished surfaces.

D. Glass Fiber Fabric Reinforced Plastic Forms: Matched, tight fitting, stiffened to support weight of concrete without deflection detrimental to tolerances and appearance of finished concrete surfaces.

E. Pan Type: Steel, of size and profile indicated.

F. Tubular Column Type: Round, spirally wound laminated fiber material, surface treated with release agent, non-reusable, of sizes indicated.

G. Void Forms: Moisture resistant treated paper faces, biodegradable, structurally sufficient to support weight of wet concrete mix until initial set; 2 inches (50 mm) thick.

2.03 FORMWORK ACCESSORIES

A. Form Ties: Removable type, galvanized metal, fixed length, cone type, with waterproofing washer, 7/8 inch back break dimension, free of defects that could leave holes larger than 1 inch in concrete surface.

B. Water Stop Ties: For water-holding structures, basements, pipe galleries, and accessible spaces below finish grade, furnish one of the following:

1. Integral steel water stop 0.103-inch thick and 0.625 inch in diameter tightly and continuously welded to tie.
2. Neoprene water stop 3/16-inch thick and 15/16 inch in diameter whose center hole is 1/2-diameter of tie, or molded plastic water stop of comparable size.
3. Orient water stop perpendicular to tie and symmetrical about center of tie.
4. Design ties to prevent rotation or disturbance of center portion of tie during removal of ends and to prevent water leaking along tie.

C. Form Release Agent: Material: Release agent shall not bond with, stain, or adversely affect concrete surfaces, and shall not impair subsequent treatment of

concrete surfaces when applied to forms. A ready-to-use water based material formulated to reduce or eliminate surface imperfections, containing no mineral oil or organic solvents. Environmentally safe, meeting local, state, and federal regulation and can be used in potable water facilities.

D. Corners: Filleted, rigid plastic type; 1 x 1 inch size; maximum possible lengths.

E. Dovetail Anchor Slot: Galvanized steel, 22 gauge thick, foam filled, release tape sealed slots, anchors for securing to concrete formwork.

F. Flashing Reglets: Galvanized steel, 22 gauge thick, longest possible lengths, with alignment splines for joints, foam filled, release tape sealed slots, anchors for securing to concrete formwork.

G. Nails, Spikes, Lag Bolts, Through Bolts, Anchorages: Sized as required, of sufficient strength and character to maintain formwork in place while placing concrete.

2.04 CONTRACTION JOINT STRIPS

Contraction joint strips shall be 1/8 inch thick tempered hardboard conforming to AHA A135.4, Class 1. In lieu of hardboard strips, rigid polyvinylchloride (PVC) or high impact polystyrene (HIPS) insert strips specifically designed to induce controlled cracking in slabs on grade may be used. Such insert strips shall have removable top section.

2.05 PREFORMED EXPANSION JOINT FILLER

Expansion joint filler shall be preformed material conforming to ASTM D 1751 or ASTM D 1752. Unless otherwise indicated, filler material shall be 10 mm 3/8 inch thick and of a width applicable for the joint formed. Backer material, when required, shall conform to ASTM D 5249.

2.06 SEALANT

A. Preformed Polychloroprene Elastomeric Type ASTM D 2628.

B. Lubricant for Preformed Compression Seals ASTM D 2835.

C. Field-Molded Type ASTM C 920, Type M, Grade P or NS, Class 25, Use [T] [NT] for horizontal joints. Type M, Grade NS, Class 25, Use NT for vertical joints. Bond breaker material shall be polyethylene tape, coated paper, metal foil or similar type materials. The back-up material shall be compressible, non-shrink, nonreactive with sealant, and non-absorptive material type such as extruded butyl or polychloroprene rubber.

2.07 PVC WATERSTOPS FOR EXPANSION JOINTS

A. Provide flexible PVC (polyvinyl chloride) waterstop as manufactured by Greenstreak, profile style number 732, or approved equal. This profile has a

length of 6", a thickness of 3/8" a bulb diameter of 7/8", and rib dimension of 5/8".

B. The PVC waterstop shall be extruded from an elastomeric plastic material of which the basic resin is prime virgin polyvinyl chloride. The PVC compound shall not contain any scrapped or reclaimed material or pigment whatsoever.

C. Performance Requirements as follows:

Property	Test Method	Required Limits
Water absorption	ASTM D 570	0.15% max
Tear Resistance	ASTM D 624	200 lb/in (35 kN/m) min.
Ultimate Elongation	ASTM D 638	350% min.
Tensile Strength	ASTM D 638	2000 psi (13.78 Mpa) min.
Low Temperature Brittleness	ASTM D 746	No Failure @ -35° F (-37° C)
Stiffness in Flexure	ASTM D 747	600 psi (4.13 Mpa) min.
Specific Gravity	ASTM D 792	1.45 max.
Hardness, Shore A	ASTM D 2240	79 ±3
Tensile Strength after accelerated extraction	CRD-C 572	1850 psi (11.03 Mpa) min.
Elongation after accelerated extraction	CRD-C 572	300% min.
Effect of Alkalies after 7 days: Weight Change Hardness Change	CRD-C 572	 between -0.10% / +0.25% +/- 5 points

2.08 HYDROPHILIC WATERSTOP FOR NON-MOVING CONTRACTION AND CONSTRUCTION JOINTS

A. Provide hydrophilic rubber waterstop as supplied by Greenstreak, HYDROTITE profile style number CJ-0725-3KAD or approved equal. This profile has a width of 0.98" and a height of 0.28".

B. The waterstop shall be a combination of chloroprene rubber and chloroprene rubber modified to impart hydrophilic properties.

C. The waterstop shall have a delay coating to inhibit initial expansion due to moisture present in fresh concrete.

D. Performance Requirements as follows:

Chloroprene Rubber

Property	Test Method	Required Limits
Tensile Strength	ASTM D 412	1300 PSI min.
Ultimate Elongation	ASTM D 412	400% min.
Hardness (Shore A)	ASTM D 2240	50 +/- 5
Tear Resistance	ASTM D 624	100 lb/inch min.

Modified Chloroprene (Hydrophilic) Rubber

Property	Test Method	Required Limits
Tensile Strength	ASTM D 412	350 PSI min.
Ultimate Elongation	ASTM D 412	600% min.
Hardness (Shore A)	ASTM D 2240	52 +/- 5
Tear Resistance	ASTM D 624	50 lb/inch
Expansion Ratio	Volumetric Change - Distilled Water @ 70° F	3 to 1 min.

2.09 WATERSTOP ACCESSORIES

A. PVC Waterstops

1. Provide factory made waterstop fabrications for all changes of direction, intersections, and transitions leaving only straight butt joint splices for the field.

2. Provide hog rings or grommets spaced at 12 inches on center along length of waterstop.

3. Provide Teflon coated thermostatically controlled waterstop splicing irons for field butt splices.

B. Hydrophilic Waterstops

1. Provide Greenstreak 7300 two component epoxy gel to secure HYDROTITE to rough, wet (or dry) concrete.

2. Provide LEAKMASTER single component hydrophilic sealant to secure HYDROTITE to rough, dry concrete.

3. Provide cyanacrylate adhesive (super glue) for all splices.

PART 3 EXECUTION

3.01 ERECTION - FORMWORK

A. Erect formwork, shoring and bracing to achieve design requirements, in accordance with requirements of ACI 301.

B. Provide bracing to ensure stability of formwork. Shore or strengthen formwork subject to overstressing by construction loads.

C. Arrange and assemble formwork to permit dismantling and stripping. Do not damage concrete during stripping. Permit removal of remaining principal shores.

D. Align joints and make watertight. Keep form joints to a minimum.

E. Obtain approval before framing openings in structural members that are not indicated on drawings.

F. Provide fillet strips on external corners of beams, joists, columns, and walls. Fillet strips shall be placed in the forms.

G. Install void forms in accordance with manufacturer's recommendations. Protect forms from moisture or crushing.

H. Coordinate this section with other sections of work that require attachment of components to formwork.

I. If formwork is placed after reinforcement, resulting in insufficient concrete cover over reinforcement, request instructions from the Engineer before proceeding.

3.02 APPLICATION - FORM RELEASE AGENT

A. Apply form release agent on formwork in accordance with manufacturer's recommendations.

B. Apply prior to placement of reinforcing steel, anchoring devices, and embedded items.

C. Do not apply form release agent where concrete surfaces will receive special finishes or applied coverings that are affected by agent. Soak inside surfaces of untreated forms with clean water. Keep surfaces coated prior to placement of concrete.

3.03 INSERTS, EMBEDDED PARTS, AND OPENINGS

A. Provide formed openings where required for items to be embedded in passing through concrete work.

B. Locate and set in place items that will be cast directly into concrete.

C. Coordinate with work of other sections in forming and placing openings, slots, reglets, recesses, sleeves, bolts, anchors, other inserts, and components of other work.

D. Position recessed anchor slots for brick veneer masonry anchors to spacing and intervals specified in Section 04 05 23.

E. Install accessories in accordance with manufacturer's instructions, so they are straight, level, and plumb. Ensure items are not disturbed during concrete placement.

F. Install waterstops in accordance with manufacturer's instructions, so they are continuous without displacing reinforcement. Heat seal joints so they are watertight.

G. Provide temporary ports or openings in formwork where required to facilitate cleaning and inspection. Locate openings at bottom of forms to allow flushing water to drain.

H. Close temporary openings with tight fitting panels, flush with inside face of forms, and neatly fitted so joints will not be apparent in exposed concrete

surfaces.

3.04 FORM CLEANING

A. Clean forms as erection proceeds, to remove foreign matter within forms.

B. Clean formed cavities of debris prior to placing concrete.

1. Flush with water or use compressed air to remove remaining foreign matter. Ensure that water and debris drain to exterior through clean-out ports.

2. During cold weather, remove ice and snow from within forms. Do not use de-icing salts. Do not use water to clean out forms, unless formwork and concrete construction proceed within heated enclosure. Use compressed air or other means to remove foreign matter.

3.05 FORMWORK TOLERANCES

A. Construct formwork to maintain tolerances required by ACI 301.

B. Construct and align formwork for elevator hoistway in accordance with ASME A17.1.

C. Camber slabs and beams 1/4 inch per 10 feet.

D. Camber slabs and beams in accordance with ACI 301.

3.06 FIELD AND QUALITY CONTROL

A. An independent testing agency will perform field quality control tests, as specified in Section 01 45 16.

B. Inspect erected formwork, shoring, and bracing to ensure that work is in accordance with formwork design, and to verify that supports, fastenings, wedges, ties, and items are secure.

C. Do not reuse wood formwork more than three (3) times for concrete surfaces to be exposed to view. Do not patch formwork.

3.07 FORM REMOVAL

Forms shall be removed preventing injury to the concrete and ensuring the complete safety of the structure. Formwork for columns, walls, side of beams and other parts not supporting the weight of concrete may be removed when the concrete has attained sufficient strength to resist damage from the removal operation but not before at least 24 hours has elapsed since concrete placement. Supporting forms and shores shall not be removed from beams, floors and walls until the structural units are strong enough to carry their own weight and any other construction or natural loads. Supporting forms or shores shall not be removed before the concrete strength has reached 70 percent of design

strength, as determined by field cured cylinders or other approved methods. Job-cured test specimens shall demonstrate this strength, and by a structural analysis considering the proposed loads in relation to these test strengths and the strength of forming and shoring system. The job-cured test specimens for form removal purposes shall be provided in numbers as directed and shall be in addition to those required for concrete quality control. The specimens shall be removed from molds at the age of 24 hours and shall receive, insofar as possible, the same curing and protection as the structures they represent.

3.08 CONTRACTION JOINTS

Contraction joints may be constructed by inserting tempered hardboard strips or rigid PVC or HIPS insert strips into the plastic concrete using a steel parting bar, when necessary, or by cutting the concrete with a saw after concrete has set. Joints shall be approximately 1/8 inch wide and shall extend into the slab one-fourth the slab thickness, minimum, but not less than 1 inch.

3.09 JOINT STRIPS

Strips shall be of the required dimensions and as long as practicable.

After the first floating, the concrete shall be grooved with a tool at the joint locations. The strips shall be inserted in the groove and depressed until the top edge of the vertical surface is flush with the surface of the slab. The slab shall be floated and finished as specified. Working of the concrete adjacent to the joint shall be the minimum necessary to fill voids and consolidate the concrete. Where indicated, the top portion of the strip shall be sawed out after the curing period to form a recess for sealer. The removable section of PVC or HIPS strips shall be discarded and the insert left in place. True alignment of the strips shall be maintained during insertion.

3.10 SAWED JOINTS

Joint sawing shall be early enough to prevent uncontrolled cracking in the slab, but late enough that this can be accomplished without appreciable spalling. Concrete sawing machines shall be adequate in number and power, and with sufficient replacement blades to complete the sawing at the required rate. Joints shall be cut to true alignment and shall be cut in sequence of concrete placement. Sludge and cutting debris shall be removed.

3.11 EXPANSION JOINTS

Preformed expansion joint filler shall be used in expansion and isolation joints in slabs around columns and between slabs on grade and vertical surfaces where indicated. The filler shall extend the full slab depth, unless otherwise indicated. The edges of the joint shall be neatly finished with an edging tool of 1/8 inch radius, except where a resilient floor surface will be applied. Where the joint is to receive a sealant, the filler strips shall be installed at the proper level below the finished floor with a slightly tapered, dressed

and oiled wood strip temporarily secured to the top to form a recess to the size shown on the drawings. The wood strip shall be removed after the concrete has set. Contractor may opt to use a removable expansion filler cap designed and fabricated for this purpose in lieu of the wood strip. The groove shall be thoroughly cleaned of laitance, curing compound, foreign materials, protrusions of hardened concrete, and any dust, which shall be blown out of the groove with oil-free compressed air.

3.12 JOINT SEALANT

Sawed contraction joints and expansion joints in slabs shall be filled with joint sealant, unless otherwise shown. Joint surfaces shall be clean, dry, and free of oil or other foreign material, which would adversely affect the bond between sealant and concrete. Joint sealant shall be applied as recommended by the manufacturer of the sealant.

3.13 JOINTS WITH PREFORMED COMPRESSION SEALS

Compression seals shall be installed with equipment capable of installing joint seals to the prescribed depth without cutting, nicking, twisting, or otherwise distorting or damaging the seal or concrete and with no more than 5 percent stretching of the seal. The sides of the joint and, if necessary, the sides of the compression seal shall be covered with a coating of lubricant. Butt joints shall be coated with liberal applications of lubricant.

3.14 JOINTS WITH FIELD-MOLDED SEALANT

Joints shall not be sealed when the sealant material, ambient air, or concrete temperature is less than 4 degrees C 40 degrees F. When the sealants are meant to reduce the sound transmission characteristics of interior walls, ceilings, and floors the guidance provided in ASTM C 919 shall be followed. Joints requiring a bond breaker shall be coated with curing compound or with bituminous paint. Bond breaker and back-up material shall be installed where required. Joints shall be primed and filled flush with joint sealant in accordance with the manufacturer's Recommendations.

3.15 WATERSTOP INSTALLATION

A. PVC Waterstop

1. Field butt splices shall be heat fused welded using a Teflon covered thermostatically controlled waterstop splicing iron at approximately 380 degrees F. Follow approved manufacturer recommendations.
2. Lapping of waterstop, use of adhesives, or solvents shall not be allowed.
3. Center waterstop in joint and secure waterstop in correct position using hog rings or grommets spaced at 12” on centers along the length of the waterstop and wire tie to adjacent reinforcing steel.

B. Hydrophilic Waterstop

1. Cut coil ends square (or at proper angle for mitered corners) with shears or sharp blade to fit splices together without overlaps.
2. Splices shall be sealed using cyanacrylate adhesive (super glue) and LEAKMASTER (LEAKMASTER is optional).
3. Seal watertight any exposed cells of HYDROTITE using LEAKMASTER.
4. Follow approved manufacturer recommendations.

C. Hydrophilic and PVC Intersections

1. Maintain continuity of waterstops at all intersections and transitions.
2. Joinery between PVC and HYDROTITE shall be sealed using LEAKMASTER.
3. Follow approved manufacturer recommendations.

END OF SECTION

SECTION 03 20 00

CONCRETE REINFORCING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Reinforcing steel for cast-in-place concrete.

B. Supports and accessories for steel reinforcement.

1.02 RELATED SECTIONS

A. Section 03 10 00 - Concrete Forming and Accessories.

B. Section 03 31 00 - Cast-In-Place Concrete.

1.03 REFERENCES

A. ACI 301 - Specifications for Structural Concrete for Buildings; American Concrete Institute International; 1996.

B. ACI 318 - Building Code Requirements For Reinforced Concrete and Commentary; American Concrete Institute International; 1999.

C. ACI 350R - Environmental Engineering Concrete Structures; American Concrete Institute International, 1989.

D. ACI SP-66 - ACI Detailing Manual; American Concrete Institute International; 1994.

E. ASTM A 82 - Standard Specification for Steel Wire, Plain, for Concrete Reinforcement; 1997a.

F. ASTM A 184/A 184M - Standard Specification for Fabricated Deformed Steel Bar Mats for Concrete Reinforcement; 1996.

G. ASTM A 185 - Standard Specification for Steel Welded Wire Fabric, Plain, for Concrete Reinforcement; 1997.

H. ASTM A 497 - Standard Specification for Steel Welded Wire Fabric, Deformed, for Concrete Reinforcement; 1997.

I. ASTM A 615/A 615M - Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement; 1996a.

J. ASTM A 641/A 641M - Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire; 1998.

K. ASTM A 704/A 704M - Standard Specification for Welded Steel Plain Bar or

Rod Mats for Concrete Reinforcement; 1996.

L. ASTM A 706/A 706M - Standard Specification for Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement; 1998.

M. ASTM A 767/A 767M - Standard Specification for Zinc-Coated (Galvanized) Steel Bars for Concrete Reinforcement; 1997.

N. ASTM A 775/A 775M - Standard Specification for Epoxy-Coated Reinforcing Steel Bars; 1997.

O. ASTM A 884/A 884M - Standard Specification for Epoxy-Coated Steel Wire and Welded Wire Fabric for Reinforcement; 1996a.

P. ASTM A 996/A 996M - Standard Specification for Rail-Steel and Axle-Steel Deformed Bars for Concrete Reinforcement; 2000.

Q. ASTM D 3963/D 3963M - Standard Specification for Fabrication and Job-Site Handling of Epoxy Coated Reinforcing Steel Bars; 1999.

R. AWS D1.4 - Structural Welding Code - Reinforcing Steel; American Welding Society; 1998.

S. CRSI (DA4) - Manual of Standard Practice; Concrete Reinforcing Steel Institute; 1997, 26th Edition.

T. CRSI (P1) - Placing Reinforcing Bars; Concrete Reinforcing Steel Institute; 1999.

1.04 SUBMITTALS

A. See Section 01 33 00 – Submittal Requirements, for submittal procedures.

B. Shop Drawings: Comply with requirements of ACI SP-66. Include bar schedules, shapes of bent bars, spacing of bars, and location of splices.

1. Prepare shop drawings under seal of a Professional Structural Engineer experienced in design of work of this type and licensed in the State of Georgia.

C. Manufacturer's Certificate: Certify that reinforcing steel and accessories supplied for this project meet or exceed specified requirements.

D. Reports: Submit certified copies of mill test report of reinforcement materials analysis.

1.05 QUALITY ASSURANCE

A. Perform work of this section in accordance with ACI 301.

1. Maintain one copy of each document on project site.

B. Provide with access to fabrication plant to facilitate inspection of reinforcement. Provide notification of commencement and duration of shop fabrication in sufficient time to allow inspection.

C. Welders' Certificates: Submit certifications for welders employed on the project, verifying AWS qualification within the previous 12 months.

1.06 DELIVERY AND STORAGE

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

PART 2 PRODUCTS

2.01 REINFORCEMENTS

A. Reinforcing Steel: ASTM A 615/A 615M Grade 60 (420).

1. Plain billet-steel bars.
2. Unfinished.
3. Shop fabricated and bent cold.

B. Reinforcing Steel Mat: ASTM A 704/A 704M, using ASTM A 615/A 615M Grade 40 (300) steel bars or rods, unfinished.

C. Stirrup Steel: ASTM A 82 steel wire, unfinished.

D. Welded Steel Wire Fabric: ASTM A 185.

1. Flat Sheets.
2. Mesh Size and Wire Gage: As indicated on drawings.
3. Minimum Lap shall be 8".

E. Synthetic Fiber Reinforcement: Synthetic fiber shall be polypropylene with a denier less than 100 and a nominal fiber length of 50 mm 2 inches.

F. Reinforcement Accessories:

1. Tie Wire: Annealed, minimum 16 gage (1.5 mm).
2. Chairs, Bolsters, Bar Supports, Spacers: Sized and shaped for adequate support of reinforcement during concrete placement.
3. Provide stainless steel components for placement within 1-1/2 inches (38 mm) of weathering surfaces.

2.02 DEVELOPMENT AND SPLICES

A. Conform to ACI 318, Chapter 12, and ACI 350R.

B. Development 38 bar diameters, minimum.

C. Class B splices 48 bar diameters, minimum.

D. Welded wire fabric lap 8 inches, minimum.

2.03 FABRICATION

A. Fabricate concrete reinforcing in accordance with CRSI (DA4) - Manual of Standard Practice.

B. Welding of reinforcement is not permitted.

C. Welding of reinforcement is permitted only with the specific approval of the Engineer. Perform welding in accordance with AWS D1.4.

1. Galvanized Reinforcement: Clean surfaces, weld and re-protect welded joint in accordance with CRSI (DA4).

D. Fabricate and handle epoxy-coated reinforcing in accordance with ASTM D 3963/D 3963M.

E. Locate reinforcing splices not indicated on drawings at point of minimum stress, if feasible.

1. Review locations of splices with the Structural Engineer.

PART 3 EXECUTION

3.01 INSTALLATION

A. Placing

1. General: Reinforcing steel shall be placed in accordance with the drawings and reviewed shop drawings and the applicable requirements of the "Codes and Standards" hereinbefore specified. Install reinforcement accurately and secure against movement, particularly under the weight of workmen and the placement of concrete.

2. Reinforcing Supports: Bars shall be supported on metal chairs or spacers on metal hangers, accurately placed and securely fastened to hold reinforcement in place. Additional bars shall be supplied whether specifically indicated on the drawings or not where necessary to securely fasten reinforcement in place. Support legs of accessories in forms without embedding in form surface. Spacing of chairs and accessories shall conform with CRSI'S "Manual of Standard Practice." Hooping and stirrups shall be accurately spaced and wired to the reinforcing. No wood will be permitted inside forms. Where the concrete surface will be exposed to the weather in the finished structure, the portions of all accessories within 1/2 inch of the concrete surface shall be noncorrosive or protected against corrosion.

B. Slab reinforcing supports: All slab reinforcement shall be supported on approved continuous slab bolsters. To prevent feet penetration into subgrade or formwork,

slab bolsters shall have a continuous base. For slabs over insulation, slab bolsters shall have a continuous plate base. Spacing of bolsters shall not exceed 4′-0” on center.

C. Placing and Tying: All reinforcing shall be set in place, spaced, and rigidly and securely tied or wired with 16 gauge steel tie wire at all splices and at sufficient points to hold the reinforcing in its proper position. Rebending of bars on the job to fit existing conditions will not be permitted without the written approval of the Engineer. Point ends of wire ties away from forms.

D. Spacing: Minimum center to center distance between parallel bars shall be in accordance with the details on the drawings or, where not indicated, the clear spacing shall be 2 times the bar diameter but in no case less than 1-1/2 inches nor less than 1-1/3 times the maximum size aggregate.

E. Splices:

1. Laps of splices, where indicated on the drawings, shall be adequate to transfer stress by bond.

2. Unless indicated otherwise on the drawings, lap bars according to ACI 318, Class B. Lap bars in masonry in accord with ACI 530, with a minimum of 48 diameters.

3. Wherever possible, splices of adjacent bars shall be staggered.

4. All splices not indicated shall be subject to acceptance by the Engineer.

5. Mechanical connections for reinforcing bars may be used subject to acceptance by the Engineer.

6. Welded wire fabric shall be overlapped wherever successive mats are continuous in such a way that the overlap measured between outermost cross wires of each fabric sheet is not less than the spacing of the cross wires plus 2 inches.

F. Welded Wire Fabric: Wire fabric shall be in as long lengths as practicable and shall be wired at all laps and splices. End laps shall be off-set in adjacent widths. Welded wire fabric shall be supported with approved slab bolsters and as required for slab reinforcing supports.

G. Dowel aligners: Dowel aligner shall be installed in accordance with manufacturer’s recommendations.

H. Dowels: Dowels shall be tied securely in place before concrete is deposited. In the event there are no bars in position to which dowels may be tied, a #3 bar minimum shall be added to provide proper support and anchorage. Bending of dowels after placement of concrete will not be permitted. Templates shall be furnished for all column and pier dowels.

I. Protective Concrete Covering: Except where indicated otherwise on drawings, the minimum concrete coverage for steel reinforcement shall be as follows:

1. Concrete cast against and permanently exposed to earth: 3 inches.

2. Formed concrete exposed to weather or earth: 1-1/2 inches for bars No. 5 and smaller, and 2 inches for bars over No. 5 in size.

3. Concrete not exposed to weather or in contact with ground:

   a. Slabs, walls, joists: 3/4 inches for bars No. 11 and smaller and 1-1/2 inches for bars over No. 11 in size.

   b. Beams, columns: Primary reinforcement, ties, stirrups, spiral : 1-1/2 inches.

J. Placing Tolerances: Bars shall be placed to the following tolerances:

1. Clear distance to formed surfaces: $\pm$ 1/4 inches.

2. Minimum spacing between bars: $\pm$ 1/4 inch.

3. Top bars in slabs and beams:

   a. Members 8 inches deep or less: $\pm$ 1/4 inch.

   b. Members more than 8 inches but not over 2 feet deep: $\pm$ 1/2 inches.

   c. Members more than 2 feet deep: $\pm$ 1 inch.

4. Crosswise of members: Spaced evenly within 2 inches.

5. Lengthwide of members. $\pm$ 2 inches.

K. Bars may be moved as necessary to avoid interference with other reinforcing steel, conduits or embedded items. If bars are moved more than one bar diameter, or enough to exceed the above tolerances, the resulting arrangement of bars shall be subject to acceptance by the Engineer.

L. Cleaning: Reinforcement, at time concrete is placed, shall be free of all coatings that would impair bond to concrete.

3.02 FIELD QUALITY CONTROL

A. Notification

1. Subcontractor shall notify the Engineer, Building Department and Testing Laboratory at least 48 hours ahead of each concrete pour, and no concrete shall be placed until all reinforcing steel has been installed by the Subcontractor and approved by the Engineer or Testing Laboratory.

B. Correction During Concreting

1. Capable steel workmen shall be kept on the work at all times during the placing of concrete and shall properly reset any reinforcement displaced by runways, workmen, or other causes.

C. Defective Work

1. The following reinforcing steel work will be considered defective and may be ordered by the Engineer to be removed and replaced by the

Subcontractor at no additional cost to the Builder or Owner.

a. Bars with kinks or bends not shown on Drawings.

b. Bars injured due to bending or straightening.

c. Bars heated for bending.

d. Reinforcement not placed in accordance with the Drawings and/or Specifications.

END OF SECTION

SECTION 03 30 53

CAST-IN-PLACE CONCRETE FOR PRECAST CONCRETE TANK BASE SLABS

PART 1 GENERAL

1.01 SCOPE

Furnish all materials, labor, and equipment to properly install all cast-in-place concrete for the base slabs of the precast post-tensioned concrete tanks and related accessories at the locations shown on the plans or as directed by the Engineer for the proper completion of the work included under this contract whether shown expressly on the plans or implied by other requirements.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. 31 20 00 – Earth Moving
B. 43 41 63 – Precast Concrete Tanks

1.03 SUBMITTALS

Complete product data and engineering data, including shop drawings, shall be submitted to the Engineer in accordance with the requirements of Section 01 33 00 of the Contract Documents.

A. Product Data: For each type of product indicated. Material test reports shall show compliance with the required standards and be less than one year old.
B. Design Mixtures: For each concrete mixture. Include minimum required compressive strength and field experience records or trial mix data.

1.04 QUALITY ASSURANCE

A. Construct and erect concrete formwork and accessories in accordance with ACI 301, ACI 347 and ACI 350.
B. Perform concrete reinforcing work in accordance with ACI 301 and ACI 350.
C. Perform cast-in-place concrete work in accordance with ACI 301 and ACI 350.
D. Conform to ACI 305R when concreting during hot weather.
E. Conform to ACI 306R when concreting during cold weather.
F. Referenced Standards:
    1. ACI 117, “Standard Specifications for Tolerances for Concrete Construction and Materials”
    2. ACI 301, “Specifications for Structural Concrete”
    3. ACI 305R, “Guide to Hot Weather Concreting”

4. ACI 306R, “Guide to Cold Weather Concreting”
5. ACI 350, “Code Requirements for Environmental Engineering Concrete Structures”
6. ACI 350.5, “Specifications for Environmental Concrete Structures”
7. ASTM A 615, “Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement”
8. ASTM A 775, “Standard Specification for Epoxy-Coated Steel Reinforcing Bars”
9. ASTM A 934, “Standard Specification for Epoxy-Coated Prefabricated Steel Reinforcing Bars”
10. ASTM A 1064, “Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete”
11. ASTM C 31, “Standard Practice for Making and Curing Concrete Test Specimens in the Field”
12. ASTM C 33, “Standard Specification for Concrete Aggregates”
13. ASTM C 39, “Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens”
14. ASTM C 94, “Standard Specification for Ready-Mixed Concrete”
15. ASTM C 143, “Standard Test Method for Slump of Hydraulic-Cement Concrete”
16. ASTM C 150, “Standard Specification for Portland Cement”
17. ASTM C 172, “Standard Practice for Sampling Freshly Mixed Concrete”
18. ASTM C 231, “Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method”
19. ASTM C 260, “Standard Specification for Air-Entraining Admixtures for Concrete”
20. ASTM C 295, “Standard Guide for Petrographic Examination of Aggregates for Concrete”
21. ASTM C 494, “Standard Specification for Chemical Admixtures for Concrete”
22. ASTM C 595, “Standard Specification for Blended Hydraulic Cements”
23. ASTM C 618, “Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete”
24. ASTM C 881, “Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete”
25. ASTM C 920, “Standard Specification for Elastomeric Joint Sealants”
26. ASTM C 989, “Standard Specification for Slag Cement for Use in Concrete and Mortars”
27. ASTM C 1012, “Standard Test Method for Length Change of Hydraulic-Cement Mortars Exposed to a Sulfate Solution”
28. ASTM C 1067, “Standard Practice for Conducting a Ruggedness Evaluation or Screening Program for Test Methods for Construction Materials”
29. ASTM C 1116, “Standard Specification for Fiber-Reinforced Concrete”
30. ASTM C 1157, “Standard Performance Specification for Hydraulic Cement”

31. ASTM C 1218, “Standard Test Method for Water-Soluble Chloride in Mortar and Concrete”
32. ASTM C 1260, “Standard Test Method for Potential Alkali Reactivity of Aggregates (Mortar-Bar Method)
33. ASTM C 1567, “Standard Test Method for Determining the Potential Alkali-Silica Reactivity of Combinations of Cementitious Materials and Aggregate (Accelerated Mortar-Bar Method)
34. ASTM C 1778, “Standard Guide for Reducing the Risk of Deleterious Alkali-Aggregate Reaction in Concrete”
35. ASTM D 4397, “Standard Specification for Polyethylene Sheeting for Construction, Industrial, and Agricultural Applications”
36. CRSI, “Manual of Standard Practice”

PART 2 PRODUCTS

2.01 FORM MATERIALS AND ACCESSORIES

A. Form Materials: At discretion of Precast Concrete Tank Supplier
B. Formed Construction Joints: Keyed joints as indicated on the tank Shop (Erection) drawings provided by the Tank Supplier. Provide holes in formwork to receive reinforcing across the joint.
C. Vapor Retarder: ASTM D 4397, 6 mil thick, clear polyethylene film.

2.02 NON-PRESTRESSED REINFORCING STEEL

A. Reinforcing Bars: ASTM A 615, Grade 60, deformed.
B. Welded Wire Reinforcement: ASTM A 1064, plain or deformed, flat sheet.
C. Chairs, Bolsters, Bar Supports, Spacers: Sized and shaped for support of reinforcing.
D. Fabricate concrete reinforcement in accordance with ACI 301, ACI 350 and CRSI Manual of Standard Practice.

2.03 CONCRETE MATERIALS

A. Hydraulic Cement:
   1. Portland Cement: ASTM C 150, Type II or Type I/II.
   2. Blended Cement: ASTM C 595 with (MS) designation for moderate sulfate resistance, excluding Type IS ≥70). Blended cements that include ASTM C 1157 cements shall not be permitted.
   3. Concrete mixtures shall include either fly ash or slag as shown below, but within the limits stipulated in 2.4.C, unless the proposed combination of cementitious materials has been tested in accordance with ASTM C 1012 and resulted in expansion of not more than 0.10 percent at 6 months.
      a. At least 15 percent fly ash replacement by mass, or
      b. At least 50 percent slag replacement by mass.

4. Different types of cement shall not be mixed or used alternately without specific written approval by the Precast Tank Engineer. Different brands of cement may be used when authorized in writing by the Precast Tank Engineer. A resubmittal will be required if different brands are proposed during the Project.

B. Supplementary Cementitious Materials
   1. Fly Ash: ASTM C 618, Class F with alkali content (%Na2Oeq) less than 3.0%.
   2. Slag: ASTM C 989, Grade 100 or 120, ground granulated blast furnace slag.

C. Fine and Coarse Aggregates: ASTM C33, 1-inch maximum size.
   1. All aggregates shall be evaluated in accordance with ASTM C 1778 for potential alkali-silica reactivity (ASR). All aggregates shall be considered reactive unless they have been examined in accordance with ASTM C 295 and found to be non-reactive.
   2. Concrete mixtures using potentially reactive aggregates, except as permitted by 2.3.C.c, shall include either fly ash or slag as shown below, but within the limits stipulated in 2.4.C.
      a. At least 25 percent fly ash replacement by mass where Portland cement alkali content is less than 1.00%, or at least 35 percent fly ash replacement by mass where Portland cement alkali content is 1.00 to 1.25%, or
      b. At least 50 percent slag replacement by mass where Portland cement alkali content is less than 1.00%, or at least 65 percent slag replacement by mass where Portland cement alkali content is 1.00% to 1.25%.
      c. Portland cement alkali loading shall not exceed 3.0 lb/yd3 (LBA). Alkali loading shall be calculated as shown below:
         LBA = Portland cement content (lbs) x alkali content (% Na2Oeq) / 100.
   3. Aggregates meeting the requirements below may be considered non-reactive.
      a. ASTM C 1260, Potential Alkali Reactivity of Aggregates (Mortar-Bar Method). Average expansion of less than 0.10 percent at 16 days after casting.
      b. ASTM C 1567, Potential Alkali-Silica Reactivity of Combinations of Cementitious Materials and Aggregates (Accelerated Mortar-Bar Method). Average expansion of less than 0.10 percent at 16 days after casting.

D. Concrete Reinforcing Fibers: ASTM C 1116, high-strength industrial-grade fibers.

E. Water: Potable; free from deleterious material that may affect setting or strength of concrete.

F. Air Entraining Admixture: ASTM C 260, certified by manufacturer to be compatible with other required admixtures.

G. Chemical Admixtures: Certified by manufacturer to be compatible with other admixtures and to not contain calcium chloride or more than 0.15 percent chloride ions or other salts by weight of admixture.

1. Water-Reducing Admixture: ASTM C 494, Type A.
2. Retarding Admixture: ASTM C 494, Type B.
3. Water-Reducing and Retarding Admixture: ASTM C 494, Type D.
4. Water-Reducing and Accelerating Admixture ASTM C494, Type E.
5. High Range, Water-Reducing Admixture: ASTM C 494, Type A and F.
6. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494, Type G.

2.04 CONCRETE MIXTURES

A. Mix and deliver concrete in accordance with ASTM C 94, Option C.

B. Select proportions for normal weight concrete in accordance with ACI 301, Method 1 or Method 2.

C. Prepare design mixtures for each type of concrete required.
   1. The inclusion of either fly ash or slag in the concrete mix is mandatory.
   2. Where fly ash is used:
      a. The minimum fly ash content shall be 15 percent replacement of cementitious material by weight, and the maximum content shall be 35%.
      b. Additional fly ash shall not be included in concrete mixed with Type IS or IP cement.
   3. Where slag is used:
      a. The minimum slag content shall be 15 percent replacement of cementitious material by weight, and the maximum content shall be 65%.
      b. Additional slag shall not be included in concrete mixed with Type IS or IP cement.
   4. The inclusion of both fly ash and slag shall not be permitted without specific written approval by the Precast Tank Engineer.
   5. Limit water-soluble chloride ions to maximum percentage by weight of cement permitted by ACI 350 when tested in accordance with ASTM C 1218.

D. Furnish concrete as indicated below:
   1. Compressive Strength (28 Days): 4,500 psi minimum
   2. Maximum Water-Cementitious Materials Ratio: 0.42
   3. Slump: 7 inches, ±1 inch utilizing high-range, water-reducing admixture.
   4. Minimum cementitious content: 564 pounds per cubic yard

E. Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having an air content of 6%, ±1-1/2%.

F. When included in design mixtures, add other admixtures to concrete mixtures according to manufacturer's written instructions.

G. Do not use calcium chloride or admixtures containing calcium chloride.

2.05 WATERSTOPS

A. Flexible PVC Waterstops: Corp of Engineers CRD-C 572 for embedding in

concrete construction joints to prevent the passage of fluids through joints. Factory-fabricate corners, intersections and directional changes.

1. Profile: Ribbed without center bulb.
2. Dimensions: 6 inches by 3/8-inch-thick, non-tapered.
3. Acceptable Products:
    a. Greenstreak PVC Waterstop #679, or equal.

B. Self-Expanding Rubber Strip Waterstops: Manufactured rectangular or trapezoidal strip, bentonite-free, hydrophilic polymer modified chloroprene rubber, for adhesive bonding to concrete.

1. Acceptable Products:
    a. Greenstreak Hydrotite® CJ-1030-4M, or equal.

C. Self-Expanding Extrudable Waterstops: Extrudable, swelling, bentonite-free, one-part polyurethane.

1. Acceptable Products:
    a. SikaSwell® S-2, or equal

2.06 RELATED MATERIALS

A. Crack Filler: ASTM C 881, two-part, moisture-tolerant, very-low-viscosity, epoxy injection adhesive for filling cracks.

1. Acceptable Products:
    a. Sikadur® 52, or equal

B. Crack Sealer: ASTM C 920, Type S, Grade NS, Class 35 one-part polyurethane, elastomeric sealant, for sealing cracks.

1. Acceptable Products:
    a. Sikaflex®-1a, or equal

PART 3 EXECUTION

3.01 PREPARATION

A. Proceed with base slab construction only after unsatisfactory conditions have been corrected in accordance with Section 43 41 63, “Precast Concrete Tanks.”

3.02 FORMWORK

A. Erect formwork, shoring and bracing to achieve design requirements.

B. Provide bracing to ensure stability of formwork.

3.03 EMBEDDED COMPONENTS AND OPENINGS

A. Coordinate work of other sections in forming and setting openings, slots, keyways, sleeves, bolts, anchors, pipe sleeves and other embedded components.

B. Install concrete accessories straight, level and plumb.

C. Install water stops continuous without displacing reinforcing. Heat seal joints watertight.
D. Place construction joint forms in accordance with base slab pouring sequence.

3.04 REINFORCEMENT PLACEMENT

A. Place reinforcement, supported and secured against displacement.
B. Ensure reinforcing is clean, free of loose scale, dirt or other foreign coatings.
C. Space reinforcement bars with minimum clear spacing in accordance with ACI 350, but not less than 1-1/2 inches.
D. Place reinforcement bars and maintain cover in accordance with tolerances listed in ACI 117 and ACI 350.

3.05 PLACING CONCRETE

A. Install vapor retarder under base slab as indicated on the tank Shop (Erection) drawings provided by the Tank Supplier.
B. Ensure reinforcement, embedded components and formwork is not displaced during concrete placement.
C. Deposit concrete as closely as practicable to final position. Prevent segregation of mix.
D. Place concrete continuously between predetermined construction joints. Subsequent placements shall use the same concrete mix as the initial placement.
E. Consolidate concrete.
F. Maintain records of concrete placement. Record date, location, quantity, air temperature and test samples taken.
G. Screed base slab level. Maintain slab flatness meeting the Conventional floor surface classification as measured using the Manual Straightedge Method per ACI 117, Table 4.8.6.1, unless indicated otherwise on the tank Shop (Erection) drawings provided by the Tank Supplier.

3.06 FINISHING

A. Steel-trowel finish unformed surfaces. See Section 03 31 00, “Cast-in-Place Concrete”, for detailed instructions.
B. In areas with floor drains, maintain slab level at walls and slope uniformly to drains.

3.07 CURING AND PROTECTION

A. Immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures, and mechanical injury.
    1. Concrete, except high-early strength concrete, shall be maintained above 50° F and in a moist condition for at least the first three days after placement.
    2. When concrete could be exposed to more than one freezing and thawing

cycle during construction, protect concrete from freezing until concrete strength of 3,500 psi is achieved. Strength shall be verified using field-cured cylinders.

B. Maintain concrete with minimal moisture loss at relatively constant temperature for period necessary for hydration of cement and hardening of concrete.

3.08 FIELD QUALITY CONTROL

A. Place no concrete for the base slab until the subgrade has been inspected and approved by the Owner's Geotechnical Engineer.

B. Perform field inspection and testing in accordance with ACI 301.

C. Testing: Owner will engage accredited independent testing and inspecting agency to perform field tests and prepare reports.
   1. Testing agency will report test results promptly and in writing to Contractor, Engineer of Record and Tank Supplier.

D. Strength Test Samples:
   1. Sampling Procedures: ASTM C 172
   2. Cylinder Molding and Curing Procedures: ASTM C 31, cylinder specimens, standard cured.
   3. When there are early-age strength requirements, strength shall be evaluated using field-cured cylinders.
   4. Sample concrete and make one set of five 4" x 8" cylinders for every 50 cubic yards or less of each class of concrete placed each day and for every 5,000 square feet of surface area.
   5. Make additional sets of three 4" x 8" cylinders at the discretion of the Tank Supplier when required to verify early-age strength.

E. Field Testing:
   1. Slump Test Method: ASTM C 143
   2. Air Content Test Method: ASTM C 231
   3. Temperature Test Method: ASTM C 1067
   4. Measure slump and temperature for each compressive strength concrete sample.
   5. Measure air content in air entrained concrete for each compressive strength concrete sample.

F. Cylinder Compressive Strength Testing:
   1. Test Method: ASTM C39
   2. Evaluation and Acceptance of Concrete: In accordance with ACI 350.
   3. Test three 4" x 8" cylinders at 28 days.
   4. Retain two cylinders for 56 days for testing when requested by Engineer.
   5. Dispose of remaining cylinders when testing is not required.

3.09 DEFECTIVE CONCRETE

A. Defective Concrete: Concrete not conforming to required lines, details, dimensions, tolerances or specified requirements.

B. Repair or replace defective concrete. Repairs will be permitted provided structural

adequacy, serviceability and durability of concrete elements comply with requirements of this section.

PART 4 SCHEDULE

END OF SECTION

SECTION 03 31 00

CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.01 SECTION INCLUDES

This section specifies cast-in place structural concrete.

1.02 RELATED SECTIONS

A. Section 03 10 00 - Concrete Forming and Accessories

B. Section 03 20 00 - Concrete Reinforcing.

1.03 REFERENCES

A. ACI 211.1 - Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete; American Concrete Institute International; 1991 (Reapproved 1997).

B. ACI 211.2 - Standard Practice for Selecting Proportions for Structural Lightweight Concrete; American Concrete Institute International; 1998.

C. ACI 301 - Specifications for Structural Concrete for Buildings; American Concrete Institute International; 1996.

D. ACI 302.1R - Guide for Concrete Floor and Slab Construction; American Concrete Institute International; 1996.

E. ACI 304R - Guide for Measuring, Mixing, Transporting, and Placing Concrete; American Concrete Institute International; 1989 (Reapproved 1997).

F. ACI 305R - Hot Weather Concreting; American Concrete Institute International; 1991.

G. ACI 306R - Cold Weather Concreting; American Concrete Institute International; 1988.

H. ACI 308 - Standard Practice for Curing Concrete; American Concrete Institute International; 1992 (Reapproved 1997).

I. ACI 318 - Building Code Requirements for Reinforced Concrete and Commentary; American Concrete Institute International; 1999.

J. AC1350R – Environmental Engineering Concrete Structures; American Concrete Institute International; 1989.

K. ASTM A 185 - Standard Specification for Steel Welded Wire Fabric, Plain, for Concrete Reinforcement; 1997.

L. ASTM A 497 - Standard Specification for Steel Welded Wire fabric, Deformed, for Concrete Reinforcement; 1997.

M. ASTM A 615/A 615M - Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement; 1996a.

N. ASTM A 767/A 767M - Standard Specification for Zinc-Coated (Galvanized) Steel Bars for Concrete Reinforcement; 1997.

O. ASTM A 775/A 775M - Standard Specification for Epoxy-Coated Reinforcing Steel Bars; 1997.

P. ASTM A 884/A 884M - Standard Specification for Epoxy-Coated Steel Wire and Welded Wire Fabric for Reinforcement; 1996a.

Q. ASTM C 33 - Standard Specification for Concrete Aggregates; 1999a.

R. ASTM C 39/C 39M - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens; 1999.

S. ASTM C 94/C 94M - Standard Specification for Ready-Mixed Concrete; 2000.

T. ASTM C 150 - Standard Specification for Portland Cement; 1999a.

U. ASTM C 171 - Standard Specification for Sheet Materials for Curing Concrete; 1997a.

V. ASTM C 173 - Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method; 1994a.

W. ASTM C 260 - Standard Specification for Air-Entraining Admixtures for Concrete; 1998.

X. ASTM C 309 - Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete; 1998a.

Y. ASTM C 330 - Standard Specification for Lightweight Aggregates for Structural Concrete; 1999.

Z. ASTM C 494/C 494M - Standard Specification for Chemical Admixtures for Concrete; 1999a.

AA. ASTM C 618 - Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Concrete; 1999.

AB. ASTM C 685 - Standard Specification for Concrete Made by Volumetric Batching and Continuous Mixing; 1998a.

AC. ASTM C 881 - Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete; 1999.

AD. ASTM C 1059 - Standard Specification for Latex Agents for Bonding Fresh to Hardened Concrete; 1999.

AE. ASTM C 1107 - Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink); 1999.

AF. ASTM D 994 - Standard Specification for Preformed Expansion Joint Filler for

Concrete (Bituminous Type); 1998.

AG. ASTM D 1751 - Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types); 1999.

AH. ASTM D 3963/D 3963M - Standard Specification for Fabrication and Job-Site Handling of Epoxy Coated Reinforcing Steel Bars; 1999.

AI. ASTM E 1155 - Standard Test Method for Determining F(F) Floor Flatness and F(L) Floor Levelness Numbers; 1996.

1.04 SUBMITTALS

A. Concrete mixture proportions shall be determined by the Contractor and submitted for review. The concrete mixture quantities of all ingredients per cubic meter yard and nominal maximum coarse aggregate size that will be used in the manufacture of each quality of concrete shall be stated. Proportions shall indicate the mass of cement, pozzolan and ground granulated blast-furnace (GGBF) slag when used, and water; the mass of aggregates in a saturated surface-dry condition; and the quantities of admixtures. The submission shall be accompanied by test reports from a laboratory complying with ASTM C 1077 which show that proportions thus selected will produce concrete of the qualities indicated. No substitution shall be made in the source or type of materials used in the work without additional tests to show the quality of the new material and concrete are satisfactory.

B. Statements that the concrete testing technicians and the concrete inspectors meet the specified requirements, in sections 01 45 29.

C. The method and equipment proposed for joint cleanup and waste disposal shall be submitted for review and approval

D. The curing medium and methods to be used shall be submitted for review and approval.

E. If concrete is to be placed under cold-weather conditions, the proposed materials, methods, and protection shall be submitted for approval.

F. If concrete is to be placed under hot-weather conditions, the proposed material and methods shall be submitted for review and approval.

G. Aggregate quality tests shall be submitted at least 30 days prior to start of concrete placement.

H. The results of the initial mixer uniformity tests shall be submitted at least 5 days prior to the initiation of placing.

I. Cementitious materials, including cement and pazzolan, (and Ground Granulated Blast Furnace Slag) will be accepted on the basis of the manufacturer's certification of compliance, accompanied by mill test reports that materials meet the requirements of the specification under which they are furnished.

Certification and mill test reports shall be form samples taken from the particular lot furnished. No cementitious materials shall be used until notice of acceptance has been given by the Contracting Officer. Cementitious material will be subject to check testing from samples obtained at the source, at transfer points, or at the project site, as scheduled by the Contracting Officer, and such sampling will be by or under the supervision of the Owner at its expense. Material not meeting specifications shall be promptly removed from the site of work.

J. Impervious-Sheet Curing materials shall be certified for compliance with all specification requirements.

K. Air-Entraining Admixture shall be certified for compliance with all specification requirements.

L. Other chemical admixtures shall be certified for compliance withal all specification requirements.

M. Membrane-Forming curing compound shall be certified for compliance with all specification requirements.

N. Epoxy Resin and Latex Bonding Compound shall be certified for compliance with all specification requirements.

O. Descriptive literature of the Nonshrink Grout proposed for use shall be furnished together with a certificate form the manufacturer stating that it is suitable for the application or exposure for which it is being considered.

1.05 PRE-CONCRETE CONFERENCE:

A. General: At least 15 days prior to submittal of design mixes, conduct a meeting to review proposed methods of concrete construction to achieve the required results.

B. Agenda: Includes but is not limited to:

1. Submittals.
2. Coordination of work.
3. Availability of material.
4. Concrete mix design including admixtures.
5. Methods of placing, finishing, and curing.
6. Finish criteria required to obtain required flatness and levelness.
7. Timing of floor finish measurements.
8. Material inspection and testing.

C. Attendees: Include but not limited to representatives of Contractor; subcontractors involved in supplying, conveying, placing, finishing, and curing concrete; lightweight aggregate manufacturer; admixture manufacturers; Resident Engineer; and Consulting Engineer.

D. Minutes of the meeting: Contractor shall take minutes and type and distribute the

minutes to attendees within five days of the meeting.

PART 2 PRODUCTS

2.01 MATERIALS

A. Portland Cement: ASTM C150 Type I, II or III.

B. Fly Ash: ASTM C618, Class C or F including supplementary optional requirements relating to reactive aggregates and alkalies, and loss on ignition (LOI) not to exceed 5 percent.

C. Coarse Aggregate: ASTM C33.

1. Size 67. Size 467 may be used for footings and walls over 12 inches thick.

2. Coarse aggregate for applied topping, encasement of steel columns, and metal pan stair fill shall be Size 7.

3. Maximum size of coarse aggregates not more than one-fifth of narrowest dimension between sides of forms, one-third of depth of slabs, nor three-fourth of minimum clear spacing between reinforcing bars.

D. Lightweight Aggregates for Structural Concrete: ASTM C330, Table 1. Maximum size of aggregate not larger than one-fifth of narrowest dimension between forms, nor three-fourth of minimum clear distance between reinforcing bars. Contractor to furnish certified report to verify that aggregate is sound and durable, and has a durability factor of not less than 80 based on 300 cycles of freezing and thawing when tested in accordance with ASTM C666.

E. Fine Aggregate: ASTM C33. Fine aggregate for applied concrete floor topping shall pass a No. 4 sieve, 10 percent maximum shall pass a No. 100 sieve.

F. Mixing Water: Fresh, clean, and potable.

G. Admixtures:

1. Water Reducing Admixture: ASTM C494, Type A and not contain more chloride ions than are present in municipal drinking water.

2. Water Reducing, Retarding Admixture: ASTM C494, Type D and not contain more chloride ions than are present in municipal drinking water.

3. High-Range Water-Reducing Admixture (Superplasticizer): ASTM C494, Type F or G, and not contain more chloride ions than are present in municipal drinking water. The admixture shall be used for all concrete used for liquid containing structures.

4. Non-Corrosive, Non-Chloride Accelerator: ASTM C494, Type C or E, and not contain more chloride ions than are present in municipal drinking water. Admixture manufacturer must have long-term non-corrosive test data from an independent testing laboratory of at least one year duration

using an acceptable accelerated corrosion test method such as that using electrical potential measures.

5. Air Entraining Admixture: ASTM C260.

6. Integral Waterproofing Admixture. An integral waterproofing admixture consisting of Portland cement, very fine treated silica sand and various active, proprietary chemicals. The active chemicals shall react with the moisture in fresh concrete using byproducts of cement hydration to cause a catalytic reaction which generates a non-soluble crystalline formation throughout the pores and capillary tracts of the concrete producing a concrete that is permanently sealed against the penetration of water or liquids. Integral waterproofing admixture shall be dosed and added to the concrete mix at the ready-mix plant; it shall not be added to the concrete at the site.

   Integral waterproofing admixture shall be added to concrete used for base slabs and walls of the following structures:

   Staged Reactor, Sludge Collection Box, Disc Filter, Parshall Flume-Chlorine Contact Chamber-Cascade Aeration Structure, Aerobic Digestor.

   a. Acceptable products and manufacturers shall be, but are not limited to, the following:

      Admix C-1000 - Xypex Chemical Corporation

6. Microsilica: Use only with prior review and acceptance of the Resident Engineer. Use only in conjunction with high range water reducer.

7. Calcium Nitrite corrosion inhibitor: ASTM C494 Type C.

8. Prohibited Admixtures: Calcium chloride, thiocyanate or admixtures containing more than 0.05 percent chloride ions are not permitted.

9. Certification: Written conformance to the requirements above and the chloride ion content of the admixture prior to mix design review.

H. Expansion Joint Filler: ASTM D1751.

I. Sheet Materials for Curing Concrete: ASTM C171.

J. Liquid Membrane-forming Compounds for Curing Concrete: ASTM C309, Type I, with fugitive dye. Compound shall be compatible with scheduled surface treatment, such as paint and resilient tile, and shall not discolor concrete surface.

K. Abrasive Aggregate: Aluminum oxide grains or emery grits.

L. Liquid Hardener and Dustproofer: Fluosilicate solution of magnesium fluosilicate or zinc fluosilicate. Magnesium and zinc may be used separately or in combination as recommended by manufacturer.

M. Liquid Densifier/Sealer: 100% active colorless aqueous siliconate solution.

N. Penetrating Sealer: For use on parking garage ramps and decks. High penetration silane sealer providing minimum 95 percent screening per National Cooperative

Highway Research Program (NCHRP) No. 244 standards for chloride ion penetration resistance. Requires moist (non-membrane) curing of slab.

O. Non-Shrink Grout:

1. ASTM C1107, pre-mixed, produce a compressive strength of at least 2500 psi at three days and 5000 psi at 28 days. Furnish test data from an independent laboratory indicating that the grout when placed at a fluid consistency shall achieve 95 percent bearing under a 4 foot by 4 foot base plate.

2. Where high fluidity or increased placing time is required, furnish test data from an independent laboratory indicating that the grout when placed at a fluid consistency shall achieve 95 percent under an 18 inch by 36 inch base plate.

2.02 CONCRETE MIX DESIGN

A. Mix Designs: Proportioned in accordance with Section 5.3, "Proportioning on the Basis of Field Experience and/or Trial Mixtures" of ACI 318. The concrete compressive strength Fc' shall be 4,000 psi unless otherwise indicated on the drawings.

1. If trial mixes are used, make a set of at least 6 cylinders in accordance with ASTM C192 for test purposes from each trial mix; test three for compressive strength at 7 days and three at 28 days.

2. Submit a report of results of each test series, include a detailed listing of the proportions of trial mix or mixes, including cement, fly ash, admixtures, weight of fine and coarse aggregate per cubic yard measured dry rodded and damp loose, specific gravity, fineness modulus, percentage of moisture, air content, water-cement -fly ash ratio, and consistency of each cylinder in terms of slump. Include dry unit weight of lightweight structural concrete.

3. Prepare a curve showing relationship between water-cement-fly ash ratio at 7-day and 28-day compressive strengths. Plot each curve using at least three specimens.

4. If the field experience method is used, submit complete standard deviation analysis.

B. After approval of mixes no substitution in material or change in proportions of approval mixes may be made without additional tests and approval of Resident Engineer or as specified. Making and testing of preliminary test cylinders may be carried on pending approval of cement and fly ash, providing Contractor and manufacturer certify that ingredients used in making test cylinders are the same. Resident Engineer may allow Contractor to proceed with depositing concrete for certain portions of work, pending final approval of cement and fly ash and approval of design mix.

C. Cement Factor: Maintain minimum cement factors in Table I regardless of compressive strength developed above minimums. Fly ash may be substituted for up to 20 percent of the minimum cement factor at option of Contractor, except fly ash may not be used in concrete designated as architectural concrete.

TABLE I - CEMENT AND WATER FACTORS FOR CONCRETE

Location	Concrete Strength	Water/Cement Ratio
	Min. 28 Day Comp. Str. psi	Max. Water Cement Ratio
All concrete for liquid containing structures including walls, mat foundations, and base slabs.[4]	4000[1,3]	0.38
Walls, floor slabs, elevated slabs and beams, columns, equipment pads, floor fill in structures.	4000[1, 3]	0.46

1. If trial mixes are used, the proposed mix design shall achieve a compressive strength 1200 psi in excess of f'c.
2. Lightweight Structural Concrete. Pump mixes may require higher cement values.
3. For concrete exposed to high sulfate content soils maximum water cement ratio is 0.44.
4. Concrete used for liquid containing structures shall utilize a high-range water reducing admixture to achieve the desired slump. Prior to the addition of the high-range water reducing admixture the slump shall not exceed 2-inches. Concrete with an initial slump greater than 2-inches shall be rejected.

D. Maximum Slump: Maximum slump, as determined by ASTM C143 with tolerances as established by ASTM C94, for concrete to be vibrated shall be as shown in Table II.

TABLE II – MAXIMUM SLUMP, INCHES

Type of Construction	Normal Weight Concrete
All concrete for liquid containing structures including walls, mat foundations, and base slabs.	2 inches[1]
Reinforced Footings and Substructure Walls	3 inches
Slabs, Beams, Reinforced Walls, and Building Columns	4 inches
Concrete approved for placement by pumping. Measured at discharge end of hose	5 inches[2]

* Slump may be increased by the use of the approved high-range water-reducing admixture (superplasticizer). Tolerances as established by ASTM

C94. Concrete containing the high-range-water-reducing admixture may have a maximum slump of 9 inches. The concrete shall arrive at the job site at a slump of 2 inches to 3 inches. This should be verified, and then the high-range-water-reducing admixture added to increase the slump to the approved level.

[1]Slump measured prior to the addition of a high range water reducing admixture.

[2]Concrete with a slump achieved without a high range water reducing admixture having a slump greater than 5-inches measured at the discharge end of the pump hose shall be rejected from the site.

E. Air-Entrainment: Air-entrainment of normal weight concrete shall conform with Table III. Air-entrainment of lightweight structural concrete shall conform with Table IV. Determine air content by either ASTM C173 or ASTM C231.

TABLE III - TOTAL AIR CONTENT

Location	Air Content
Concrete Exposed to Weather	4.5% to 7.5%
Interior normal weight concrete slabs	2% to 3%

F. High early strength concrete, made with Type III cement or Type I cement plus non-corrosive accelerator, shall have a 7-day compressive strength equal to specified minimum 28-day compressive strength for concrete type specified made with standard Portland cement.

G. Concrete slabs placed at air temperatures below 50 degrees Fahrenheit use non-corrosive, non-chloride accelerator. Concrete required to be air entrained use approved air entraining admixture. Pumped concrete, synthetic fiber concrete, architectural concrete, concrete required to be watertight, and concrete with a water/cement ratio below 0.50 use high-range water-reducing admixture (superplasticizer).

H. Durability: Use air entrainment for exterior exposed concrete subjected to freezing and thawing and other concrete shown or specified. Air content as shown in Table III.

I. Enforcing Strength Requirements: Test as specified in Section 01 45 29, TESTING LABORATORY SERVICES, during the progress of the work. Seven-day tests may be used as indicators of 28-day strength. Average of any three 28-day consecutive strength tests of laboratory-cured specimens representing each type of concrete shall be equal to or greater than specified strength. No single test shall be more than 500 psi below specified strength. Interpret field test results in accordance with ACI 214. Should strengths shown by test specimens fall below required values, Resident Engineer may require any one or any combination of the following corrective actions, at no additional cost to the Owner:

1. Require changes in mix proportions by selecting one of the other appropriate trial mixes or changing proportions, including cement content, of approved trial mix.

2. Require additional curing and protection.

3. If five consecutive tests fall below 95 percent of minimum values given in Table I or if test results are so low as to raise a question as to the safety of the structure, Resident Engineer may direct Contractor to take cores from portions of the structure. Use results from cores tested by the Contractor retained testing agency to analyze structure.

4. If strength of core drilled specimens falls below 85 percent of minimum value given in Table I, Resident Engineer may order load tests, made by Contractor retained testing agency, on portions of building so affected. Load tests in accordance with ACI 318 and criteria of acceptability of concrete under test as given therein.

5. Concrete work, judged inadequate by structural analysis, by results of load test, or for any reason, shall be reinforced with additional construction or replaced, if directed by the Resident Engineer.

PART 3 EXECUTION

3.01 PREPARATION

A. Mixing

1. All concrete shall be ready-mixed concrete and shall be mixed and delivered in accordance with the requirements of "Specifications for Ready-Mixed Concrete", ASTM C94 and ACI 318 to produce concrete with the required strength, slump and air content.

2. The concrete producer shall furnish with each load of concrete a numbered delivery ticket showing name of Contractor, name and location of project, date and time batched, truck number, number of cubic yards in load, specified strength, slump, and mix design number.

3. In the event concrete is mixed at a central batching plant, the delivery shall be arranged so that intervals between batches are kept at a minimum, and in any event not more than thirty (30) minutes. Trucks shall be in first class condition and kept in constant rotation during delivery.

4. When concrete is delivered in a truck mixer or agitator, no water from the truck water system or elsewhere shall be added after the initial introduction of mixing water for the batch, except when on arrival at the job site the slump of the concrete is less than that specified. Such additional water to bring the slump within required limits shall be injected into the mixer, provided the maximum water-cement ratio specified is not exceeded. The drum or blades shall be turned an additional 30 revolutions

or more at mixing speed until the concrete is within the proper slump limits.

B. Discharge of concrete after initial batching shall be completed within 90 minutes, or before the drum has revolved 300 revolutions, whichever comes first, after the introduction of the mixing water to the cement and aggregates. In hot weather (as defined by ACI) the discharge of the concrete shall be completed within 60 minutes.

C. Maximum delivery temperature of concrete shall be 90°F. Minimum delivery temperature as follows.

Atmospheric Temperature	Minimum Concrete Temperature
30 degrees to 40 degrees F	60 degrees F
0 degrees to 30 degrees F	70 Degrees F

3.02 VAPOR BARRIER

A. Except where membrane waterproofing is required, interior concrete slab on grade shall be placed on a continuous vapor barrier.

1. 6 mil thick clear polyethylene film, type recommended for below grade application.
2. Place 4 inches of fine granular fill over the vapor barrier to act as a blotter for concrete slab.
3. Vapor barrier joints lapped 6 inches and sealed with compatible waterproof pressure-sensitive tape.
4. Patch punctures and tears.

3.03 CONSTRUCTION JOINTS

A. Unless otherwise shown, location of construction joints to limit individual placement shall not exceed 80 feet in any horizontal direction, except slabs on grade which shall have construction joints shown. Allow 48 hours to elapse between pouring adjacent sections unless this requirement is waived by Resident Engineer.

B. Locate construction joints in suspended floors near the quarter-point of spans for slabs, beams or girders, unless a beam intersects a girder at center, in which case joint in girder shall be offset a distance equal to twice width of beam. Provide keys and inclined dowels as shown. Provide longitudinal keys as shown.

C. Place concrete for columns slowly and in one operation between joints. Install joints in concrete columns at underside of deepest beam or girder framing into column.

D. Allow 2 hours to elapse after column is cast before concrete of supported beam,

girder or slab is placed. Place girders, beams, grade beams, column capitals, brackets, and haunches at the same time as slab unless otherwise shown.

E. Install polyvinyl chloride or rubber water seals, as shown in accordance with manufacturer's instructions, to form continuous watertight seal. Waterstops selection shall be defined in specification section 03 10 00 Concrete Forming and Accessories.

3.04 EXPANSION JOINTS

A. Clean expansion joint surfaces before installing premolded filler and placing adjacent concrete.

B. Install polyvinyl chloride or rubber water seals, as shown in accordance with manufacturer's instructions, to form continuous watertight seal and as specified in section 03 10 00.

3.05 PLACING CONCRETE

A. Preparation:

1. Remove hardened concrete, wood chips, shavings and other debris from forms.

2. Remove hardened concrete and foreign materials from interior surfaces of mixing and conveying equipment.

3. Have forms and reinforcement inspected and approved by Resident Engineer before depositing concrete.

4. Provide runways for wheeling equipment to convey concrete to point of deposit. Keep equipment on runways which are not supported by or bear on reinforcement. Provide similar runways for protection of vapor barrier on coarse fill.

B. Bonding: Before depositing new concrete on or against concrete which has been set, thoroughly roughen and clean existing surfaces of laitance, foreign matter, and loose particles.

1. Preparing surface for applied topping:

a. Remove laitance, mortar, oil, grease, paint, or other foreign material by sand blasting. Clean with vacuum type equipment to remove sand and other loose material.

b. Broom clean and keep base slab wet for at least four hours before topping is applied.

c. Use a thin coat of one part Portland cement, 1.5 parts fine sand, bonding admixture; and water at a 50: 50 ratio and mix to achieve the consistency of thick paint. Apply to a damp base slab by scrubbing with a stiff fiber brush. New concrete shall be placed

while the bonding grout is still tacky.

C. Conveying Concrete: Convey concrete from mixer to final place of deposit by a method which will prevent segregation. Method of conveying concrete subject to approval of Resident Engineer.

D. Placing: For special requirements see Paragraphs, HOT WEATHER and COLD WEATHER.

1. Do not place concrete when weather conditions prevent proper placement and consolidation, or when concrete has attained its initial set, or has contained its water or cement content more than 1 1/2 hours.

2. Deposit concrete in forms as near as practicable in its final position. Prevent splashing of forms or reinforcement with concrete in advance of placing concrete.

3. Do not drop concrete freely more than 10 feet for concrete containing the high-range water-reducing admixture (superplasticizer) or 5 feet for conventional concrete. Where greater drops are required, use a tremie or flexible spout (canvas elephant trunk), attached to a suitable hopper.

4. Discharge contents of tremies or flexible spouts in horizontal layers not exceeding 20 inches in thickness, and space tremies such as to provide a minimum of lateral movement of concrete.

5. Continuously place concrete until an entire unit between construction joints is placed. Rate and method of placing concrete shall be such that no concrete between construction joints will be deposited upon or against partly set concrete, after it's initial set has taken place, or after 45 minutes of elapsed time during concrete placement.

6. On bottom of members with severe congestion of reinforcement, deposit 1 inch layer of flowing concrete containing the specified high-range water-reducing admixture (superplasticizer). Successive concrete lifts may be a continuation of this concrete or concrete with a conventional slump.

7. Concrete on metal deck:

a. Concrete on metal deck shall be minimum thickness shown. Allow for deflection of steel beams and metal deck under the weight of wet concrete in calculating concrete quantities for slab.

1) The Contractor shall become familiar with deflection characteristics of structural frame to include proper amount of additional concrete due to beam/deck deflection.

E. Consolidation: Conform to ACI 309. Immediately after depositing, spade concrete next to forms, work around reinforcement and into angles of forms, tamp lightly by hand, and compact with mechanical vibrator applied directly into concrete at approximately 18 inch intervals. Mechanical vibrator shall be power driven, hand operated type with minimum frequency of 5000 cycles per minute having an intensity sufficient to cause flow or settlement of concrete into place. Vibrate

concrete to produce thorough compaction, complete embedment of reinforcement and concrete of uniform and maximum density without segregation of mix. Do not transport concrete in forms by vibration.

1. Use of form vibration shall be approved only when concrete sections are too thin or too inaccessible for use of internal vibration.
2. Carry on vibration continuously with placing of concrete. Do not insert vibrator into concrete that has begun to set.

3.06 HOT WEATHER

Follow the recommendations of ACI 305 or as specified to prevent problems in the manufacturing, placing, and curing of concrete that can adversely affect the properties and serviceability of the hardened concrete. Methods proposed for cooling materials and arrangements for protecting concrete shall be made in advance of concrete placement and approved by Resident Engineer.

3.07 COLD WEATHER

Follow the recommendations of ACI 306 or as specified to prevent freezing of concrete and to permit concrete to gain strength properly. Use only the specified non-corrosive, non-chloride accelerator. Do not use calcium chloride, thiocyantes or admixtures containing more than 0.05 percent chloride ions. Methods proposed for heating materials and arrangements for protecting concrete shall be made in advance of concrete placement and approved by Resident Engineer.

3.08 PROTECTION AND CURING

A. Conform to ACI 308: Initial curing shall immediately follow the finishing operation. Protect exposed surfaces of concrete from premature drying, wash by rain and running water, wind, mechanical injury, and excessively hot or cold temperatures. Keep concrete not covered with membrane or other curing material continuously wet for at least 7 days after placing, except wet curing period for high-early-strength concrete shall be not less than 3 days. Keep wood forms continuously wet to prevent moisture loss until forms are removed. Cure exposed concrete surfaces as described below. Other curing methods may be used if approved by Resident Engineer.

1. Liquid curing and sealing compounds: Apply by power-driven spray or roller in accordance with the manufacturer's instructions. Apply immediately after finishing. Maximum coverage 400 square feet per gallon on steel troweled surfaces and 300 square feet per gallon on floated or broomed surfaces for the curing/sealing compound.
2. Plastic sheets: Apply as soon as concrete has hardened sufficiently to prevent surface damage. Utilize widest practical width sheet and overlap adjacent sheets 2 inches. Tightly seal joints with tape.

3. Paper: Utilize widest practical width paper and overlap adjacent sheets 2 inches. Tightly seal joints with sand, wood planks, pressure-sensitive tape, mastic or glue.

B. Location and Method of Curing

1. Base slabs and all slabs-on-grade: Cure by ponding or immersion, moist curing or pervious sheeting or impervious sheeting.

2. Concrete in formed services – Liquid containment structures: Cure by leaving the forms in place. Wooden forms shall be kept continuously wet; steel forms shall be broken loose slightly and the surface of the concrete kept continuously wet for the entire curing period. If forms are completely removed, the walls shall be cured by moist curing or pervious sheet curing.

3.09 REMOVAL OF FORMS

A. Remove in a manner to assure complete safety of structure after the following conditions have been met.

1. Where structure as a whole is supported on shores, forms for beams and girder sides, columns, and similar vertical structural members may be removed after 24 hours, provided concrete has hardened sufficiently to prevent surface damage and curing is continued without any lapse in time as specified for exposed surfaces.

2. Take particular care in removing forms of Engineerural exposed concrete to insure surfaces are not marred or gouged, and that corners and arises are true, sharp and unbroken.

B. Control Test: Use to determine if the concrete has attained sufficient strength and curing to permit removal of supporting forms. Cylinders required for control tests taken in accordance with ASTM C172, molded in accordance with ASTM C31, and tested in accordance with ASTM C39. Control cylinders cured and protected in the same manner as the structure they represent. Supporting forms or shoring not removed until strength of control test cylinders have attained at least 70 percent of minimum 28-day compressive strength specified. For post-tensioned systems supporting forms and shoring not removed until stressing is completed. Exercise care to assure that newly unsupported portions of structure are not subjected to heavy construction or material loading.

C. Reshoring: Reshoring is required if superimposed load plus dead load of the floor exceeds the capacity of the floor at the time of loading. In addition, for flat slab/plate, reshoring is required immediately after stripping operations are complete and not later than the end of the same day. Reshoring accomplished in accordance with ACI 347 at no additional cost to the Owner.

3.10 CONCRETE SURFACE PREPARATION

A. Metal Removal: Unnecessary metal items cut back flush with face of concrete members.

B. Patching: Maintain curing and start patching as soon as forms are removed. Do not apply curing compounds to concrete surfaces requiring patching until patching is completed. Use cement mortar for patching of same composition as that used in concrete. Use white or gray Portland cement as necessary to obtain finish color matching surrounding concrete. Thoroughly clean areas to be patched. Cut out honeycombed or otherwise defective areas to solid concrete to a depth of not less than 1 inch. Cut edge perpendicular to surface of concrete. Saturate with water area to be patched, and at least 6 inches surrounding before placing patching mortar. Give area to be patched a brush coat of cement grout followed immediately by patching mortar. Cement grout composed of one part Portland cement, 1.5 parts fine sand, bonding admixture, and water at a 50:50 ratio, mix to achieve consistency of thick paint. Mix patching mortar approximately 1 hour before placing and remix occasionally during this period without addition of water. Compact mortar into place and screed slightly higher than surrounding surface. After initial shrinkage has occurred, finish to match color and texture of adjoining surfaces. Cure patches as specified for other concrete. Fill form tie holes which extend entirely through walls from unexposed face by means of a pressure gun or other suitable device to force mortar through wall. Wipe excess mortar off exposed face with a cloth.

C. Upon removal of forms, clean vertical concrete surface that is to receive bonded applied cementitious application with wire brushes or by sand blasting to remove unset material, laitance, and loose particles to expose aggregates to provide a clean, firm, granular surface for bond of applied finish.

3.11 CONCRETE SLAB FINISHES

A. General

1. Finish slab concrete per the requirements of ACI 302.1R.

2. Use manual screeds, vibrating screeds, or roller compacting screeds to place concrete level and smooth.

3. Do not use “jitterbugs” or other special tools designed for purpose of forcing coarse aggregate away from surface and allowing layer of mortar, which will be weak and cause surface cracks or delamination, to accumulate.

4. Do not dust surfaces with dry materials.

5. Round off edges of slabs with steel edging tool, except where cove finish is shown. Steel edging tool radius shall be 1/4 inch for slabs subject to wheeled traffic.

B. Type S-1 (Bull Float Finish):

1. Finish slab to receive fill and mortar setting bed by screeding with

straightedges to bring surface to required finish plane.

2. Wood float finish to compact and seal surface.

3. Remove laitance and leave surface clean.

4. Coordinate with other finish procedures.

C. Type S-2 (Steel Troweled Finish):

1. Finish by screeding and floating with straightedges to bring surfaces to required finish elevation. Use evaporation retardant.

2. While concrete is still green, but sufficiently hardened to bear a person's weight without deep imprint, wood float to true, even plane with no coarse aggregate visible.

3. Use sufficient pressure on wood floats to bring moisture to surface.

4. After surface moisture has disappeared, hand trowel concrete to produce smooth, impervious surface, free from trowel marks.

5. Burnish surface with an additional troweling. Final troweling shall produce ringing sound from trowel.

6. Do not use dry cement or additional water during troweling, nor will excessive troweling be permitted.

7. Power Finishing:

a. Approved power machine may be used in lieu of hand finishing in accordance with directions of machine manufacturer.

b. Do not use power machine when concrete has not attained necessary set to allow finishing without introducing high and low spots in slab.

c. Do first steel troweling for slab S-1 finish by hand.

D. Type S-3 (Underside Elevated Slab Finish): When forming is removed, grind off projections on underside of slab and patch defective areas, including small shallow air pockets where schedule of concrete finishes requires:

1. Prepare surfaces for painting as specified in Section 09 90 00 Painting and Coating.

E. Type S-4 (Broomed Finish):

1. Finish as specified for Type S-1 floor finish, except omit final troweling and finish surface by drawing fine-hair broom lightly across surface.

2. Broom in same direction and parallel to expansion joints, or, in the case of inclined slabs, perpendicular to slope, except for round roof slab, broom surface in radial direction.

3.12 CONCRETE SLAB TOLERANCES

A. Concrete Thickness Tolerances shall be 3/8" greater or ¼" less than specified as specified in ACI code section 117.

B. Concrete Level Tolerances shall be F_F25 as defined in ACI code section 117 or ¼" gap under an unleveled 10 ft. straightedge.

C. Slope slabs to floor drain and gutter, and shall adequately drain regardless of tolerances.

3.13 CONCRETE WALL FINISHES

A. Type W-1 (Ordinary Wall Finish):

1. Point & Patch tie holes.
2. Knock off projections.
3. Patch defective areas.

B. Type W-2 (Smooth Wall Finish):

1. Point & Patch tie holes.
2. Grind off projections, fins, and rough spots.
3. Patch defective areas and repair rough spots resulting from form release agent failure or other reasons to provide smooth uniform appearance.

C. Type W-3 (Finish for Painting):

1. Point & Patch tie holes.
2. Grind off projections, fins, and rough spots.
3. Patch and repair defective areas as specified for Type W-2.
4. Leave surface ready for painting as specified in Section 09 90 00 Painting and Coating.

D. Type W-4 (Smooth Rubbed Wall Finish):

1. Only water curing will be permitted on walls being rubbed.
2. Patch and repair defective areas as specified for Type W-2.
3. Perform rubbing while green concrete can be physically worked and smoothed without adding other materials, if structurally possible, the day following placement. Finish no later than 3 days after placement has been completed.
4. Remove forms at such a rate that all finishing, form tie filling, fin removal, and patching can be completed on same day forms are removed while curing wall.
5. After pointings have set sufficiently to permit working on surface, thoroughly saturate entire surface with water for period of 3 hours and rub until uniform surface is obtained.

6. Rub either by hand with carborundum stone of medium-coarse grade or abrasive of equal quality, or mechanically operated carborundum stone.

7. Mechanically operated carborundum stones shall be approved by ENGINEER before concrete finishing.

8. No cement grout, other than cement paste drawn from the concrete itself by the rubbing process shall be used.

9. Finish Paste Formed by Rubbing by Either Brushing or Floating as Follows:

   a. Brushing:

      1) Carefully strike with clean brush.

      2) Brush in long direction of surface being finished.

   b. Floating:

      1) Spread uniformly over surface and allow to reset.

      2) Finish by floating with canvas, carpet face, or cork float, or rub down with dry burlap.

10. Continue water curing of wall during finishing operation in areas not being rubbed.

11. Move water curing onto rubbed areas as soon as water will not erode rubbed surface.

E. Type W-5 (Cementitious water-proof coating)

1. Patch and repair defective areas as specified for Type W-2.

2. Substrate must be clean, sound, and free of surface contaminates. Remove dust, laitance, grease, oils, curing compounds, form release agents and all foreign particles by mechanical means. An open-textured, sandpaper-like substrate is ideal. Substrate shall be in accordance with ICRI Guideline No. 03732 for coatings and fall within CSP4. All surfaces must be saturated surface dry (SSD), with no standing water at time of application.

3. Apply cementitious water proof coating identified as Thoroseal by ChemRex, Inc., Sealcoat 1000 by Dayton Superior, or SikaTop 144 by the Sika Corporation (contractor selection) per the manufacturer's recommendation and as described below:

   a. Thoroseal by ChemRex Inc.

      1. Prepare a mixing solution of 1 part Acryl 60 and 3 parts water.

      2. Mix one 50-pound bag of Thoroseal with 8 quarts of mixing solution from item 1 above.

      3. 1st coat shall be applied at a rate of 225 sq. feet per 50lb bag.

4. 2nd coat shall be applied at a rate of 450 sq. feet per 50lb bag.

b. Sealcoat 1000 by Dayton Superior

1. Prepare a mixing solution of 1 part Ad Bond (J-40) to 3 parts clean water.
2. Mix one 50lb bag of Sealcoat 1000 with 8 quarts of mixing solution from item 1 above.
3. 1st coat shall be applied at a rate of 225 sq. feet per 50lb bag.
4. 2nd coat shall be applied at a rate of 450 sq. feet per 50lb bag.

c. Sikatop 144 by Sika Corporation

1. Mix components A and B at a 1:1.647 by weight ratio
2. 1st coat 100 sq. feet per gallon
3. 2nd coat 150 sq. feet per gallon

3.14 CONCRETE WALL TOLERANCES

Concrete Wall Tolerances shall be as defined in specification section "03 10 00 Concrete Forming and Accessories" and as indicated in ACI code section 301.

3.15 BEAM AND COLUMN FINISHES (B=Beam, C=Column)

A. Type B-1: Match wall Type W-1.

B. Type B-2: Match wall Type W-2.

C. Type B-3: Match wall Type W-3

D. Type B-4: Match wall Type W-4

E. Type B-5: Match wall Type W-5

F. Type C-1: Match wall Type W-1.

G. Type C-2: Match wall Type W-2.

H. Type C-3: Match wall Type W-3

I. Type C-4: Match wall Type W-4

J. Type C-5: Match wall Type W-5.

3.16 CONCRETE BEAM AND COLUMN TOLERANCES

Concrete Beam and Column Tolerances shall be as defined in specification section "03 10 00 Concrete Forming and Accessories" and as indicated in ACI code section 301.

3.17 BACKFILL AGAINST WALLS

A. Do not backfill against walls until concrete has obtained specified 28 day compressive strength.

B. Place backfill simultaneously on both sides of wall, where required, to prevent differential pressures.

3.18 FIELD QUALITY CONTROL

A. General:

1. Provide adequate facilities for safe storage and proper curing of concrete test cylinders onsite for first 24 hours, and for additional time as may be required before transporting to test lab.

2. Provide concrete for testing of slump, air content, and for making cylinders from the point of discharge into forms. When concrete is pumped, Samples used shall be taken from discharge end of pump hose.

3. Evaluation will be in accordance with ACI 301, Chapter 17 and Specifications.

4. Specimens shall be made, cured, and tested in accordance with ASTM C31 and ASTM C39.

5. Frequency of testing may be changed at discretion of ENGINEER.

6. Pumped Concrete: Take concrete samples for slump (ASTM C143) and test cylinders (ASTM C31 and C39) and shrinkage specimens (ASTM C157) at placement (discharge) end of line.

7. Reject concrete represented by cylinders failing to meet strength and air content specified.

3.19 SCHEDULE OF CONCRETE FINISHES

Structure	Type of Finish
Staged Reactor (including Influent Splitter Box	
1) Foundation Slab	S-2
2) Elevated Slab	S-4
3) Walls – Interior and Exposed Exterior	W-2
4) Walls – Buried Exterior	W-1
Disc Filter	
1) Foundation Slab	S-2
2) Walls - Interior	W-2
3) Walls - Exterior	W-1

Structure	Type of Finish
Parshall Flume/Chlorine Contact Chamber/Cascade Aeration	
1) Foundation Slab	S-2
2) Walls - Interior	W-2
3) Walls - Exterior	W-1
Aerobic Digestor	
1) Foundation Slab	S-2
2) Elevated Slab	S-4
3) Walls – Interior and Exterior	W-2

END OF SECTION

SECTION 05 50 01

METAL ASSEMBLIES

PART 1 GENERAL

1.01 SECTION INCLUDES

The work under this Section includes, but is not limited to, furnishing and installation of all miscellaneous metals and/or related items as necessary and indicated on the Drawings for proper and complete performance of this work.

A. Shop fabricated steel and aluminum or items requiring special fabrication.

B. Miscellaneous angle and channel supports, flat bars and fastenings, all as shown on the Drawings and not provided under structural steel frame.

C. Brackets and supports.

1.02 RELATED SECTIONS

A. Section 05 51 33.23 – Alternating Tread Aluminum Stairs

B. Section 05 52 00 – Aluminum Railings

C. Section 05 53 00 - Aluminum Bar Gratings

D. Section 09 90 00 – Painting and Coating.

1.03 REFERENCES

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C. AAMA 2603 - Voluntary Specification, Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels; 1998.

D. AAMA 2604 - Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels; 1998.

E. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels; 1998.

F. ANSI A14.3 - American National Standard for Ladders -- Fixed -- Safety Requirements; 1992.

G. ASTM A 36/A 36M - Standard Specification for Carbon Structural Steel; 1997a.

H. ASTM A 53/A 53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 1999b.

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P. ASTM B 26/B 26M - Standard Specification for Aluminum-Alloy Sand Castings; 1999.

Q. ASTM B 85 - Standard Specification for Aluminum-Alloy Die Castings; 1999.

R. ASTM B 177 - Standard Guide for Chromium Electroplating on Steel for Engineering Use; 1993.

S. ASTM B 209 / 209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 1996.

T. ASTM B 210 / 210M - Standard Specification for Aluminum and Aluminum-Alloy Drawn Seamless Tubes; 1995.

U. ASTM B 211 / 211M - Standard Specification for Aluminum and Aluminum-Alloy Bar, Rod, and Wire; 1999.

V. ASTM B 221 / 221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 1996.

W. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination; American Welding Society; 1998.

X. AWS D1.1 - Structural Welding Code - Steel; American Welding Society; 2000.

Y. SSPC-Paint 15 - Steel Joist Shop Primer; Society for Protective Coatings; 1991 (Part of Steel Structures Painting Manual, Vol. Two).

Z. SSPC-Paint 20 - Zinc-Rich Primers (Type I, "Inorganic," and Type II, "Organic"); Society for Protective Coatings; 1991 (Part of Steel Structures Painting Manual, Vol. Two).

AA. SSPC-SP 2 - Hand Tool Cleaning; Society for Protective Coatings; 1995 (Part of Steel Structures Painting Manual, Vol. Two).

1.04 SUBMITTALS

A. See Section 01 33 00 - Submittals.

B. Shop Drawings shall show dimensions, sizes, thickness, gauges, finishes, joining, attachments and relationship of work to adjoining construction. Indicate profiles, connection attachments, reinforcing, anchorage, size and type of fasteners, and any accessories. Include erection drawings, elevations, and details where applicable. Where items must fit and coordinate with finished surfaces and/or constructed spaces, measurements from the site shall control.

1. Indicate welded connections using standard AWS A2.4 welding symbols. Indicate net weld lengths.

C. Welders' Certificates: Submit certification for welders employed on the project, verifying AWS qualification within the previous 12 months.

1.05 QUALITY ASSURANCE

Design by or under direct supervision of a Professional Structural Engineer experienced in design of this Work and licensed in the State of Georgia.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in coordination with erection schedule.

B. Store materials above ground and under cover. Keep dry and clean.

PART 2 PRODUCTS

2.01 MATERIALS

A. Materials shall be new, top quality of their respective kinds, standard sizes and fabricated in a shop whose principal business is manufacturing the items specified in this Section. Materials shall be free of defect impairing strength, durability or appearance. Miscellaneous anchors, plates, clips, bolts, nuts and the like shall be provided as necessary to complete the work, whether or not they appear on the Drawings or in the Specifications.

B. Steel:

1. Steel Sections: ASTM A 36/A 36M.

2. Steel Tubing: ASTM A 500, Grade B cold-formed structural tubing.

3. Plates: ASTM A 283.

4. Pipe: ASTM A 53/A 53M, Grade B Schedule 40, black finish.

5. Fasteners: As specified elsewhere and shown on the drawings.

6. Bolts, Nuts, and Washers: ASTM A 325 (ASTM A 325M) galvanized to ASTM A 153/A 153M for galvanized components.

7. Welding Materials: AWS D1.1; type required for materials being welded.

8. Shop and Touch-Up Primer: SSPC-Paint 15, Type I - Red Oxide.

9. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20, Type I - Inorganic.

C. Aluminum:

1. Extruded Aluminum: ASTM B 221 (ASTM B 221M), 6063 alloy, T6 temper.

2. Sheet Aluminum: ASTM B 209 (ASTM B 209M), 5052 alloy, H32 temper.

3. Aluminum-Alloy Drawn Seamless Tubes: ASTM B 210 (ASTM B 210M), 6063 alloy, T6 temper.

4. Aluminum-Alloy Bars: ASTM B 211 (ASTM B 211M), 6061 alloy, T6 temper.

5. Aluminum-Alloy Sand Castings: ASTM B 26.

6. Aluminum-Alloy Die Castings: ASTM B 85.

7. Bolts, Nuts, and Washers: Stainless steel.

8. Welding Materials: AWS D1.1; type required for materials being welded.

2.02 MANUFACTURED UNITS

A. Ladders: Steel; in compliance with ANSI A14.3; with mounting brackets and attachments; prime paint finish.

1. Side Rails: 3/8 x 2 inches members spaced at 20 inches.

2. Rungs: one inch diameter solid round bar spaced 12 inches on center.

3. Space rungs 7 inches from wall surface.

B. Telescopic Steel Columns: Steel pipe; prime paint finish.

1. Diameter: 3 inch.

2. Height: 6 to 9 feet.

C. Bumper Posts and Guard Rails: As detailed; prime paint finish.

D. Bollards: Steel pipe, concrete filled with crowned cap, as detailed; prime paint finish.

E. Joist and Equipment Pipe Hangers: Strap anchors, fabricated with minimum of 18 gauge (1.21 mm) steel; galvanized finish.

F. Inserts and sleeves: Provide all necessary inserts and sleeves of type and manufacturer best suited for work.

G. Ledge Angles, Shelf Angles, Channels, and Plates Not Attached to Structural Framing: For support of metal decking; prime paint finish.

H. Lintels: As detailed; prime paint finish.

I. Sill Angles for Tempered Glass Railing Assemblies: ASTM A 36/A 36M steel angles with anchoring devices and sizes as indicated in shop drawings for section 05 12 23, drilled and tapped for fastener types, sizes, and spacing indicated, prime paint finish.

J. Door Frames for Overhead Door Openings, Wall Openings, and Lintels: Channel sections; prime paint finish.

K. Foot Scrapers, Mud and Foot Grilles, and Pans: As detailed; aluminum, mill finish.

L. Elevator Hoistway Divider Beams: Beam sections; prime paint finish.

M. Toilet Partition Suspension Members: Steel channel sections; prime paint finish.

2.03 FABRICATION

A. General: Fabricate metals of unused mill of foundry products, free from defects impairing strength, durability and appearance. Form metals clean and straight with smooth finished surfaces. Furnish al parts necessary for securing metal work to other construction. Wherever possible, fit and assemble work in shop, ready for erection assemble items in largest practical sections, for delivery to site. Shop attach all miscellaneous metals to structural steel by welding or bolting, unless a field attachment is indicated. Grind all exposed welds smooth. If flush welds are indicated, grind welds flush with adjacent surfaces.

B. Fabricate items with joints tightly fitted and secured. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.

C. Continuously seal joined members by intermittent welds and plastic filler.

D. Exposed Mechanical Fastenings: Flush countersunk screws or bolts; unobtrusively located; consistent with design of component, except where specifically noted otherwise.

D. Supply components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.

2.04 FINISHES

A. Steel:

1. Shop Primers:

a. Primer for structural steel in areas to receive epoxy finish:

Manufacturer	Product
Tnemec Co., Inc.	66-1211
Induron	

b. Primer for structural steel in other areas: Select one of following:

Manufacturer	Product
PPG industries	G9366
Porter Paint Co.	274 (Gray)
Tnemec Co., Inc.	10-1009

2. Prime paint all steel items.

a. Exceptions: Galvanize items to be embedded in concrete or masonry and items specified for galvanized finish.

b. Exceptions: Do not prime surfaces in direct contact with concrete, where field welding is required, and items to be covered with sprayed fireproofing.

3. Prepare surfaces to be primed in accordance with SSPC-SP2.

4. Clean surfaces of rust, scale, grease, and foreign matter prior to finishing.

5. Prime Painting: One coat.

6. Galvanizing of Structural Steel Members: Galvanize after fabrication to ASTM A 123/A 123M. Provide minimum 1.3 oz/sq ft (390 g/sq m) galvanized coating.

7. Galvanizing of Non-structural Items: Galvanize after fabrication to ASTM A 123/A 123M. Provide minimum 1.3 oz/sq ft (390 g/sq m) galvanized coating.

B. Aluminum

1. Exterior Aluminum Surfaces: Class I natural anodized.

2. Interior Aluminum Surfaces: Class I natural anodized.

3. Comply with AA DAF-45 for aluminum finishes required.

4. Class I Natural Anodized Finish: AAMA 611 AA-M12C22A41 Clear anodic coating not less than 0.7 mils (0.018 mm) thick.

5. Class II Natural Anodized Finish: AAMA 611 AA-M12C22A31 Clear anodic coating not less than 0.4 mils (0.01 mm) thick.

6. Class I Color Anodized Finish: AAMA 611 AA-M12C22A42 Integrally colored anodic coating not less than 0.7 mils (0.018 mm) thick; light bronze.

7. Class I Color Anodized Finish: AAMA 611 AA-C22A44 Electrolytically deposited colored anodic coating not less than 0.7 mils (0.018 mm) thick; light bronze.

8. Class II Color Anodized Finish: AAMA 611 AA-M12C22A32 Integrally colored anodic coating not less than 0.4 mils (0.01 mm) thick; light bronze.

9. Class II Color Anodized Finish: AAMA 611 AA-M12C22A34 Electrolytically deposited colored anodic coating not less than 0.4 mils (0.01 mm) thick; light bronze.

10. Pigmented Organic Coating System: AAMA 2603 polyester or acrylic baked enamel finish; color as scheduled.

11. High Performance Organic Coating System: AAMA 2604 multiple coat, thermally cured fluoropolymer system; color as scheduled.

12. Superior Performance Organic Coating System: AAMA 2605 multiple coat, thermally cured polyvinylidene fluoride system; color as scheduled.

13. Apply one coat of bituminous paint to concealed aluminum surfaces in contact with cementations or dissimilar materials.

2.05 SOURCE QUALITY CONTROL

A. Squareness: 1/8 inch (3 mm) maximum difference in diagonal measurements.

B. Maximum Offset Between Faces: 1/16 inch (1.5 mm).

C. Maximum Misalignment of Adjacent Members: 1/16 inch (1.5 mm).

D. Maximum Bow: 1/8 inch (3 mm) in 48 inches (1.2 m).

E. Maximum Deviation From Plane: 1/16 inch (1.5 mm) in 48 inches (1.2 m).

2.06 WELDING

A. General: All welds shall be sound and free from embedded scale and slag. All butt welds shall be continuous and where exposed to view shall be ground smooth. All continuous welds shall be gas and liquid-tight. Intermittent welds shall have an effective length of at least 2-inches and shall be spaced not more than 6-inches apart.

B. All welding of steel and aluminum, including materials, welding techniques, general safety practices, appearance and quality of welds and methods of correcting defective work, shall conform to the latest requirement of AWS Specifications. Structural steel welding shall conform to the requirements of the AWS Structural Welding Code. The general recommendations and requirements of the AWS Structural Welding Code shall also apply to welded aluminum structures. The welding process and welding operators shall meet qualification tests and welding performance tests in accordance with the latest provisions of ASME Boiler and Pressure Vessel Code, Section IX, Welding and Brazing Qualifications. Welding process and qualification procedures for welding of pipe shall conform to the latest requirements of ANSI B31.1, Section 327, Welding and Section 328, Brazing and Soldering. All costs associated with the qualification or testing of welders and welding operators shall be borne by the Contractor.

C. Welding Aluminum:

1. Dirt, grease, forming or machining lubricants or any organic materials shall be removed from the areas to be welded by cleaning with a suitable solvent or by vapor degreasing. Additional operations to remove the oxide coating just prior to welding are required when the inert gas tungsten arc welding method is used. This may be done by etching or scratch brushing. The oxide coating need not be removed if the welding is done with the automatic or semi-automatic inert gas shielding metal arc. Suitable edge preparation to assure 100 percent penetration in butt welds shall be used. Oxygen cutting shall not be used. Sawing, chipping, machining or shearing may be used.

2. Any welding of aluminum shall be done using a non-consumable tungsten electrode, with filler metal in an inert gas atmosphere (TIG) or using a consumable filler metal electrode in an inert gas atmosphere (MIG). No welding process that requires the use of a welding flux shall be used unless prior approval has been obtained from the Engineer. Preheating for welding is permissible provided the temperature does not exceed 400 degree F for a total time of 30 minutes. Welding of any structure which is to be anodized shall be done using filler alloy rods which will not discolor when anodized.

3. The welding process and welding operators shall both meet a qualification test conforming to the qualification methods described in the ASME Boiler and Pressure Vessel Code, Section IX, Welding Qualifications.

PART 3 EXECUTION

3.01 EXAMINATION

Verify that field conditions are acceptable, ready to receive work and measurements at the jobsite have been verified.

3.02 PREPARATION

A. Clean and strip primed steel items to bare metal where site welding is required.

B. Supply setting templates to the appropriate entities for steel items required to be cast into concrete or embedded in masonry.

3.03 INSTALLATION

A. General: Erect miscellaneous metals plumb, straight, true and accurately fitted with even, close joints and connections. Coordinate all metal work with adjoining work for details of attachment, fittings, etc. Grind all field welds smooth. If flush welds are indicated, grind welds flush with adjacent surfaces. Tighten bolted connections and nick threads to prevent loosening. Insulate dissimilar metals in contact with

each other by methods and materials as approved by the Engineer. Protect from galvanic corrosion by pressure tapes, coatings or isolators as approved. Do not drill or punch holes; do not use cutting torch.

B. Install items plumb and level, accurately fitted, free from distortion or defects. Conceal all fastenings where practicable. Joints exposed to weather shall be formed to exclude water.

C. Provide for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.

D. Field weld components indicated in accordance with AWS D1.1.

E. Obtain approval prior to site cutting or making adjustments not scheduled.

F. After erection, prime welds, abrasions, and surfaces not shop primed or galvanized, except surfaces to be in contact with concrete.

3.04 FIELD QUALITY CONTROL

A. Maximum Variation From Plumb: 1/4 inch (6 mm) per story, non-cumulative.

B. Maximum Offset From True Alignment: 1/4 inch (6 mm).

C. Maximum Out-of-Position: 1/4 inch (6 mm).

END OF SECTION

SECTION 05 51 33.23

ALTERNATING TREAD ALUMINUM STAIRS

PART 1 GENERAL

1.01 SECTION INCLUDES

The work covered by this section includes furnishing all labor, equipment, and materials required to furnish and install aluminum alternating tread stairs including handrails, treads, upper platform, toe board, fittings, hardware, and accessories as required by the Contract Documents.

1.02 RELATED SECTIONS

A. Section 03 31 00 - Cast-In-Place Concrete

B. Section 05 51 01 – Metal Assemblies

C. Section 05 52 00 - Aluminum Railings

1.03 REFERENCES

A. National Association of Architectural Metal Manufacturers (NAAMM): NAAMM, Standard Amp 510-92 Metal Stairs Manual 5th Edition

B. Aluminum Association: Aluminum standards and data, latest Edition

C. American Welding Society: AWS D1.2, Structural Welding Code, Aluminum

1.04 SYSTEM DESCRIPTION

A. Aluminum alternating tread stairs shall be designed and constructed in strict compliance with all applicable OSHA standards.

B. Aluminum stairs shall be a fixed system designed to be permanently attached top and bottom to concrete structures and shall be installed at approximately 68 degrees from horizontal as shown in the Construction Drawings. Treads shall be flat, and slip-free. Handrails shall be as specified in Section 05 52 00 Aluminum Railings, or as provided by manufacturer. The stairs shall be constructed to span the vertical drop as indicated on the Construction Drawings.

C. Aluminum stairs shall be engineered, fabricated, and installed to withstand the structural loadings as specified below:

1. Aluminum Alternating Tread Stair Treads shall be designed to withstand a single concentrated 1,000 pound load without permanent deformation; or

100 pounds per square foot or 300 pounds on an area of 4 square inches without exceeding the allowable working stress of the material.

2. Alternating Tread Stair Guard and Handrail shall be capable of withstanding a single concentrated load of 200 pounds or a uniform load of 50 pounds per linear foot applied in any direction at any point on the rail without exceeding the allowable working stress of the material.

3. Alternating Tread Stair Stringers: shall be capable of withstanding a single concentrated load of 1000 pounds at any point on the stair without permanent deformation; or a uniform live loading of 100 pounds per square foot applied in a downward direction to all tread surfaces or a 300 pound load on an area of 4 square inches without exceeding the allowable working stress of the material.

1.05 SUBMITTALS

A. See Section 01 33 00 – Submittal Procedures.

B. Submit product data including manufacturer's specifications and installation instructions for all components of each product type specified.

C. Shop Drawings shall be prepared specifically for this project which includes the following:

1. Show complete layout; plan views, elevations, connections, details for fabrication and attachment to other elements, and other installation details.

2. Include structural calculations and anchorage requirements, signed and sealed by a registered engineer in the State of Georgia responsible for the structural design of the system, certifying compliance with structural performance requirements.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: The manufacturer and craftsmen having resources to provide consistent quality in appearance and physical properties, without delay of work.

B. Installer Qualifications: Approved by the manufacturer.

C. Handrail shall be the product of a company regularly engaged in the manufacture of pipe railing for a minimum of 5 years. Railing shall be shop assembled in lengths not to exceed 24 feet for field erection.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Handrails shall be properly packaged to prevent scratching and denting during shipment, storage and erection. Inspect materials to ensure that specified products have been received. Maintain protective wrapping until project is completed.

B. Store components to avoid damage from moisture, abrasion, bending, and other construction activities.

C. Exercise particular care to avoid damage to material finishes or unprotected surfaces when handling.

1.08 SEQUENCING

A. Review and coordinate setting drawings, shop drawings, templates, and instructions for installation of related items to be embedded in concrete and masonry.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Lapeyre Stair, Inc. – Harahan, LA

B. Approved Equal.

2.02 COMPONENTS

A. Cast Aluminum Treads, Landings, and Mounting Base: shall be gas metal arc welded, shielded metal arc welded or other approved welding process to a rectangular HSS stringer.

B. Tread Castings: shall have integrally cast handrail support arms which are precision machined and welded to continuous aluminum handrails. Shall be made of aluminum alloy F356F.

C. Landing and Tread Surfaces: shall be cast with skid resistant surfaces and all treads shall have upturned integrally cast skid barriers. Shall be made of aluminum alloy F356F.

D. Riser Spacing: shall be equally spaced to within 3/16" for adjacent and to within 3/8" for any two non-adjacent risers on a stair.

E. Guards and Handrails: shall be contoured for body guidance and underarm support, and shall have inclined hand side portions for free sliding of the hands unimpeded by the handrail supports. Shall be made of 1-1/2" Φ x 1/8" Tube; Aluminum Alloy 6063-T4

F. Cast Aluminum Foot Divider: shall be an integral part of the landing and shall form a support for a rubber bumper strip.

G. Rubber Bumper. A rubber bumper strip shall be attached or will be provided for field attaching to the center stringer. Shall be a hollow neoprene strip.

H. Central Stringer: Shall be made of HSS 1-3/4" x 4" x 1/8"; Aluminum Alloy 6063-T52.

I. Finishes: Standard: Mill finish on aluminum stair components.

2.03 ACCESSORIES

A. Provide Type 316 stainless steel hardware for aluminum stair assembly and connection to concrete structures.

B. Provide bitumastic coating or mylar spacers to attach aluminum components to concrete structures.

2.04 FABRICATION

A. Factory- or shop-fabricate stair sections to the greatest practicable extent to comply with specifications, manufacturer's construction requirements, and the shop drawings.

1. Maintain post spacing and anchorage as required to comply with specified structural requirements.
2. Use connections that maintain structural capacity of joined members.

B. Pre-assemble railing system, including posts, in easy to lift sections whenever possible; clearly mark units for site assembly and installation.

PART 3 EXECUTION

3.01 PREPARATION

A. Coordination: Coordinate start and installation of aluminum alternating tread stairs with all other related and adjacent work. Installation shall not start until the construction has progressed to the point that weather conditions and remaining construction operations will not damage stair installation.

B. Verification: Verify that dimensions and angle are correct and that substrate is in proper condition for alternating tread stair installation. Do not proceed with installation until all necessary corrections have been made.

3.02 INSTALLATION

A. Install in strict accordance with manufacturer's printed installation instructions and shop drawings.

3.03 PROTECTION SCHEDULES

Provide adequate protection for all surfaces of completed installations to prevent damage during remainder of construction activities.

END OF SECTION

SECTION 05 52 00

ALUMINUM RAILINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. The work covered by this section includes furnishing all labor, equipment and materials required to furnish and install aluminum component handrail including all fittings, anchors, bases and accessories, as required by the contract documents.

B. All guardrails shall be furnished with a toe-board, except where concrete curbs are shown.

C. Mounting hardware and trim.

1.02 RELATED SECTIONS

A. Section 03 31 00 – Cast-In-Place Concrete

B. Section 05 53 00 – Aluminum Bar Gratings

C. Section 05 54 00 – Aluminum Stairs

1.03 REFERENCES

A. AA DAF-45 - Aluminum Association Designation System for Aluminum Finishes; Aluminum Association; 1997, Eighth Edition.

B. ASTM B 209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 1996.

C. ASTM B 209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric); 1995.

D. ASTM B 221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 1996.

E. ASTM B 221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric); 1996.

F. ASTM B 429 - Standard Specification for Aluminum-Alloy Extruded Structural Pipe and Tube; 1995.

1.04 SYSTEM DESCRIPTION

A. The component aluminum handrail system shall be designed and constructed in strict compliance with the requirements of OSHA and the Standard Building Code. It shall be engineered, fabricated, and installed to withstand the structural loadings as required by applicable codes or as defined below, whichever is greater.

1. Guardrails shall be designed to withstand a uniform horizontal load of 50 pounds per foot with a simultaneous vertical load of 100 pounds per foot applied to the top rail.

2. Handrail and stair rails shall be designed to withstand a uniform horizontal load of 50 pounds per foot applied to the top rail.

3. All guardrails, handrails and stair rails shall be designed to withstand a concentrated load of 200 pounds applied in any direction, at any point on the railing system.

B. The handrail system design and installation should allow for thermal movement resulting from the maximum changes in ambient temperature, preventing opening of joints, buckling, overstressing of connections, and other detrimental effects. Expansion joints shall be placed at 60-foot intervals and at all concrete expansion joints.

C. This contract is partially funded by the GEFA CWSRF and the equipment manufacturer shall meet the requirements identified in the SRF Supplemental General conditions.

1.05 SUBMITTALS

A. See Section 01 33 00 – Submittal Procedures.

B. Submit product data including manufacturer's specifications and installation instructions for all components of each product type specified.

C. Shop Drawings shall be prepared specifically for this project which includes the following:

1. Show complete layout; plan views, elevations, connections, details for fabrication and attachment to other elements, and other installation details.

2. Include structural calculations and anchorage if requested by the project Engineer. The submittal should be signed and sealed by the registered engineer in the State of Georgia responsible for the structural design of the system, certifying compliance with structural performance requirements.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: The manufacturer and craftsmen having resources to provide consistent quality in appearance and physical properties, without delay of work.

B. Installer Qualifications: Approved by the manufacturer.

C. Handrail shall be the product of a company regularly engaged in the manufacture of pipe railing for a minimum of 5 years. Railing shall be shop assembled in lengths not to exceed 24 feet for field erection.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Handrails shall be properly packaged to prevent scratching and denting during shipment, storage and erection. Inspect materials to ensure that specified products have been received. Maintain protective wrapping until project is completed.

B. Store components to avoid damage from moisture, abrasion, and other construction activities.

1.08 SEQUENCING

Review and coordinate setting drawings, shop drawings, templates, and instructions for installation of related items to be embedded in concrete and masonry.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Thompson Fabricating - Birmingham, Alabama.

B. Hollaender Corporation - Cincinnati, Ohio.

C. Approved equal.

2.02 MATERIALS

A. Posts and rails shall be a minimum of 1 1/2" schedule 40 aluminum pipe, alloy 6063-T6 or 6105-T5, ASTM B-429 or B-221. Post spacing shall be as shown in the Construction Plans.

B. Bars, Rods, and Tubes: ASTM B 221. Plate and Sheet: ASTM B 209.

C. Handrail shall be made of pipe and fittings mechanically fastened together with Series 300 stainless steel hardware. Handrail systems, which use fittings that are cast, glued, pop-riveted or sheet metal screws will not be acceptable.

D. Toe-boards shall conform to OSHA standards. Toe-boards shall be a minimum of 4" high and attach to the post using clamps which allow for expansion and contraction between posts. Toe-boards shall be set 1/4" above the walking surface.

E. Wedge anchors shall be type 303 stainless steel. Wedge anchors to be spaced 10d apart and 5d edge distance for no reduction in pullout strength. A safety factor of 4 shall be used on pullout values published by the manufacturer.

F Drainage: Provide weep holes or other means to allow trapped water to drain from hollow sections exposed on exterior or to condensation or moisture from other sources.

G. All aluminum surfaces in contact with concrete, grout or dissimilar metals will be protected with a coat of bituminous paint, mylar isolators or other approved material.

2.03 ACCESSORIES

Provide appropriate returns, corners, and mounting brackets as required to properly finish handrail system and to support it in conformance with Uniform Federal Accessibility Standards.

2.04 FABRICATION

A. Factory- or shop-fabricate to comply with specifications, manufacturer's printed requirements, and shop drawings. Field fabrication of the railing system is not permitted.

1. Maintain post spacing and anchorage as required to comply with specified structural requirements.

2. Use connections that maintain structural capacity of joined members.

B. Pre-assemble railing system, including posts, in easy to lift sections whenever possible; clearly mark units for site assembly and installation

2.05 FINISHES

All handrail and components shall be clear anodized per Aluminum Association M10C22A41 (215-R1). The pipe shall be plastic wrapped to protect the finish.

PART 3 EXECUTION

3.01 INSTALLERS

A. Field fabrication of the railing system is not permitted.

B. Set handrails plumb within 1/8" of vertical and align horizontally to within 1/8" in 12 feet.

C. Install wedge anchors to proper depth to develop full pullout and shear values. Check all fasteners and bolts in base connections and splices for tightness.

D. Adequate provisions for expansion and contraction shall be incorporated into the rail.

E. Toe-boards shall be shipped loose and attached to the handrail in the field. Attachment to the posts will be made with clamps.

3.02 EXAMINATION

A. Examine substrate and conditions where railing systems are to be installed.

B. Notify in writing of unsatisfactory conditions. Do not proceed with the work until unsatisfactory conditions have been corrected.

3.03 PREPARATION

Prepare surrounding construction to receive railing system installations in accordance with manufacturer's requirements.

3.04 INSTALLATION

A. Install in strict accordance with manufacturer's printed installation instructions and shop drawings.

B. Install posts in concrete with pipe sleeves preset and anchored into concrete whenever possible, or by core drilling. Posts may also be installed using base plates with slip-tube attachments anchored to the concrete surface.

1. Separate aluminum, which might contact concrete, masonry, or other metals, by means of asphaltic paint or other approved method to prevent electrolytic action.

2. After posts are inserted, solidly fill the remaining space between post and side of sleeve or hole, with non-shrink nonmetallic grout to approximately 1/2 inch (13 mm) below exposed surface.

3. Install appropriate waterproof sealant as recommended by the manufacturer; slightly taper away from posts.

C. Adjust, level, and securely install railing system components.

1. Avoid springing assembled components of system into place.

2. Align rails so that variations from level for horizontal members, and from parallel with rake of steps and ramps for sloping members, do not exceed 1/4 inch in 12 feet (6 mm in 3.6 m).

D. Provide for thermal expansion and contraction by use of expansion joints/gaps in top rails, at intervals required by manufacturer; strictly adhere to manufacturer's instructions for locations of expansion joints and fastening of expansion sleeves.

E. If installed configuration will not allow water drainage from hollow sections, drill weep holes at bottom locations or use other approved methods to provide drainage.

3.05 RE-INSTALLATION

All defective, damaged or otherwise improperly installed handrail shall be removed and replaced with an appropriate material, which complies with this section at no additional cost to the Owner.

3.06 ADJUSTING

Verify that handrail is level and rigidly secured to substrate; make any adjustments required.

3.07 CLEANING

Following installation, aluminum handrail shall be cleaned with a mild soap and clean water. Acid solutions, steel wool or harsh abrasives shall not be used.

3.08 PROTECTION SCHEDULES

Provide adequate protection for all surfaces of completed installations to prevent damage during remainder of construction activities.

END OF SECTION

SECTION 05 53 00

ALUMINUM BAR GRATINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. The work covered by this section includes furnishing all labor, equipment and materials required to furnish and install aluminum component gratings and treads including all fittings, anchors, bases and accessories, as required by the contract documents.

B. Grating: Steel, welded I-bar type with banding bars and full width safety nosing at edge of treads and landings.

C. Checkered Plate: ASTM A 786/A 786M, rolled steel floor plate.

D. Tread and Landing Concrete Reinforcement: Mesh type as detailed, galvanized.

1.02 RELATED SECTIONS

A. Section 033100 - Cast-In-Place Concrete.

B. Section 055200 – Aluminum Railings.

1.03 REFERENCES

A. AA DAF-45 - Aluminum Association Designation System for Aluminum Finishes; Aluminum Association; 1997, Eighth Edition.

B. ASTM B 209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 1996.

C. ASTM B 209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric); 1995.

D. ASTM B 221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 1996.

E. ASTM B 221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric); 1996.

F. ASTM B 429 - Standard Specification for Aluminum-Alloy Extruded Structural Pipe and Tube; 1995.

G. Metal Bar Grating Manual – Published by the National Association of Architectural Metal Manufacturers.

1.04 SYSTEM DESCRIPTION

A. The gratings and treads shall be designed and constructed in strict compliance with the requirements of OSHA and the Standard Building Code. It shall be engineered, fabricated, and installed to withstand the structural loadings as required by applicable codes or as defined below, whichever is greater.

1. All guardrails, handrails and stair rails shall be designed to withstand a uniform load of 200 pounds per square foot with a deflection of not more than ¼".

B. The handrail system design and installation should allow for thermal movement resulting from the maximum ranges (change) in ambient temperature, preventing opening of joints, buckling, overstressing of connections, and other detrimental effects. Expansion joints shall be placed at 60-foot intervals and at all concrete expansion joints. See Section 055200 – Aluminum Railings.

1.05 SUBMITTALS

A. See Section 013300 – Submittal Procedures.

B. Submit product data including manufacturer's specifications and installation instructions for all components of each product type specified.

C. Shop Drawings shall be prepared specifically for this project which includes the following:

D.

1. Show complete layout; plan views, elevations, connections, details for fabrication and attachment to other elements, and other installation details.

2. Include structural calculations and anchorage if requested by the project Engineer. The submittal should be signed and sealed by the registered engineer responsible for the structural design of the system, certifying compliance with structural performance requirements.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: The manufacturer and craftsmen having resources to provide consistent quality in appearance and physical properties, without delay of work.

B. Installer Qualifications: Approved by the manufacturer.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Gratings and treads shall be properly packaged to prevent scratching and denting during shipment, storage and erection. Inspect materials to ensure that specified products have been received. Maintain protective wrapping until project is completed.

B. Store components to avoid damage from moisture, abrasion, and other construction activities.

1.08 SEQUENCING

Review and coordinate setting drawings, shop drawings, templates, and instructions for installation of related items to be embedded in concrete and masonry.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Thompson Fabricating - Birmingham, Alabama.

B. McNichols Grating Company

C. Ohio Gratings

D. or approved equal.

2.02 MATERIALS

A. Gratings shall be fabricated of I – shaped bars, alloy 6063-T6; with swaged cross bars spaced on 4” centers. Bearing bars shall be spaced on 1-3/16” centers. Top surface of bearing bars shall be striated to provide a non-slip surface. Minimum depth of grating shall be 1-1/4 inches.

B. Grating shall be designed to support a uniform load of 200 pounds per square foot, with a maximum deflection of ¼”. The maximum fiber stress shall not exceed that which is allowed by the Aluminum Association.

C. Aluminum shelf angles shall be anchored to the concrete using type 304 stainless steel wedge anchors.

D. Aluminum stair treads shall be I-bar grating type with and extruded aluminum corrugated nosing.

E. All aluminum surfaces in contact with concrete, grout or dissimilar metals will be protected with a coat of bituminous paint, mylar isolators or other approved material.

2.03 FABRICATION

Factory- or shop-fabricate to comply with specifications, manufacturer's printed requirements, and shop drawings.

2.04 FINISHES

All components shall be clear anodized per Aluminum Association M10C22A41 (215-R1). The pipe shall be plastic wrapped to protect the finish.

PART 3 EXECUTION

3.01 INSTALLERS

A. Field fabrication is not permitted.

B. Align horizontally to within 1/8" in 12 feet.

C. Install shelf anchors to proper depth to develop full pullout and shear values. Check all fasteners and bolts in base connections and splices for tightness.

D. Adequate provisions for expansion and contraction shall be incorporated.

3.02 EXAMINATION

A. Examine substrate and conditions where systems are to be installed.

B. Notify in writing of unsatisfactory conditions. Do not proceed with the work until unsatisfactory conditions have been corrected.

3.03 PREPARATION

Prepare surrounding construction to receive installations in accordance with manufacturer's requirements.

3.04 INSTALLATION

A. Install in strict accordance with manufacturer's printed installation instructions and shop drawings.

B. Standard installation clearances and tolerances shall conform to the requirements of the current metal Bar Grating Manual.

C. Adjust, level, and securely install components.

D. Install aluminum clamps or clips to anchor the grating securely to its supports. A minimum of four fasteners per panel shall be provided, unless otherwise shown on the drawings. Clips shall not protrude above the top of the grating.

E. If installed configuration will not allow water drainage from hollow sections, drill weep holes at bottom locations or use other approved methods to provide drainage.

F. Cut-outs for circular obstructions are to be at least 2” larger in diameter than the obstruction. Cut outs for all piping 2” in diameter and smaller shall be made in the field, Bond all ends of gratings.

3.05 RE-INSTALLATION

All defective, damaged or otherwise improperly installed materials shall be removed and replaced with material which complies with this section at no additional cost to the owner.

3.06 CLEANING

Following installation, aluminum surfaces shall be cleaned with a mild soap and clean water. Acid solutions, steel wool or harsh abrasives shall not be used.

3.07 PROTECTION SCHEDULES

Provide adequate protection for all surfaces of completed installations to prevent damage during remainder of construction activities.

END OF SECTION

SECTION 06 10 53

MISCELLANEOUS ROUGH CARPENTRY

PART 1 GENERAL

1.01 SCOPE

A. Furnish all materials, labor, and equipment to properly install all miscellaneous rough carpentry work and related accessories at the locations shown on the plans or as directed by the Engineer for the proper completion of the work included under this contract whether shown expressly on the plans or implied by other requirements.

B. The Work also includes:

1. Providing openings in miscellaneous rough carpentry to accommodate the Work under this and other Sections and building into miscellaneous rough carpentry items such as sleeves, anchorages, inserts and other items to be embedded in or penetrating miscellaneous rough carpentry for which placement is not specifically provided under other Sections.
2. Providing openings in miscellaneous rough carpentry to accommodate the Work under other contracts and assisting other contractors in building into miscellaneous rough carpentry items such as, sleeves, anchorages, inserts, and items required for which provision is not specifically included under other contracts.

C. Extent of miscellaneous rough carpentry is shown or indicated.

D. Types of materials required include:

1. Miscellaneous blocking, furring strips, and other miscellaneous wood framing.
2. Lumber for temporary protection.
3. Lumber for temporary support.
4. Pressure treatment of lumber specified in this Section.
5. Miscellaneous accessories.
6. Air and water infiltration barrier system.
7. Vapor barrier system.

1.02 REFERENCES

A. ALSC PS 20, American Softwood Lumber Standard.

B. ASME B18.2.1 Square and Hex Bolts and Screws, Inch Series.

C. ASME B18.6.1 Wood Screws, Inch Series.

D. ASTM A653/A653M, Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

E. ASTM D2898, Standard Practice for Accelerated Weathering of Fire-Retardant-Treated Wood for Fire Testing

F. ASTM D5516, Test Method for Evaluating the Flexural Properties of Fire-Retardant Treated Softwood Plywood Exposed to Elevated Temperatures.
G. ASTM D5664, Test Method for Evaluating the Effects of Fire-Retardant Treatments and Elevated Temperatures on Strength Properties of Fire-Retardant Treated Lumber.
H. ASTM D6305, Practice for Calculating Bending Strength Design Adjustment Factors for Fire-Retardant-Treated Plywood Roof Sheathing.
I. ASTM D6841, Practice for Calculating Design Value Treatment Adjustment Factors for Fire-Retardant-Treated Lumber.
J. ASTM F1667, Specification for Driven Fasteners: Nails, Spikes, and Staples.
K. AWPA M4, Care of Preservative Treated Wood Products.
L. AWPA P5, Waterborne Preservatives.
M. AWPA P17, Fire Retardant Formulations.
N. AWPA T1, Use Category System: Processing and Treatment Standard.
O. AWPA U1, Use Category System: User Specification for Treated Wood.
P. APA E445S, Performance Standards and Policies for Structural-Use Panels (APA PRP-108).
Q. NIST PS-1, Construction and Industrial Plywood.
R. National Lumber Grade Authority (NLGA), Standard Grading Rules for Canadian Lumber.
S. Northeastern Lumber Manufacturers Association (NELMA), Standard Grading Rules for Northeastern Lumber.
T. Southern Pine Inspection Bureau (SPIB), Standard Grading Rules for Southern Pine Lumber.
U. West Coast Lumber Inspection Bureau (WCLIB), Standard Grading Rules.
V. Western Wood Products Association (WWPA), Western Lumber Grading Rules.

1.03 SUBMITTALS

Complete product data and engineering data, including shop drawings, shall be submitted to the Engineer in accordance with the requirements of Section 01 33 00 of the Contract Documents.

A. Action Submittals; Submit the following:
   1. Shop Drawings:
      a. List of species and grade of lumber proposed for each use.
      b. Fastener schedule with location, size, material and type of each fastener to be used in the Work.
   2. Samples:
      a. Provide Sample of each fastener tagged for use in the Work.
B. Informational Submittals: Submit the following:
   1. Certificates:
      a. Lumber treater's certification of compliance, in accordance with Paragraph 1.3.B.1 of this Section.
      b. Certificates of grade in accordance with Paragraph 1.3.B.2 of this Section.
   2. Tests and Evaluation Reports:

a. For fire retardant treated structural panels, test data and design adjustment values in accordance with ASTM D5516 and ASTM D6305.
b. For fire retardant treated lumber, test data and design adjustment in accordance with ASTM D5664 and ASTM D6841.

3. Manufacturer's Instructions:
a. Chemical treatment manufacturer's instructions for proper use of each type of treated material.

PART 2 PRODUCTS

2.01 QUALITY ASSURANCE

A. Regulatory Requirements: Comply with requirements of authorities having jurisdiction and the building code referred to in Section 01 42 00, References for size, spacing and attachment of wood members, unless more stringent requirements are shown or specified in the Contract Documents.

B. Certifications:
1. Pressure Treatment: For each type of pressure treatment specified, submit certifica¬tion by wood treating plant stating chemicals and process used, and certifying conformance with applicable stan¬dards referenced in the Contract Documents.
a. For water borne preservatives, include statement that moisture content of treated materials was reduced to maximum of 19 percent prior to shipment to the Site.
2. Certificates of Grade: Where appearance of wood is important and grade marks will deface the Work, in lieu of grade markings on wood, submit certificates attesting that materials comply with grade requirements specified.

2.02 MATERIALS

A. Lumber, General:
1. Factory-mark each piece of lumber with type, grade, mill and grading agency. Surfaces that will be exposed to view shall not have grade marks or other types of identifying marks.
2. Nominal sizes are shown or indicated, unless otherwise shown or indicated in the Contract Documents. Provide actual sizes as required by ALSC PS 20 for moisture content specified for each use.
a. Provide dressed lumber, surfaced four sides (S4S), unless otherwise shown or specified.
b. Provide seasoned lumber with 19 percent maximum moisture content at time of dressing.
3. Provide the following grade and species:
a. Construction Grade, for material up to and including four-inch wide.
b. No. 2 or better for material greater than four-inch wide up to and

including 12-inch wide.
c. Eastern White Pine, NELMA.
d. Spruce-Pine-Fir, NLGA.
e. Hem-Fir (North), NLGA.
f. Southern Pine, SPIB.
g. Douglas Fir, WCLB.
h. Douglas Fir, WWPA.

4. Lumber for Protection and Temporary Support: Size and grades to conform to Laws and Regulations, including OSHA.

B. Plywood for Diaphragms: Provide the following:
1. NIST PS-1 rated sheathing, exterior exposure, Grade C-C, with minimum thickness shown on the Drawings, and span rating not less than 24/0.
a. Mark each sheet to identify plywood by species group or span rating, exposure durability classification, grade, and compliance with NIST PS-1) Surfaces that will be exposed to view shall not bear grade marks or other identifying marks.

C. Oriented Strand Board for Roof Sheathing: Provide the following:
1. APA E445S, sheathing grade with durability equivalent to Exposure 1 and span rating not less than 24/16.
a. Mark each panel with a mark that identifies end use, span rating, and exposure durability classification.

D. Vapor Barrier:
1. Provide reinforced rubber, modified high density polyethylene vapor barrier with perm rating of 0.045 maximum. Provide maximum widths to minimize field seaming.
2. Provide adhesive, tapes and flashings as recommended by vapor barrier manufacturer, of type that maintains perm rating of entire vapor barrier installation.
3. Products and Manufacturers: Provide one of the following:
a. Rufco SS-300 Vapor Retarder and Adhesives by Raven Indus¬tries, Inc.
b. Or equal.

E. Water and Air Infiltration Barrier:
1. Provide vapor permeable membrane recommended by manufactur¬er for installation on outside face of plywood wall siding.
2. Provide minimum moisture vapor transmission of 35 grains per square meter per 24 hour period.
3. Products and Manufacturers: Provide one of the following:
a. Tyvek Housewrap by DuPont Company Textile Fibers Department.
b. Typar Housewrap by Reemay, Incorporated.
c. Or equal.

F. Fasteners and Anchorages:
1. Fasteners exposed to the weather as well as fasteners embedded in, or in contact with, preservative treated wood shall be hot-dip galvanized.
2. Fasteners for fire retardant-treated lumber exposed to the weather shall be copper alloy.

3. Common wire nails shall conform to ASTM F1667.
4. Wood screws shall conform to ASME B18.6.1.
5. Lag screws and lag bolts shall conform to ASME B18.2.1.
6. Anchorage devices shall conform to Section 05 05 33, Anchor Systems.
7. Use joist hangers, framing anchors and clips where shown or specified.
    a. Joist hangers shall be steel, zinc coated, sized to fit the supporting member, of sufficient strength to develop full strength of the supported member in accordance with applicable building code, and furnished complete with special nails required by joist hanger manufacturer.
    b. Framing anchors shall be hot-dip galvanized steel conforming to ASTM A653/A653M, Z275 G90. Steel shall not be lighter than 18-gage. Use special nails furnished by manufacturer for nailing.
    c. Clips shall consist of hot-dip galvanized conforming to ASTM A653/A653M, Z275 G90 steel angles, minimum 3/16-inch thick.

G. Wood Trim:
1. Western red cedar, custom grade.
2. Provide solid wood boards and battens complying with ALSC PS 20 and with applicable grading rules of authorized lumber inspection bureau or association under which each species is produced, S4S, with square edges.
3. Provide dressed, seasoned boards and battens with 15 percent maximum moisture content complying with dry size requirements of ALSC PS 20. Mark boards “MC-15” (moisture content 15 percent) or “KD” (kiln dried).

H. Panel edge clips: Extruded galvanized steel, H-shaped clips to prevent differential deflection of roof sheathing.

2.03 WOOD TREATMENT

A. Preservative Treatment: Where lumber is specified in this Section as treated, comply with AWPA P5, "Alkaline Copper Quat Mixture". Mark each treated item to comply with AWPA quality mark requirements.
1. Pressure-treat above ground items with water-borne preservatives in accordance with AWPA U1 and AWPA T1. After treatment, kiln-dry to maximum moisture content of 19 percent. Treat materials indicated on the Drawings and the following:
    a. Wood nailers, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
    b. Wood, plates, blocking, furring, stripping, and similar concealed members and wood in contact with masonry, concrete, or steel.
    c. Soffit and rain drainage framing.
2. Complete the fabrication of treated items prior to treatment, wherever possible. If wood is cut after treatment, coat cut surfaces with heavy brush coat of same chemical used for treatment. Inspect each piece of wood after drying and discard damaged or defective pieces.

PART 3 EXECUTION

3.01 DELIVERY, STORAGE, AND HANDLING

A. Packing, Shipping, Handling, and Unloading:
   1. Deliver products to Site to ensure uninterrupted progress of the Work. Deliver anchorage products that are to be embedded in concrete or masonry in ample time to prevent delaying the Work.
   2. Handle treated materials in accordance with AWPA M4.

B. Storage and Protection:
   1. Keep materials dry during delivery and storage.
   2. Keep materials off ground using pallets, platforms, or other appropriate supports. Protect materials from corrosion and deterioration. Stack lumber, and provide air circulation within stacks.

3.02 INSTALLATION

A. Examine substrates and supporting structure and conditions under which miscellaneous rough carpentry Work will be installed and notify ENGINEER in writing of conditions detrimental to proper completion of the Work. Do not proceed with installation until unsatisfactory conditions are corrected.

B. Coordination: Fit miscellaneous rough carpentry Work to other Work and work under other contracts, as applicable, and scribe and cope as required for accurate fit. Correlate location of furring, nailers, blocking, grounds and similar supports to allow proper attachment of other construction.

C. General:
   1. Discard units of material with defects that might impair quality of the Work, and units too small to fabricate the Work with minimum joints or optimum joint arrangement.
   2. Set miscellaneous rough carpentry Work accurately to required levels and lines, with members plumb and true, accurately cut and fitted.
   3. Securely attach miscellaneous rough carpentry Work to substrates by anchoring and fastening as shown and indicated in the Contract Documents. Countersink nail heads on exposed miscellaneous rough carpentry Work and fill holes. Make tight connections between members.
   4. Install fasteners without splitting of wood, pre-drill as required and for masonry anchors fastened to wood stud wall framing.

D. Wood Grounds, Nailers, and Blocking:
   1. Provide where shown or indicated, and where required for attachment of other construction. Form to shapes as shown or indicated and cut as required for true line and level of Work to be attached. Coordinate location with other work involved.
   2. Attach substrates as required to support applied loading. Countersink bolts and nuts flush with surfaces, unless otherwise shown or indicated.
   3. Provide permanent grounds of dressed, preservative-treated, key-bevelled lumber not less than 1.5-inch wide and of thickness required to bring face of ground to exact thickness of finish material involved. Remove temporary

grounds when no longer required.

E. Plywood, General:
   1. Install in accordance with the Contract Documents and requirements of authorities having jurisdiction.
   2. Allow for installed clearances between individual plywood panels as specified by plywood manufacturer. Provide 1/4-inch space at panel edge joints and 1/8-inch space at panel end joints, unless otherwise recommended by manufacturer.
   3. Install plywood with long dimension across supports.
   4. Install roof sheathing using 8d helical or annular nails spaced fix inches at panel edges and 12 inches at intermediate framing.
   5. Provide panel edge clips at unsupported edges of roof sheathing.

F. Plywood, Diaphragm:
   1. Diaphragms shall be blocked or unblocked, as shown or indicated on the Drawings. Comply with nailing schedule on the Drawings.
   2. Provide continuous lumber blocking at unsupported edges of blocked diaphragms. Do not use panel edge clips in blocked diaphragms.

G. Air and Water Infiltration Barrier:
   1. Install air and water infiltration barrier over entire wall area of wood framed building, as shown or indicated in the Contract Documents.
   2. Comply with manufacturer's written installation instruction and provide large head sheathing nails sufficiently long to penetrate and grip framing studs, sills, and plates.
   3. Fabric shall be snugly taunt before nailing with all fabric lapped 12-inches minimum, at splices.
   4. Tape all seams along sills.

H. Vapor Barrier:
   1. Install vapor barrier over entire interior room-side surfaces of exterior gypsum board perimeter walls, and over entire interior room-side surface plane of bottom of ceiling joists.
   2. Install in accordance with manufacturer's written recommendations and using all taped joints and all taped fastener location to maintain perm rating of entire installed system in accordance with the Contract Documents.

PART 4 SCHEDULE

END OF SECTION

SECTION 09 90 00

PAINTING AND COATING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. This specification covers preparation of surfaces, performance and completion of painting of all surfaces as required by the drawings and as specified herein. All work shall be done in strict accordance with this specification, the design drawings and the painting package, including manufacturers' printed instructions.

B. The Contractor shall furnish all supervision, labor, tools, materials, equipment, scaffolding and/or other structure, and supervision required for the transportation, unloading, storage and application of the paint and associated products covered by this specification.

1. The Contractor will obtain, at its own expense, all permits, licenses and inspections and shall comply with all laws, codes, ordinances, rules and regulations promulgated by authorities having jurisdiction which may bear on the work. This compliance will include Federal Public Law 91-596 more commonly known as the "Occupational Safety and Health Act of 1970."

2. Any omission of minor items in the schedule of work shall not relieve the Contractor of his obligation to include such items where they come within the general intent of this specification as stated herein.

C. The following items shall not be painted:

1. Any code requiring labels, such as Underwriter's Laboratories and Factory Mutual, or any equipment identification performance rating, name or nomenclature.

2. Any moving parts of operating units, mechanical and electrical parts, such as valve or damper operations, linkages, sensing devices, motor and fan shafts, unless otherwise specified.

3. Aluminum handrails, walkways, windows, louvers and grating, unless specified herein.

a. Signs and nameplates.

b. Finish hardware.

c. Products with polished chrome, aluminum, nickel or stainless steel finish.

d. Plastic switch plates and receptacle plates.

e. Flexible couplings, lubricated bearing surfaces, insulation and metal or plastic pipe interior.

f. Galvanized components except as noted.

1.02 RELATED SECTIONS

A. Related Work Specified Elsewhere:

1. Cast-In-Place Concrete, Section 03 31 00
2. Sealants and Caulking, Section 07 92 00

1.03 REFERENCES

A. American Society for Testing and Materials (ASTM)

1. ASTM D 3359 (Method B), Adhesion.
2. ASTM D 4541, Adhesion
3. ASTM D 4060, Abrasion
4. ASTM D 3363, Hardness
5. ASTM B-117, Salt Spray (Fog)
6. ASTM D 522, Cylindrical Mandrel Flexibility
7. ASTM 96-66, Permeability
8. ASTM D 2794, Direct Impact
9. ASTM E 96, Moisture Vapor Permeance
10. ASTM D 412, Tensile Elongation
11. ASTM D 4587, QUV

B. Steel Structures Painting Council (SSPC); /Endorsed by the National Association of Corrosion Engineers (NACE):

1. SP 1 - Solvent Cleaning.
2. SP 2 - Hand Tool Cleaning.
3. SP 3 - Power Tool Cleaning.
4. SP 5/NACE 1 - White Metal Blast Cleaning.
5. SP 6/NACE 3 - Commercial Blast Cleaning.
6. SP 10/NACE 2 - Near-White Metal Blast Cleaning.
7. SP 13/NACE 6 - Surface Preparation of Concrete.
8. SP 7 Brush Off Blast.
9. SP 10 Near White Blast

C. ASTM D 16 - Terminology Relating to Paint, Varnish, Lacquer, and Related Products.

D. ASTM D 4263 - Indicating Moisture in Concrete by the Plastic Sheet Method.

E. ASTM F 1869 - Measuring Moisture Vapor Emission Rate of Concrete Sub floor Using Anhydrous Calcium Chloride.

F. AWWA C 652 - Disinfection of Water-Storage Facilities.

G. AWWA D 102 - Painting Steel Water Storage Tanks.

H. International Concrete Repair Institute (ICRI) Guideline No. 03732 - Selecting and Specifying Concrete Surface Preparation for Sealers, Coatings, and Polymer Overlays.

I. Federal Test Methods

1. TT-C-555B, Wind Driven Rain

J. Other

1. Graffiti Resistance
2. Chemical Immersion

1.04 SYSTEM DESCRIPTION

Waterproofing, damp proofing and caulking is included in other sections.

1.05 SUBMITTALS

A. Within 30 days after Notice to Proceed, the Contractor shall submit to the Engineer for approval, a complete Schedule of Painting Operations including coating materials to be used giving the manufacturer's name, brand name, volume solids, coverage and number of coats the Contractor is proposing in order to achieve the specified dry film thickness.

1. No request for substitution will be considered which decreases the film thickness designated and/or the number of coats to be applied, or which offers a change from the generic type of coating specified.
2. It shall be the Contractor's responsibility to properly notify and coordinate the fabricators' surface preparation and painting operations with these specifications.

B. Two copies of the manufacturer's technical data sheets for each coating, giving descriptive data, curing time, mixing, thinning, and application instructions to certify compliance with requirements and systems specified herein.

C. Color Samples:

1. Two samples of each finish and color shall be submitted to the Engineer for approval before any work is started.

2. Prepare samples of clear and stained finishes on the same type and grade of substrate specified for the project.

D. Certificates: Manufacturers' certified test reports confirming compliance with specified performance.

1.06 QUALITY ASSURANCE

A. Manufacturer’s Qualifications:

1. Specialize in manufacture of coatings with a minimum of 10 years successful experience.

2. Able to demonstrate successful performance on comparable projects.

3. Single Source Responsibility: Coatings and coating application accessories shall be products from a single manufacturer.

B. Applicator’s Qualifications:

1. Experienced in application of specified coatings for a minimum of 5 years on projects of similar size and complexity to this Work.

2. Applicator's Personnel: Employ persons trained for application of specified coatings.

C. Include on the label or containers:

1. Manufacturer's Name

2. Product type & stock number

3. Color

4. Batch Number indicating date of manufacture.

D. Field Quality Control:

1. Review of the first finished room, item or area to be conducted by engineer or engineer's on site representative. Each room, item or area used as a project standard shall be no smaller than 100 square feet in surface area and shall serve as the project standard for the rest of the work.

2. Manufacturer's representative shall be available to advise applicator on proper application techniques and procedures.

E. Resolution of Conflicts:

1. It shall be the responsibility of the Contractor to arrange a meeting prior to the start of painting, between the Painting Contractor, the Paint Manufacturer and the Engineer. All aspects of surface preparation, application and coating systems as covered by this specification will be reviewed at this meeting, including but not limited to: Environmental requirements, protection of surfaces not scheduled to be coated, surface preparation, application, disinfection, repair and cleaning. Also, Field

quality control, protection of coating systems, a one-year inspection and coordination with other work

2. Clarification shall be requested promptly from the Engineer when instructions are lacking, conflicts occur in the specification, or the procedure seems improper or inappropriate for any reason.

3. The Painting Contractor shall furnish copies of all manufacturers' instructions and recommendations to the Engineer.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Delivery: Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying:

1. Coating or material name.

2. Manufacturer.

3. Color name and number.

4. Batch or lot number.

5. Date of manufacture.

6. Mixing and thinning instructions.

B. Storage:

1. Store materials in a clean dry area exclusively for the purpose of paint storage and mixing. Storage facilities should be within temperature range in accordance with manufacturer's instructions, well ventilated, and located away from open flames.

2. Keep containers sealed until ready for use.

3. Do not use materials beyond manufacturer’s shelf life limits.

4. Paint, coatings, reducing agents and other solvents must be stored in original containers until opened: if not resealable, they must be transferred to UL approved safety containers. All handling of paint and related products must comply with the occupational Safety and Health Act (OSHA).

1.08 PROJECT/SITE CONDITIONS

A. Shop Priming:

1. Furnish all labor, materials, equipment and incidentals required for the surface preparation and application of shop primers on ferrous metals, excluding stainless steel, as specified herein.

2. Ferrous metal surfaces subject to continuous or intermittent immersion or high temperature exposure shall be sandblasted to a near-white grade in

accordance to specification SSPC-SP-10. All blasted surfaces must be coated the same day as blasted. Acceptable paint types are Sherwin-Williams Series B62Y110 Copoxy Shop Primer (3-5 mils DFT), Tnemec Series 66 Hi-Build Epoxoline primer (3-5 mils) or Induron, rust inhibitive Polyamide Epoxy Primer (3-5 mils), or Madison Chemical Corroprime primer at (2-3 dry mils).

3. All other ferrous metal surfaces subject to normal industrial exposure shall be sandblasted to a commercial grade in accordance to specification SSPC-SP-6. All blasted surfaces must be coated the same day as blasted. Acceptable paint types are Sherwin Williams Series B67 Recoatable Epoxy Primer (2-3 mils DFT), Tnemec Tneme-zinc 90-97 (2.5-3.5 mils) or Induron, Surface Tolerant Epoxy Primer, Induramastic 85 (2.5-3.5 mils) or Madison Chemical Corroprime primer at (2-3 dry mils).

4. Where approved, pickling of ferrous metal surfaces may be substituted for sandblasting. Pickling shall be in accordance with specification SSPC-SP-8.

5. Where, in the opinion of the Engineer, it is not practical or possible to sandblast or pickle, ferrous metals may be prepared for painting by power tool cleaning in accordance to specification SSPC-SP-3 or by hand tool cleaning in accordance to specification SSPC-SP-2.

6. Compatibility of coating systems: Shop-priming shall be done with primers that are guaranteed by the manufacturer to be compatible with their corresponding primers and finish coats specified herein foe use in the field. The finish coats applied in the field shall be from the same manufacturer as those applied in the shop.

B. Apply coatings only under the following prevailing environmental conditions.

1. Air and surface temperature are not below 50 F or above 110 F.

2. Relative humidity is not higher than 85% and the surface temperature is at least 5 F. above the dew point.

3. Wind velocity should be under 15 mph for exterior spray painting.

4. The atmosphere is relatively free of airborne dust. Do not apply finish in areas where dust is being generated.

5. Precipitation: Do not prepare surfaces or apply coatings in rain, snow, fog, or mist.

C. Cover or otherwise protect surfaces not to be painted, or those not to be painted concurrently.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Acceptable manufacturers

1. Induron Coatings, Inc., Birmingham, Alabama, (800) 284-1029, Henkel Surface Technologies, Corrosion Engineering Department, Gulp Mills, Pennsylvania, (888) 215-7237 are specified as a standard of quality.

2. Tnemec Company Incorporated, 6800 Corporate Drive, Kansas City, Missouri 64120-1372. Toll Free (800) 863-6321. Phone (816) 483-3400. Fax (816) 483-3969. Web Site www.tnemec.com.

3. Madison Chemical Industries, Inc., 840 Prestonwood Drive, Lawrenceville, Georgia 30043. Phone (770) 339-7858. Fax (678) 985-0940. Web site: www.madisonchemical.com

4. Sherwin Williams Company. 2191 Northlake Parkway, Building 11, Tucker, Georgia 30083 678-261-6863 www.sherwinwilliams.com

B. Equivalent materials of other manufacturers may be substituted only by approval of the engineer/owner 10 days or more prior to the bid opening date. Requests for substitution shall include the manufacturer's literature for each product giving name, generic type, descriptive information, solids by volume, recommended dry film thickness, and a list of five projects where each product has been used and rendered satisfactory service. Manufacturer's certified test reports showing that the substitute product(s) equal or exceed the performance of the specified products as outlined in Paragraph 2.3, shall be submitted.

C. The Engineer reserves the right to deduct the cost savings realized (if any) for approved alternate coating manufacturers or deletion of areas to be coated.

D. Products for each specified function and system shall be of a single manufacturer.

2.02 SOURCE QUALITY CONTROL

A. After application of each coating and subsequent cure, measure the dry film thickness with a Nordson Magnetic Dry Film Thickness Gauge, or equivalent. Follow standard method for measurement of dry paint thickness with magnetic gauges as outlined in SSPC-PA2-73T.

B. Make as many determinations as needed to insure the specified thickness values in each typical area. To all surfaces having lower dry film thickness than specified, apply additional coat(s) at no extra cost to Owner to bring thickness up to specifications

C. Masonry, drywall, or other non-metallic surfaces shall be continuously checked with wet-film thickness gauges during application to insure proper dry film thickness will be obtained. In addition, monitor square foot coverage to verify proper coverage rates are being achieved.

D. Painting Contractor shall permit Owner’s Representative and/or coating manufacturer representative (as requested by Owner) to inspect his work for

conformance to this specification. Owner reserves the right to reject all work that does not comply with this specification.

PART 3 EXECUTION

3.01 PREPARATION

A. All surface preparation, coating and painting shall conform to applicable standards of the Steel Structures Painting Council (SSPC), and the manufacturers' printed instructions. Materials applied prior to approval of the surface by the Engineer shall be removed and reapplied to the satisfaction of the Engineer at the expense of the Contractor.

B. All work shall be performed by skilled craftsmen qualified to perform the required work in a manner comparable with the best standard of practice. Continuity of personnel shall be maintained and transfers of key personnel shall be coordinated with the Engineer.

C. The Contractor shall provide a supervisor at the work site during cleaning and application operations. The supervisor shall have the authority to sign change orders, coordinate work and make decisions pertaining to the fulfillment of the contract.

D. Dust, dirt, oil, grease or any foreign matter that will affect the adhesion or durability of the finish must be removed by washing with clean rags dipped in an approved cleaning solvent and wiped dry with clean rags as per SSPC-SP 1.

E. Coating and painting systems include surface preparation, prime coating and finish coatings. Any off-site work, which does not conform to these specifications, is subject to rejection by the Engineer.

F. Shop applied prime coatings which are damaged during transportation, construction or installation shall be thoroughly cleaned and touched up in the field as directed by the Engineer. The Contractor shall use repair procedures which insure the complete protection of all adjacent primer. The specified repair method and equipment may include wire brushing, hand or power tool cleaning or abrasive blast cleaning. In order to prevent injury to surrounding painted areas, blast cleaning may require use of lower air pressure, small nozzle and abrasive particle sizes, short blast nozzle distance from surface, shielding and masking. If damage is too extensive or uneconomical to touch-up, then the item shall be re-cleaned and coated or painted as directed by the Engineer.

G. Application of the first coat shall follow immediately after surface preparation and cleaning and within an eight hour working day. Any cleaned areas not receiving first coat within eight hour period shall be re-cleaned prior to application of the first coat.

H. Prior to assembly, all surfaces made inaccessible after assembly shall be prepared as specified and shall receive the coating or paint system specified.

3.02 APPLICATION

A. General:

1. All surfaces shall be properly prepared in accordance with these specifications and the paint manufacturer's recommendations. The Engineer shall have the authority to approve or reject prepared surfaces and to determine when conditions are suitable for painting.

2. Dislodge dirt, plaster nibs, mortar spatter and other dry materials by scraping or brushing. Remove dust and loose material by brushing, sweeping, vacuuming, or blowing with high-pressure air.

3. Remove oil, wax and grease by scraping off heavy deposits and cleaning with mineral spirits or a hot trisodium phosphate solution followed by a water rinse.

4. Verify that surfaces to be coated are dry, clean and free of dust, dirt, oil, wax, grease or other contaminates.

5. Protect surrounding areas and surfaces not scheduled to be coated, from damage during surface preparation and application of coatings. Immediately remove coatings that fall on surrounding areas and surfaces not scheduled to be coated.

B. Concrete, Masonry and Cement Stucco:

1. Prepare concrete surfaces in accordance with manufacturer’s instructions, SSPC-SP 13/NACE 6, and ICRI 03732.

2. Allow new concrete and masonry to cure a minimum of 30 days prior to any paint applications.

3. Concrete surfaces shall have been finished as specified in the Section entitled "Cast-in-Place Concrete". Report unsatisfactory surfaces to the Engineer.

4. Structural cracks and defects shall be repaired properly. Fill holes, pits, voids, and cracks with Tnemec 63-1500 Filler and Surfacer or equivalent Sherwin-Williams, Induron or Madison Chemical product.

5. Submerged concrete surfaces shall be acid washed or brush-blasted with abrasive to remove laitance and curing compounds (if utilized) prior to painting (Acid treated areas shall be rinsed and allowed to dry before painting). Rake all mortar joints clean.

6. Test concrete for moisture in accordance with ASTM D 4263 and F 1869.

C. Concrete Floors:

1. Prepare concrete surfaces in accordance with manufacturer’s instructions, SSPC-SP 13/NACE 6, and ICRI 03732. Acid etch or brush blast to achieve a uniform surface profile comparable to one hundred grit or medium textured sand paper.

2. Allow concrete to cure for a minimum of 28 days before coating.

3. Test concrete for moisture in accordance with ASTM D 4263 and F 1869.

D. Submerged Concrete (Void Free Surface):

1. Brush blast entire surface to remove laitance from concrete, provide a uniform surface texture similar to 100-grit sandpaper. Perform blast cleaning so as to open up voids and bug holes such that holes are concave. Care should be taken to keep aggregate exposure to a minimum.

2. Any voids 1/2" in-depth and/or 2" in diameter shall be filled and patched with a cementitious product compatible with the next coat applied or Induron Aquatapoxy A-7 Filler or Tnemec 63-1500 Filler and Surfacer, CDP Rapidcrete or General Polymers TPM #723 Vertical Repair Mortar.

E. Plaster

1. Prepare plaster surfaces in accordance with manufacturer's instructions. Ensure surfaces are clean, dry, and free of oil, grease, dirt, dust, and other contaminants.

2. Remove nibs and other protrusions by scraping flush with the surface; sand smooth.

3. Patch voids and cracks with spackling compound to match the texture of the surface.

4. Allow plaster to cure and dry out for a minimum of 28 days before coating. Do not coat over plaster containing free water, lime, or other soluble alkaline salts. "Hot" spots appearing after primer coat shall be repainted until all sections are sealed.

F. Gypsum Wallboard:

1. Sand joint compound smooth (feathering edges) and flush with surface using fine grit sandpaper.

2. Fill nicks, scratches, holes and uneven spots with spackling compound and after dry, sand flush with surface.

3. Do not apply putty, patching pencils, caulking, or masking tape to drywall surfaces to be painted.

G. Shop Primed Metal:

1. Hand or power tool clean field connections, welds, burned and abraded areas to remove rust and contaminants, and touch-up with the same type shop coating before further rusting occurs in accordance with SSPC-SP2 &3.

2. All shop coated surfaces, which are faded, discolored or requiring more than minor touch up, in the opinion of the Engineer, shall be completely repainted.

H. Ferrous and Non-Ferrous Metals:

1. Solvent Cleaning (SSPC-SP1): Removal of oil, grease, soil and other contaminants by use of solvents, emulsions, cleaning compounds, steam cleaning or similar materials and methods which involve a solvent or cleaning action.

2. Hand Tool Cleaning (SSPC-SP 2): Removal of loose rust, loose mill scale and other detrimental foreign matter to degree specified by hand chipping, scrapping, sanding and wire brushing.

3. Power Tool Cleaning (SSPC-SP 3): Removal of loose rust, loose mill scale and other detrimental foreign matter to degree specified by power wire brushing, power impact tools or power sanders.

4. White Metal Blast Cleaning (SSPC-SP 5); Blast cleaning to a gray-white uniform metallic color until each element of surface area is free of all visible residues.

5. Commercial Blast Cleaning (SSPC-SP 6): Blast cleaning until at least two thirds of each element of surface is free of all visible residues.

I. Lightweight Metal:

1. Prepare surfaces in accordance with SSPC-SP 3.

J. Galvanized Steel:

1. Prepare surfaces by Solvent Cleaning in accordance with SSPC-SP 3 or SPPC-SP7.

K. Wood Surfaces:

1. Prepare wood surfaces in accordance with manufacturer's instructions.

2. Ensure surfaces are clean, dry, and free of oil, grease, dirt, dust, surface deposits of sap or pitch, and other contaminants.

3. Seal knots and pitch pockets.

4. Sand any rough spots with the grain.

5. Fill cracks and holes with approved materials after primer is dry. Sand flush with surface once filler is hard.

6. Lightly sand between coats.

3.03 CONSTRUCTION

A. COATING SCHEDULE A (Sherwin-Williams Coatings)

The appropriate Sherwin Williams system may vary depending on the type of chemical, concentration, and exposure temperatures. Faster cure/low temperature cure alternatives can be used. System recommendation will also vary depending on the generic type and condition of the existing system. Overcoating of aged coatings requires testing before application. Actual film thickness of the spreading rate will depend on the porosity of the substrate. Number of coats and film

thickness may also vary depending on gloss and skid-resistance properties to be achieved. Consult Sherwin Williams in any of these conditions for specific recommendations.

1. Steel - (Structural, Carbon), Miscellaneous Metals, Tanks, Pipes, Equipment and Support Steel.

   a. Exterior, Non Immersion

      System: Epoxy/urethane.

      Surface Preparation: SSPC-SP-6 Commercial Blast Cleaning

      Primer: Dura-Plate 235 Multi-Purpose Epoxy. DFT 3.0 to 5.0 mils

      1st Coat: Dura-Plate 235 Multi-Purpose Epoxy. DFT 3.0 to 5.0 mils.

      2nd Coat: Sherthane 2K Urethane. DFT 2.0 to 2.5 mils.

      Total Dry Film Thickness: 8.0 to 12.5 mils.

   b. Interior, Non Immersion

      System Type: Epoxy Polyamide

      Surface Preparation: SSPC-SP 6.

      Primer: Dura-Plate 235 Multi-Purpose Epoxy. DFT 3.0 to 5.0 mils.

      Finish Coat: Dura-Plate 235 Multi-Purpose Epoxy. DFT 4.0 to 6.0 mils.

      Total Dry Film Thickness: 7.0 to 11.0 mils.

   c. Immersion, Non-potable water

      System: Epoxy Polyamide

      Surface Preparation: SSPC-SP-10

      Primer: Dura-Plate 235 Multi-Purpose Epoxy. DFT 3.0 to 5.0 mils

      Finish Coat: Dura-Plate 235 Multi-Purpose Epoxy. DFT 4.0 to 6.0 mils

      Total Dry Film Thickness: 7.0 to 11.0 mils.

   d. Immersion, Potable water

      System: Epoxy Polyamide

      Surface Preparation: SSPC-SP-10

      1st Coat: Dura-Plate 235 NSF Multi-Purpose Epoxy. DFT 3.0 - 5.0 mils

      2nd Coat: Dura-Plate 235 NSF Multi-Purpose Epoxy. DFT 4.0 - 6.0

Total Dry Film Thickness: 7.0 to 11.0 mils.

2. Ductile Iron Pipe

   a. Exterior, Non-immersion

      System: Epoxy-Polyamide

      Surface Preparation: Clean and Dry. Pipe to be furnished with prime coat applied.

      Primer: Dura-Plate 235 Multi-Purpose Epoxy. 3.0 - 5.0 mils

      2nd Coat: Sherthane 2K Urethane. 2.0 - 3.0 mils

      Total Dry Film Thickness: 5.0 to 8.0 mils.

   b. Interior, Non-immersion

      System: Epoxy-Polyamide

      Surface Preparation: Clean and Dry. Pipe to be furnished with prime coat applied.

      Primer: Dura-Plate 235 Multi-Purpose Epoxy. 3.0 - 5.0 mils

      2nd Coat: Dura-Plate 235 Multi-Purpose Epoxy. 4.0 - 6.0 mils

      Total Dry Film Thickness: 7.0 to 11.0 mils.

   c. Immersion, Non-potable Water

      System: Epoxy-Polyamide

      Surface Preparation: Clean and Dry. Pipe to be furnished with prime coat applied.

      Primer: Dura-Plate 235 Multi-Purpose Epoxy. 3.0 - 5.0 mils

      2nd Coat: Dura-Plate 235 Multi-Purpose Epoxy. 4.0 - 6.0 mils

      Total Dry Film Thickness: 7.0 to 11.0 mils.

   d. Immersion, Potable Water

      System: Epoxy-Polyamide

      Surface Preparation: Clean and Dry. Pipe to be furnished with both coats applied.

      Primer: Dura-Plate 235 NSF Multi-Purpose Epoxy. 3.0 - 5.0 mils

      2nd Coat: Dura-Plate 235 NSF Multi-Purpose Epoxy. 4.0 - 6.0 mils

      Total Dry Film Thickness: 7.0 to 11.0 mils.

3. Concrete

   a. Exterior dense concrete, below grade

      System: Coal Tar Epoxy

Surface Preparation: Clean and Dry

One Coat: Hi-Mil Sher-Tar Epoxy. DFT 14.0-20.0 mils

Total Dry Film Thickness: 14.0 to 20.0 mils.

b. Immersion, Non-potable Water

System: Coal Tar Epoxy

Surface Preparation: Sweep Blast

Filler: Steel-Seam VSE Epoxy as needed

1st Coat: Hi-Mil Sher-Tar Epoxy 10.0-12.0 mils

2nd Coat: Hi-Mil Sher-Tar Epoxy 10.0-12.0 mils

Total Dry Film Thickness: 20.0-24.0 mils.

c. Immersion, Potable water

System: Epoxy - Polyamide

Surface prep = SSPC13

1st coat = Macropoxy 646 NSF Fast Cure Epoxy @ 4 to 6 mils dft

2nd coat = Macropoxy 646 NSF Fast Cure Epoxy @ 4 to 6 mils dft

Total Dry Film Thickness: 8.0-12.0 mils

d. Concrete Floors

System: Epoxy Surface Preparation: Acid etch, brush-off blast, or grind

*1st Coat: ArmorSeal 33 Epoxy Primer/Sealer at 3-5 dry mils

2nd Coat: ArmorSeal 1000 HS at 3-5 dry mils.

*For wet & chemical feed areas, Broadcast silica into wet film and backroll to encapsulate at a broadcast rate of 3 to 4 lbs of 50 mesh per 100 square feet.

4. Concrete Masonry Units (CMU)

a. Porous Masonry, Exterior

System: Modified Acrylic Emulsion

Surface Preparation: Clean and Dry

1st Coat: Loxon Block Surfacer @60-80 S.F./gal

2nd Coat: SherLastic Elastomeric Coating. DFT 8.0 mils

Total Dry Film Thickness: 8.0 mils plus surfacer.

b. Porous Masonry, Interior

System: Epoxy-Polyamide

Surface Preparation: Clean and Dry

1st Coat: Loxon Block Surfacer @60-80 S.F./gal

2nd Coat: SherLastic Elastomeric Coating. DFT @ 3-5 mils

3rd Coat: SherLastic Elastomeric Coating. DFT @ 3-5 mils

Total Dry Film Thickness: 6.0 to 10.0+ mils plus surfacer.

5. Plaster and Gypsum Wallboard

System: Water-Borne Acrylic-Epoxy

Surface Preparation: Clean and Dry

1st Coat: PrepRite 200 Wall Primer. DFT 1.0 - 2.0 mils

2nd Coat: Epo-Plex Multi-Mil WB Epoxy Finish. 4.0 – 6.0 mils

3rd Coat: Epo-Plex Multi-Mil WB Epoxy Finish. 4.0 – 6.0 mils

Total Dry Film Thickness: 9.0 to 14.0 mils.

6. Wood

a. Exterior

System: Acrylic Latex

Surface Preparation: Clean and Dry

1st Coat: A-100 Latex Wood Primer B42W41. DFT 2.0 - 3.0 mils

2nd Coat: DTM Acrylic. DFT 2.0

3rd Coat: DTM Acrylic. DFT 2.0

Total Dry Film Thickness: 6.0 to 7.0 mils.

b. Interior

System: Acrylic Epoxy

Surface Preparation: Clean and Dry

1st Coat: Epo-Plex Multi-Mil WB Epoxy Finish. 3.0 – 5.0 mils

2nd Coat: Epo-Plex Multi-Mil WB Epoxy Finish. 3.0 – 5.0 mils

Total Dry Film Thickness: 6.0 to 10.0 mils.

B. COATING SCHEDULE B (Tnemec Coatings)

The appropriate Tnemec system may vary depending on the type of chemical, concentration, and exposure temperatures. Faster cure/low temperature cure alternatives can be used. System recommendation will also vary depending on the generic type and condition of the existing system. Overcoating of aged coatings requires testing before application. Actual film thickness of the spreading rate will depend on the porosity of the substrate. Number of coats and film thickness may also vary depending on gloss and skid-resistance properties to be achieved.

Consult Tnemec manufacturer in any of these conditions for specific recommendations.

1. Steel - (Structural, Carbon), Miscellaneous Metals, Tanks, Pipes, Equipment and Support Steel.

   a. Exterior, Non Immersion

      System: Epoxy/urethane.

      Surface Preparation: SSPC-SP-6 Commercial Blast Cleaning

      Primer: Series 66 Hi-Build Epoxoline. DFT 3.0 to 5.0 mils

      1st Coat: Series 66 Hi-Build Epoxoline. DFT 3.0 to 5.0 mils.

      2nd Coat: Series 73 Endura-Shield. DFT 2.0 to 2.5 mils.

      Total Dry Film Thickness: 8.0 to 12.5 mils.

   b. Interior, Non Immersion

      System Type: Epoxy Polyamide

      Surface Preparation: SSPC-SP 6.

      Primer: Series 66 Hi-Build Epoxoline. DFT 3.0 to 5.0 mils.

      Finish Coat: Series 66 Hi-Build Epoxoline. DFT 4.0 to 6.0 mils.

      Total Dry Film Thickness: 7.0 to 11.0 mils.

   c. Immersion, Non-potable water

      System: Epoxy Polyamide

      Surface Preparation: SSPC-SP-10

      Primer: Series 66 Hi-Build Epoxoline. DFT 3.0 to 5.0 mils

      Finish Coat: Series 66 Hi-Build Epoxoline. DFT 4.0 to 6.0 mils

      Total Dry Film Thickness: 7.0 to 11.0 mils.

   d. Immersion, Potable water

      System: Epoxy Polyamide

      Surface Preparation: SSPC-SP-10

      1st Coat: Series 20 Pota-Pox. DFT 3.0 - 5.0 mils

      2nd Coat: Series 20 Pota-Pox. DFT 4.0 - 6.0

      Total Dry Film Thickness: 7.0 to 11.0 mils.

2. Ductile Iron Pipe

   a. Exterior, Non-immersion

      System: Epoxy-Polyamide

Surface Preparation: Clean and Dry. Pipe to be furnished with prime coat applied.

Primer: Series 66 Hi-Build Epoxoline. 3.0 - 5.0 mils

2nd Coat: Series 73 Endura-Shield. 2.0 - 3.0 mils

Total Dry Film Thickness: 5.0 to 8.0 mils.

b. Interior, Non-immersion

System: Epoxy-Polyamide

Surface Preparation: Clean and Dry. Pipe to be furnished with prime coat applied.

Primer: Series 66 Hi-Build Epoxoline. 3.0 - 5.0 mils

2nd Coat: Series 66 Hi-Build Epoxoline. 4.0 - 6.0 mils

Total Dry Film Thickness: 7.0 to 11.0 mils.

c. Immersion, Non-potable Water

System: Epoxy-Polyamide

Surface Preparation: Clean and Dry. Pipe to be furnished with prime coat applied.

Primer: Series 66 Hi-Build Epoxoline. 3.0 - 5.0 mils

2nd Coat: Series 66 Hi-Build Epoxoline. 4.0 - 6.0 mils

Total Dry Film Thickness: 7.0 to 11.0 mils.

d. Immersion, Potable Water

System: Epoxy-Polyamide

Surface Preparation: Clean and Dry. Pipe to be furnished with both coats applied.

Primer: Series 20 Pota-Pox. 3.0 - 5.0 mils

2nd Coat: Series 20 Pota-Pox. 4.0 - 6.0 mils

Total Dry Film Thickness: 7.0 to 11.0 mils.

3. Concrete

a. Exterior dense concrete, below grade

System: Coal Tar Epoxy

Surface Preparation: Clean and Dry

One Coat: Series 46H-413 H.B. Tneme-Tar. DFT 14.0-20.0 mils

Total Dry Film Thickness: 14.0 to 20.0 mils.

b. Immersion, Non-potable Water

System: Coal Tar Epoxy

Surface Preparation: Sweep Blast

Filler: Series 63-1500 as needed

1st Coat: Series 46H-413 10.0-12.0 mils

2nd Coat: Series 46H-413 10.0-12.0 mils

Total Dry Film Thickness: 20.0-24.0 mils.

c. Immersion, Potable Water

System: Epoxy

Surface Preparation: Brush-off Blast

1st Coat: Series 66 or 69 Hi-Build Epoxoline 4.0 to 6.0 mils

2nd Coat: Series 66 or 69 Hi-Build Epoxoline at 4.0 to 6.0 mils

Total Dry Film Thickness: 8.0 to 12.0 mils

d. Concrete Floors

System: Epoxy Surface Preparation: Acid etch, brush-off blast, or grind

*1st Coat: Series 66 Hi-Build Epoxoline at 3.0-5.0 dry mils

2nd Coat: Series 66 Hi-Build Epoxoline at 3-5 dry mils.

*For wet & chemical feed areas, Broadcast silica into wet film and backroll to encapsulate at a broadcast rate of 3 to 4 lbs of 50 mesh per 100 square feet.

Total Dry Film Thickness: 8.0 to 10.0 mils

4. Concrete Masonry Units (CMU)

a. Porous Masonry, Exterior

System: Modified Acrylic Emulsion

Surface Preparation: Clean and Dry

1st Coat: Series 54-562 Fine Masonry Filler @60-80 S.F./gal

2nd Coat: 181 W.B. Tneme-Crete. DFT 8.0 mils

Total Dry Film Thickness: 8.0 mils plus surfacer.

b. Porous Masonry, Interior

System: Epoxy-Polyamide

Surface Preparation: Clean and Dry

1st Coat: Series 54-562 Fine Masonry Filler @ 60-80 S.F./gal

2nd Coat: Series 66 Hi-Build Epoxoline. DFT 3.0 - 5.0 mils

3rd Coat: Series 66 Hi-Build Epoxoline. DFT 3.0 - 5.0 mils

Total Dry Film Thickness: 6.0 to 10.0 mils plus surfacer.

5. Plaster and Gypsum Wallboard

   System: Water-Borne Acrylic-Epoxy

   Surface Preparation: Clean and Dry

   1st Coat: Series 51-792PVA Sealer. DFT 1.0 - 2.0 mils

   2nd Coat: Series 113 H.B. Tneme-Tufcoat. 4.0 – 6.0 mils

   3rd Coat: Series 113 H.B. Tneme-Tufcoat. 4.0 – 6.0 mils

   Total Dry Film Thickness: 9.0 to 14.0 mils.

6. Wood

   a. Exterior

      System: Acrylic Latex

      Surface Preparation: Clean and Dry

      1st Coat: Series 36 Undercoater. DFT 2.0 - 3.0 mils

      2nd Coat: Series 28 Tufcryl. DFT 2.0

      3rd Coat: Series 28 Tufcryl. DFT 2.0

      Total Dry Film Thickness: 6.0 to 7.0 mils.

   b. Interior

      System: Epoxy-Polyamide

      Surface Preparation: Clean and Dry

      1st Coat: Series 66 Hi-Build Epoxoline. DFT 3.0 - 5.0 mils

      2nd Coat: Series 66 Hi-Build Epoxoline. DFT 3.0 - 5.0 mils

      Total Dry Film Thickness: 6.0 to 10.0 mils.

C. COATING SCHEDULE C (Induron Coatings)

1. Steel - (Structural, Carbon), Miscellaneous Metals, Tanks, Pipes, Equipment and Support Steel.

   a. Exterior, Non Immersion

      Surface Preparation: SSPC-SP 6 Commercial Blast Cleaning

      Shop Primer: Armorguard P-14 Epoxy Primer @ 3.0 - 5.0 mils dft

      First Coat: Armorguard Epoxy @ 3.0 - 5.0 mils dft.

      Second Coat: Indurethane 5500 @ 2.0 - 2.5 mils dft.

      Total Dry Film Thickness: 8.0-12.5

   b. Interior, Non Immersion

Surface Preparation: SSPC-SP 6 Commercial Blast Cleaning

Shop Primer: Armorguard P-14 Epoxy Primer @ 3.0 - 5.0 mils dft

Finish Coat: Armorguard Epoxy @ 4.0 - 6.0 mils dft.

Total Dry Film Thickness: 7.0-11.0 mils.

c. Immersion, Non-potable water

Surface Preparation: SSPC-SP 10 Near White Blast Cleaning

Shop Primer: PE-54 Epoxy Primer @ 3.0 - 5.0 mils dft

Finish Coat: Armorguard Epoxy @ 4.0 - 6.0 mils dft.

Total Dry Film Thickness: 7.0 - 11.0 mils.

d. Immersion, Potable water

Surface Preparation: SSPC-SP 10 Near White Blast Cleaning

Shop Primer: PE-54 Epoxy Primer @ 3.0 - 5.0 mils dft

Finish Coat: PE-54 Epoxy Finish @ 4.0 - 6.0 mils dft.

Total Dry Film Thickness: 7.0 - 11.0 mil.

2. Ductile Iron Pipe

a. Exterior, Non-Immersion

Surface Preparation: Abrasive blast to remove all contaminants

First Coat: PE-54 Epoxy Primer @ 3.0 - 5.0 mils dft

Second Coat: Armorguard Epoxy @ 2.0 - 3.0 mils dft

Total Dry Film Thickness: 5.0-8.0 mils

b. Interior, Non-Immersion

Surface Preparation: Abrasive blast to remove all contaminants. All surfaces must be struck by abrasive.

First Coat: PE-54 Epoxy Primer @ 3.0 - 5.0 mils dft

Second Coat: Armorguard Epoxy @ 4.0 - 6.0 mils dft.

Total Dry Film Thickness: 7.0 -11.0 mils.

c. Immersion, Non-potable Water

Surface Preparation: Abrasive blast to remove all contaminants. All surfaces must be struck by abrasive.

First Coat: PE-54 Epoxy Primer @ 3.0 - 5.0 mils dft

Second Coat: Armorguard Epoxy @ 4.0 - 6.0 mils dft

Total Dry Film Thickness: 7.0 - 11.0 mils.

d. Immersion, Potable Water

Surface Preparation: Abrasive blast to remove all contaminants. All surfaces must be struck by abrasive.

Shop Primer: PE-54 Epoxy Primer @ 3.0 - 5.0 mils dft

First Coat: PE-54 Epoxy @ 4.0 - 6.0 mils dft

Total Dry Film Thickness: 7.0 - 11.0 mils dft

3. Concrete

a. Exterior dense concrete, below grade

Surface Preparation: Surfaces shall be clean and dry.

First Coat: Coal Tar Epoxy Induron Ruff Stuff 2100 @ 14.0-20.0 mils dft

Total Dry Film Thickness: 14.0- 20.0 mils

b. Immersion, Non-potable Water

Surface Preparation: Brush-Off Blast Cleaning.

First Coat: PE-54 Epoxy Primer @ 10.0 - 12.0 dry mils.

Filler & Surfacer: Trowel or squeegee apply Aquatapoxy A-7.

Second Coat: Armorguard Epoxy @ 10.0 – 12.0 mils dft.

Total Dry Film Thickness: 20.0-24.0 mils.

c. Immersion, Portable Water

Surface Preparation: SSPC sp7

1st Coat: PE Epoxy Primer@ 4.0-6.0 mils

2nd Coat: PE Epoxy Primer @ 4.0-6.0 mils

Total Dry Film Thickness: 8.0-12.0 mils

d. Concrete Floors

Surface Preparation: Acid etch, brush-off blast or vacuum blast cleaning.

*First Coat: Armorguard Epoxy @ 3.0 - 5.0 mils dft.

Second Coat: Armorguard Epoxy @ 3.0 - 5.0 mils dft.

*For wet & chemical feed areas, Broadcast silica into wet film and backroll to encapsulate at a broadcast rate of 3 to 4 lbs of 50 mesh per 100 square feet.

Total Dry Film Thickness: 6.0 - 10.0.

4. Concrete Masonry Units (CMU)

a. Porous Masonry, Exterior

Surface Preparation: Clean & Dry.

First Coat: AC 220 Block Filler @ 60 - 80 sq. ft./gal.

Second Coat: AC 403 @ 8.0 mils dft

Total Dry Film Thickness: 8.0 mils excluding block filler.

b. Porous Masonry, Interior

Surface Preparation: Clean & Dry.

First Coat: Polyfill Epoxy Block Filler @60-80 S.F./gal

Second Coat: Armorguard Epoxy @ 3.0 - 5.0 mils dft.

Third Coat: Armorguard Epoxy @ 3.0 - 5.0 mils dft.

Total Dry Film Thickness: 6.0 - 10.0 mils excluding block filler.

5. Plaster and Gypsum Wallboard

Surface Preparation: Clean & Dry.

First Coat: AC 210 Acrylic Primer Eggshell @ 1.5 - 2.5 mils dft.

Second Coat: AC 230 Acrylic Eggshell @ 4.0 - 6.0 mils dft.

Third Coat: AC 230 Acrylic Eggshell @ 4.0-6.0 mills dft.

Total Dry Film Thickness: 4.0 - 6.0 mils.

6. Wood

a. Exterior

Surface Preparation: Clean & Dry.

First Coat: AC 301 Wood Primer @ 2.0 - 3.0 mils dft.

Second Coat: Armorlux 2200 @ 2.0 mils dft

Third Coat: Armorlux 2200 @ 2.0 mils dft

Total Dry Film Thickness: 6.0 - 7.0 mils.

b. Interior

Surface Preparation: Clean & Dry.

First Coat: AC 301 Wood Primer @ 3.0 - 5.0 mils dft.

Second Coat: Armorlux 2200 @ 3.0-5.0 mils dft

Total Dry Film Thickness: 6.0-10.0 mils.

D. COATING SCHEDULE D (Madison Chemical Coatings)

The recommended Madison Chemical coating / lining system may vary. Please consult with a Madison Chemical representative for specific recommendations.

1. Steel - (Structural, Carbon), Miscellaneous Metals, Tanks, Pipes, Equipment and Support Steel.

a. Exterior, Non Immersion

System: Polyurethane.

Surface Preparation: SSPC-SP-6 Commercial Blast Cleaning

1st Coat: Acrylathane. DFT 4.0 to 6.0 mils.

2nd Coat: Acrylathane. DFT 4.0 to 6.0 mils.

Total Dry Film Thickness: 8.0 to 12.0 mils.

b. Interior, Non Immersion

System: Polyurethane.

Surface Preparation: SSPC-SP-6 Commercial Blast Cleaning

1st Coat: Acrylathane. DFT 4.0 to 6.0 mils.

2nd Coat: Acrylathane. DFT 4.0 to 6.0 mils.

Total Dry Film Thickness: 8.0 to 12.0 mils.

c. Immersion, Non-potable water

System: Polyurethane

Surface Preparation: SSPC-SP-10

1st Coat: Corrocote "S". DFT 6.0 to 7.0 mils.

2nd Coat: Corrocote "S". DFT 6.0 to 7.0 mils.

Total Dry Film Thickness: 12.0 to 14.0 mils.

Or

System: Polyurethane

Surface Preparation: SSPC-SP-10

One Coat System: Corropipe II Wasteliner. DFT 20.0 mils.

Total Dry Film Thickness: 20.0 mils.

d. Immersion, Potable water

System: Polyurethane

Surface Preparation: SSPC-SP-10

One Coat System: Corrocote II PW (AM). DFT 20.0 mils.

Total Dry Film Thickness: 20.0 mils.

2. Steel Pipe

a. Exterior, Non-Immersion

Surface Preparation: SSPC-SP10.

First Coat: Corropipe II Omni. DFT 16.0 mils

Second Coat: Polysheen. DFT 3.0 - 5.0 mils

Total Dry Film Thickness: 19.0 – 21.0 mils

b. Interior, Non-Immersion

Surface Preparation: SSPC-SP10

First Coat: Corropipe II Omni. DFT 16.0 mils

Second Coat: Acrylathane. DFT 3.0 - 5.0 mils

Total Dry Film Thickness: 19.0 – 21.0 mils

c. Immersion Non-Potable Water

Surface Preparation: SSPC-SP10

1st Coat: Corropipe II Wasteliner. DFT 20.0 mils

Total Dry Film Thickness: 20.0 mils

d. Immersion Potable Water

Surface Preparation: SSPC-SP10

1st Coat: Corropipe II PW. DFT 20.0 mils

Total Dry Film Thickness: 20.0 mil.

3. Concrete

a. Exterior dense concrete, below grade

System: Polyurethane

Surface Preparation: Sand Blast

One Coat: Corrocote Plus. DFT 40.0 mils

Total Dry Film Thickness: 40.0 mils.

b. Immersion, Non-Potable Water

System: Polyurethane

Surface Preparation: Sand Blast

One Coat: Corropipe II Wasteliner. DFT 40.0 mils

Total Dry Film Thickness: 40.0 mils.

c. Immersion, Potable Water

System: Polyurethane

Surface Prep: Sand Blast

One Coat: Corrocoat II PW. DFT 40.0 mils

Total Dry Film Thickness: 40.0 mils

d. Concrete Floors

System: Epoxy / Polyurethane

Surface Preparation: Clean and Dry

*1st Coat: MG 201. DFT 2.0 - 3.0 mils

2nd Coat: Gemthane 1:4 Aromatic. DFT 3.0 – 5.0 mils

If non-skid is required, broadcast sand before last coat is applied.

3rd Coat: Gemthane 1:4 Aromatic. DFT 3.0 – 5.0 mils

Total Dry Film Thickness: 8.0 to 13.0 mils.

*For wet & chemical feed areas, Broadcast silica into wet film and backroll to encapsulate at a broadcast rate of 3 to 4 lbs of 50 mesh per 100 square feet.

4. Concrete Masonry Units (CMU)

a Porous Masonry, Exterior

System: Cementitious Rendering Material / Epoxy / Polyurethane

Surface Preparation: Brush Blast

1st Coat: MG 220. DFT 3-5 mils.

2nd Coat: Acrylathane. DFT 6-8 mils. System:

Total Dry Film Thickness: 8.0 to 13 mils plus cementitious rendering material.

b. Porous Masonry, Interior

System: Cementitious Rendering Material / Epoxy / Polyurethane

Surface Preparation: Brush Blast

1st Coat: MG 220. DFT 3-5 mils.

2nd Coat: Acrylathane. DFT 6-8 mils.

Total Dry Film Thickness: 8.0 to 13 mils plus cementitious rendering material.

5. Plasters or Gypsum Wallboard

System: Epoxy / Water based Polyurethane

Surface Preparation: Clean and Dry

1st Coat: MG 201. DFT 2.0 - 3.0 mils

2nd Coat: Aquatech. DFT 2.0 – 3.0 mils

3rd Coat: Aquatech. DFT 2.0 – 3.0 mils

Total Dry Film Thickness: 6.0 to 9.0 mils.

6. Wood

a. Exterior

System: Epoxy / Polyurethane

Surface Preparation: Clean and Dry

1st Coat: MG 201. DFT 2.0 - 3.0 mils

2nd Coat: Gemthane 1:4 Aliphatic. DFT 2.0 – 3.0 mils

3rd Coat: Gemthane 1:4 Aliphatic. DFT 2.0 – 3.0 mils

Total Dry Film Thickness: 6.0 to 9.0 mils.

b. Interior

System: Epoxy / Water based Polyurethane

Surface Preparation: Clean and Dry

1st Coat: MG 201. DFT 2.0 - 3.0 mils

2nd Coat: Aquatech. DFT 2.0 – 3.0 mils

3rd Coat: Aquatech. DFT 2.0 – 3.0 mils

Total Dry Film Thickness: 6.0 to 9.0 mils.

E. Color Schedule For Mechanical, HVAC, Plumbing, And Electrical Piping And Equipment

1. Pipe lines, equipment or other items which are not listed here shall be assigned a color by the Engineer and shall be treated as an integral part of the Contract.

2. When color coding is specified or directed by the Engineer, it shall consist of color-code painting and identification of all exposed conduits, through lines and pipelines for the transport of gases, liquids, semi-liquids, all accessories (such as valves), insulated pipe coverings, fittings, junction boxes, bus bars, connectors and any operating accessories which are integral to a whole functional mechanical pipe and electrical conduit systems.

3. All moving parts, drive assemblies, and covers for moving parts which are potential hazards shall be TNEMEC's 04SF Safety Orange (meets ANSI 253.1 – 1971) color or Sherwin-Williams, Induron or Madison Chemical equivalent.

4. All safety equipment shall be painted in accordance with OSRA Standard Safety Green – TNEMEC's 09SF Safety Green Color or Sherwin-Williams, Induron or Madison Chemical equivalent.

5. Description of titles (Abbreviated code on Pipes/Equipment) to be lettered on pipes or equipment color, will be black or white to contrast with pipe color, and shall be stencil applied.

6. All in line equipment and appurtenances not assigned any other color shall be painted the same base color as piping. The pipe system shall be painted with mechanical equipment assigned to another color.

7. All conduit shall be painted to match its background surface. Doors and Frames shall be painted as scheduled in the Coatings Systems Schedule or as selected by the Engineer.

8. Each major piece of equipment is to be identified by number in accordance with the Contract Drawings or as directed by the Engineer

9. The color code for pipes as tabulated below shall be followed where applicable for water and wastewater treatment plants. Arrows painted in contrasting colors shall be painted at suitable locations, designated by the Engineer, to indicate direction of flow. Valves and operators shall be finish painted to match the pipes to which they are connected.

10. The following colors have been used successfully in water and wastewater plants for identification of various materials contained in tanks and pipes. These colors are in accordance with the Recommended Standards for Water Works, Published by the Great Lakes-Upper Mississippi River State Public health and Environmental Managers

Pipe Identification and Color Coding

Large Diameter Process Piping

Pipe System	Paint Color's		Stencil Text
	Pipe	Letters & Arrows	
Wastewater			
Wastewater Influent	Dark Grey	White	INF.
Screenings/Grit Washer Piping	Purple	White	NON-POTABLE
Mixed Liquor Solids	Tan	Black	MLSS
Scum Piping	Grey	Black	SCUM
Return Activated Sludge	Light Brown	Black	RAS
Waste Activated Sludge	Dark Brown	White	WAS
Digested Sludge	Black	White	DS
Thickener Filtrate	Grey	Black	FILTRATE
Secondary Effluent	Dark Green	Black	SEC. EFF.
Filtered Effluent	Light Green	Black	FIL. EFF.
Wastewater Effluent	Pale Green	Black	EFF.
LAS Piping	Purple	Black	LAS
Plant Drain	Grey	Black	DRAIN
Sump Pump Discharge	Grey	Black	SUMP
Fire Main	Red	Black	FIRE
Nonpotable Fire Hydrants	Purple	Black	
Nonpotable Water	Purple	Black	NON-POTABLE
Potable Fire Hydrants	Blue	Black	
Potable Water	Blue	Black	POTABLE
Process Air	Green	Black	AIR
Water			
Raw Water	Olive Green	Black	RAW
Settled Water	Aqua	Black	SETTLED
Filtered Water	Light Blue	Black	FILTERED
Finished Water	Dark Blue	Black	FINISHED
Backwash Water	Light Brown	Black	BACKWASH
Plant Drain	Dark Grey	White	DRAIN
Sump Pump Discharge	Grey	Black	SUMP
Thickened Sludge	Dark Brown	White	SLUDGE

Thickener Effluent	Light Grey	Black	DRAIN
Fire Main	Red	Black	FIRE
Nonpotable Fire Hydrants	Purple	Black	
Nonpotable Water	Purple	Black	NON-POTABLE
Potable Fire Hydrants	Blue	Black	
Potable Water	Blue	Black	POTABLE
Process Air	Green	Black	AIR

Small Diameter Process Piping

Pipe System	Color Tape	Color Letters & Arrows	Stencil Text
Wastewater			
Lime	Light Green	Black	LIME
Caustic Soda	Yellow & Green	Black	NAOH
Sodium Bicarbonate	Light Green & Blue	Black	SOD. BICARB.
Chlorine (gas & solution)	Yellow	Black	CHLORINE
Sulfur Dioxide	Light Green & Yellow	Black	SUL. DIOXIDE
Sulfuric Acid	Yellow & Red	Black	ACID
Primary Coagulant	Orange	Black	COAGULANT
Polymers	Orange & Green	Black	POLYMER
Potable Water Hot	Blue & Red	Black	HOT WATER
Potable Water Cold	Blue	Black	COLD WATER
Sanitary Waste	Dark Grey	Black	DWV
Compressed Air	Green	Black	AIR
Vacuum Lines	Green	Black	VACUUM
Water			
Alum	Orange	Black	ALUM
PAC	Orange	Black	PAC
Ferric Chloride	Orange	Black	FERRIC
Polymer	Orange & Green	Black	POLYMER
Lime	Light Green	Black	LIME
Caustic Soda	Yellow & Green	Black	NAOH
Sodium Bicarbonate	Light Green & Blue	Black	SOD. BICARB.
Potassium Permanganate	Purple	Black	PPM
Carbon	Black	Black	CARBON
Phosphate	Light Green & Red	Black	PHOSPHATE
Chlorine (gas & solution)	Yellow	Black	CHLORINE
Chlorine Dioxide	Yellow & Yellow	Black	CHLORINE DIOX.
Oxidants	Three Yellows	Black	OXIDANT
Fluoride	Light Blue & Red	Black	FLUORIDE
Potable Water Hot	Blue & Red	Black	HOT WATER
Potable Water Cold	Blue	Black	COLD WATER
Sanitary Waste	Dark Grey	Black	DWV
Compressed Air	Green	Black	AIR
Vacuum Lines	Green	Black	VACUUM

3.04 SPECIAL SCHEDULE FOR CONCRETE REQUIRING COATING

STRUCTURE	COATING REQUIRED, TYPE
None Required	

3.05 FIELD QUALITY CONTROL

A. Examine surfaces to be coated and report any conditions that would adversely affect the appearance or performance of the coating system and which cannot be put into an acceptable condition by the preparatory work specified in Paragraph 2.3.

B. Do not proceed with surface preparation and application until the surface is acceptable or authorization to proceed is given by the Engineer/Owner.

3.06 CLEANING

A. Remove paints spatters from glass, plumbing fixtures and adjoining surfaces. Repair any damage to coatings or surfaces caused by cleaning operations.

B. Upon completion, painting Contractor shall clean up and remove from the site all surplus materials, tools, appliances, empty cans, cartons, and rubbish resulting from painting operations. The site shall be left in a neat, orderly condition.

C. Remove all protective drop cloths and masking from surfaces not being painted. Provide touch-up around same areas as directed by Owner's Representative.

END OF SECTION

SECTION 26 00 00

GENERAL ELECTRICAL PROVISIONS

PART 1 GENERAL

1.1 DESCRIPTION

A. Furnish and install all materials, equipment, labor, supervision and services necessary to complete all electrical work specified herein, and shown on the Drawings.

B. Principal Features

1. Removing and replacing pump control panel
2. Removing and replacing RTU panel
3. Temporary Starter

1.2 APPLICABLE STANDARDS AND CODES

A. Local, State, and National Electrical Codes.

B. National Electrical Code, latest edition.

C. Rules of the Electrical Utility and the National Electrical Safety Code.

D. Life Safety Code 101.

E. NECA Standard of Installation.

F. NFPA (National Fire Protection Association).

1.3 FEES AND TESTS

A. Contractor shall be responsible for all fees for permits, inspections, and tests necessary to complete this work. Contractor shall demonstrate to the Owner and the Engineer that all items of equipment installed are completely operational and free of defects in all modes.

1.4 COORDINATION WITH OTHER TRADES

A. Furnish and locate all anchor bolts, inserts and supports for installation by the other trades as required. Coordinate the location of all fixtures, outlets, equipment, and devices with other trades to avoid conflicts.

1.5 LIST OF PROPOSED MANUFACTURERS

A. List of Proposed Materials: The Contractor shall submit a complete list of the proposed manufacturers for each proposed items as required to complete the work. Additional submittal data, sufficient to determine equality, shall be required if the Contractor proposes to substitute another manufacturer's equipment.

B. Intent of Drawings: Electrical plan drawings show only general locations of equipment, devices and raceways, unless specifically dimensioned. The Contractor shall be responsible for the proper routing of raceway, subject to the review of the Engineer.

C. Departures from Contract Documents: Submit to the Engineer in writing details of any necessary, proposed departures from these Contract Documents, and the reasons therefore. Submit such requests as soon as practicable and within 30 days after award of the Contract. Make no such departures without written approval of the Engineer.

PART 2 PRODUCTS

2.1 REFERENCE TO DRAWINGS

A. Reference shall be made to Drawing Schedules, Details, Notes, and Specifications for: Manufacturer, model, catalog number, size, capacity, performance, ratings and installation of equipment and material.

2.2 CHOICE OF MATERIALS AND EQUIPMENT

A. In submitting substitutions, bidders should note the following minimum considerations: (1) capacities shown are absolute minimal and must be equaled, (2) physical size limitations for space allotted, (3) structural properties, (4) noise level, (5) interchangeability, (6) compatibility with other materials and assemblies, (7) similar items shall be same manufacture and style wherever possible.

B. All material and equipment, for which a UL, ANSI, or a NEMA Standard is established, shall be so approved and labeled or stamped.

C. Adhesives are not acceptable as a mounting, supporting, or assembling technique, unless noted otherwise.

2.3 ELECTRICAL EQUIPMENT

A. NEMA Standards shall be taken as minimum requirements for electrical equipment.

B. Equipment shall operate properly under a plus or minus 10 percent voltage variation.

2.4 SUBMITTALS DURING CONSTRUCTION

A. Provide complete manufacturers' descriptive information and shop drawings for all permanently installed equipment, material and devices furnished under Division 26, Electrical, including certified outline drawings, arrangement drawings, elementary (schematic) diagrams, interconnection and connection diagrams, in accordance with provisions elsewhere in these Contract Documents. Provide the number of copies specified in Section 01 33 00. Operation and Maintenance Manuals shall be submitted.

B. Provide certified shop drawings, literature and requested samples showing items proposed for use, size, dimensions, capacity, special features required, schematic (elementary) control diagrams, equipment schedules, rough-in, etc., as required by the Engineer for complete review and for use during installation. Use NEMA device designations and symbols for all electric circuit diagrams submitted. Make content of the schematic (elementary) connection or interconnection diagrams in accordance with the latest edition of NEMA ICS 1.

C. Manufacturer's standardized elementary diagrams will not be acceptable unless applicable portions of the diagram have been clearly identified and non-applicable portions deleted or crossed out.

D. Certified arrangement drawings, outline dimensions, and weights for all major (engineered) equipment including, but not limited to:

1. Low voltage switchgear
2. Transformers
3. Motor control centers
4. Engine - generators
5. Variable frequency drives

E. Functional description or logic diagrams for all control systems furnished under Division 26, Electrical.

F. Characteristic curves for all protective devices.

G. Certified drawings and descriptive literature for all equipment and devices furnished under Division 26, Electrical, and not listed above.

H. Schematic (elementary) drawings for any electrical control and bills of material for equipment including, but not limited to:

1. Switchgear
2. Motor control
3. Control systems furnished under Division 26, Electrical
4. Generators
5. Switchgear, Breakers, and Automatic Controllers

I. Connection diagrams showing all internal wiring and all required field connections for the following:

1. Low voltage switchboard
2. Generators
3. Breakers
4. Automatic Transfer Controllers

J. The interconnection diagrams shall show terminal points, intermediate connections, device designation, terminal numbers, polarity of dc circuits, conductor identification, and any other information necessary to show which conductor connects to which point; the Contractor shall review and sign off on the control interconnection diagrams.

K. In addition to submittals for specific items mentioned above, furnish shop drawing information on the following items:

1. Conduit, tubing, and fittings
2. Power conductors
3. Wireway
4. Outlet and device boxes
5. Pull boxes and junction boxes
6. Terminal junction boxes
7. Manholes and handholes
8. 600-volt conductors
9. Medium Voltage Conductors
10. Control cable
11. Receptacles
12. Surge suppressors

PART 3 EXECUTION

3.1 WIRING ELECTRICALLY OPERATED EQUIPMENT

A. The Contractor shall be responsible for electrical connections to all equipment requiring electrical power. This responsibility applies to equipment furnished under this and other Divisions and by the Owner.

3.2 RECORD AND AS-BUILT DOCUMENTS

A. Maintain at the job site a set of Contract Documents kept current by indicating thereon all changes, revisions and substitutions, between work as specified and as installed.

B. Furnish Owner with complete set of Operation and Maintenance Manuals.

3.3 EQUIPMENT OPERATION

A. This Division is responsible for: (1) proper rotation, (2) observing that lubrication has been properly performed, (3) that motors operate within nameplate limits, and (4) adjustment of circuit breaker and MCP trip settings.

3.4 CLEANING AND PAINTING

A. Fixtures, panels and equipment shall be thoroughly cleaned. All equipment shall be touched up or repainted as required to present a clean professional appearance. Paint all ferrous metal that is not otherwise protected against corrosion. Paint exposed pipe threads with Bitumastic No. 50.

3.5 IDENTIFICATION

A. Identify all major items of equipment including controls, panels, switches, contactors, motor starters, junction boxes and metering by permanent nameplates, with wording approved by Engineer. Secure metal nameplate frame with screws or brads. Adhesives are acceptable on components within NEMA 1 enclosures.

B. Nameplates after installation shall be easily visible and shall bear notations corresponding to those shown on record drawings.

C. All conduits shall be identified with a stamped stainless steel tag system (Brady or approved equal). Conduit tags shall be permanently attached to each exposed end of conduit runs such as in manholes, pull boxes, panels, MCC's, junction boxes, etc. and at each point of entry into a structure or building. Each tag shall be stamped with the appropriate conduit number per the conduit and cable schedules.

D. Each instrument shall be identified with a stamped stainless steel tag system (Brady or approved equal). Instrument tags shall be permanently attached to each individual instrument and stamped with the appropriate number per instrument specification section.

E. Each cable shall be identified with a permanent labeling system (Brady Catalog Number B-292 with printed legends or approved equal). Instrumentation cables shall be labeled with the appropriate instrument number of the originating signal (Ex. FT-2020-1). Multiplex cables, power and control cables shall be labeled with the appropriate cable number per the conduit and cable schedules.

F. All switchgears, MCC's, MCC compartments, power panels, lighting panels, control panels, control cabinets, etc. shall be identified with permanently mounted phenolic labels.

G. All power and lighting panels shall have typed schedules mounted on panel doors.

H. All terminals and associated wires shall be numbered and labeled respectively, and wiring diagrams shall be installed in the MCC or electrical panel doors.

3.6 TEST PERIOD

A. Each piece of equipment shall continue to meet performance specifications throughout the first year of operation. Contractor shall replace or repair any defect due to faulty workmanship or material which shall develop within 1 year from date of acceptance. This guaranty shall be in accordance with these specifications.

B. For first year after final acceptance, Contractor shall provide, at no cost to Owner, any required maintenance and service necessary to assure the proper operation of the system. Date of acceptance shall be certified by Engineer as that date on which the Contract Work has been satisfactorily completed, as a whole, in accordance with the Contract Documents.

3.7 GROUNDING

A. See Specification 26 05 26.

3.8 ELECTRICAL TESTING AND START-UP

A. General

1. Prior to energizing any equipment, the electrical contractor shall thoroughly vacuum clean the equipment with an industrial type vacuum cleaner. The outside of all electrical equipment shall be cleaned and paint touched up as required to leave equipment in an "as purchased" condition.

2. During start-up of new equipment, the electrical contractor shall provide sufficient personnel to aid with start-up of the electrical equipment to remove any faults, and to make the necessary adjustment for proper operation of electrical equipment and installation. This includes sufficient personnel to aid equipment service personnel in their check-out of the electrical equipment and service.

3. All testing equipment shall be furnished by the Contractor.

4. All failures under tests due to defective material or poor workmanship shall be corrected by the Contractor at no expense to the Owner.

5. The electrical contractor shall not, under any circumstances, energize any electrical equipment covered by these Specifications without first obtaining permission from the Engineer.

B. Grounding: After all connections have been made to the ground, ground tests shall be made to verify its adequacy.

C. Typewritten directories shall be inserted in all panels showing the designation of each circuit. All power and replacement fuses necessary for testing shall be furnished and paid for under this item.

D. Circuit Continuity: Complete installation shall be free of short circuits, open circuits, and other defects. Insulation Resistance and Continuity Tests shall be performed in accordance with Section 16120-3.2 to prove that all parts of the installation are intact.

3.9 INSTALLATION OF EQUIPMENT

A. The electrical contractor shall coordinate with the Contractor and Owner in order to have electric power available when required.

3.10 TEMPORARY ELECTRIC POWER

A. Provide temporary power as required.

END OF SECTION

SECTION 26 05 19

ELECTRIC WIRE AND CABLE

PART 1 GENERAL

1.1 SCOPE

A. Work covered by this section includes furnishing all labor, equipment, and materials required to install, connect, and test all wire and cable, including splices, terminations, connectors, and accessories for a complete installation as shown on the Drawings and/or specified herein.

B. The Contractor's attention is directed to the fact that all wires and cables are not necessarily shown on the Drawings, which are more or less schematic. However, the Contractor shall be responsible for furnishing and installing all wire and cable indicated or required to properly connect and place into operation all equipment and services requiring such wiring and/or cable.

1.2 QUALITY ASSURANCE

A. Samples of all wire and cable, clearly marked and long enough to show complete identification, shall be submitted to the office of the Engineer for approval prior to wiring installation.

B. No defective or damaged wire and cable shall be incorporated into the work.

1.3 SIZING OF CONDUCTORS

A. Unless otherwise required or directed by the Engineer, conductors shall be furnished in the sizes shown on the Drawings. No wire for lighting, power, or motor control circuits shall be smaller than No. 12 AWG. Motor control circuits carrying less than 8 amps may be No. 14 AWG. No wire for instrumentation and low-level signal transmission pairs shall be smaller than No. 16 AWG for single pairs or No. 20 AWG for bundled cable.

B. All wires and cables shall be of such size as to conform to the regulations of the current edition of the National Electrical Code for current carrying capacity.

C. Where the size of lighting wiring is not given on the Drawings, it shall be of such size that the voltage drop from the main panel to the lighting panel is not more than 1 percent, and the drop in the branch circuit is not more than 2 percent. The voltage drop in motor feeder, when the wire size is not specified, shall not be more than 3 percent at full load from the Motor Control Center to the motor terminal.

1.4 SHOP DRAWINGS AND ENGINEERING DATA

A. Complete shop drawings and engineering data shall be submitted in accordance with requirements of the Section 01 33 00 of these Specifications.

1.5 STORAGE AND PROTECTION

A. Store and protect all wire and cable in accordance with the manufacturer's recommendations.

B. Wire and cable shall be stored indoors in a dry and warm location and in its original packaging.

1.6 GUARANTEE

A. Provide a guarantee against defective materials and workmanship.

PART 2 PRODUCTS

2.1 CONDUCTORS - GENERAL

A. Conductors shall be solid or Class B concentric stranded, soft or annealed, uncoated copper free from kinks and defects in accordance with ASTM B3 or B8.

B. Conductors should have a conductivity not less than 97 percent.

C. The wire and cable shall have size, grade of insulation, voltage, and manufacturer's "E-Number" permanently marked on the outer covering at not more than 2-foot intervals.

D. All wires shall conform to the latest Standards of the ASTM and ICEA and shall be tested for their full length by these Standards.

E. Insulation thickness shall be not less than that specified by the National Electrical Code.

F. All control circuit wiring and all wiring No. 8 AWG and larger shall be stranded. Lighting branch circuits No. 12 and No. 10 AWG may be solid. Wiring shall be stranded as follows:

1. No. 14 thru No. 2 AWG shall have a minimum of 7 strands.
2. No. 1 thru No. 4/0 AWG shall have a minimum of 19 strands.
3. No. 250 MCM thru No. 500 MCM shall have a minimum of 37 strands.

4. All circuits except control and instrumentation circuits shall have a separate grounding conductor carried in the conduit.

2.2 CONDUCTORS FOR WIRE AND CABLE

A. XHHW: For service entrance, motor branch, and feeder circuits operating at 208, 240, and 480 volts, the conductors shall be single-conductor, cable rated, 600 volts. The single-conductor cable shall consist of uncoated annealed copper, Class B stranded per ASTM B 8 and insulated with corona, ozone, heat and moisture resisting cross-linked polyethylene insulation rated to withstand a copper temperature of 90 degrees C, Underwriter's approved Type XHHW and shall be as manufactured by Southwire, General Cable Corporation, Okonite Company or equal.

B. THWN-2: For general lighting and receptacle branch circuits operating at 115 volts, the conductor shall be single-conductor cable rated 600 volts. The single-conductor cable shall be uncoated annealed copper. No. 12 and No. 10 AWG may be solid, or stranded; larger cables shall be stranded per ASTM B8 and insulated with polyvinyl chloride insulation rated to withstand a copper temperature of 75 degrees C, Underwriter's approved Type THWN-2, and shall be as manufactured by Southwire, General Cable Corporation, Okonite Company, or equal.

C. For lighting fixture drop wire or for running in fluorescent units, the conductors shall be single-conductor cable rated 600 volts. The single-conductor cable shall be stranded tinned copper with a 31-mil-thick wall silicone insulation and a glass braid jacket overall rated to withstand a copper temperature of 150 degrees C, Underwriter's approved silicone insulated fixture wire type SFF-2, and shall be as manufactured by General Cable Corporation, General Electric Company, or equal.

D. For control circuits the conductors may be single or multi-conductor cable rated 600 volts. The conductors shall consist of uncoated annealed copper Class B stranded per ASTM B 8 and shall be No. 14 or No. 12 AWG, 7-strand, identified at each end using Brady wire markers B-500 vinyl cloth, Thomas and Betts "E-Z Code" wire markers, or equal.

1. Single-conductor cable shall have 45-mil-thick wall of cross-linked polyethylene or polyvinyl chloride insulation, color red, to withstand a copper temperature of 90 degrees C, Underwriter's Laboratories approved Type RHH-RHW, and shall be as manufactured by General Electric Company, Phelps Dodge, General Cable, Okonite, or equal.

2. Multi-conductor cable shall consist of single-conductor cables rated 600 volts and insulated to withstand a copper temperature of 90 degrees C

cabled together to form a cable assembly which is Underwriter's Laboratories approved for installation in conduit. The core shall be color coded in accordance with ICEA, Method 1, with a plastic tape cover and a PVC or neoprene jacket overall.

E. Bare grounding conductor shall be Class A or B medium hard drawn, high conductivity bare copper, sized as shown on the Drawings. Conductors No. 6 AWG and smaller may be solid. Conductors No. 4 AWG and larger shall be stranded.

F. Flexible power cords shall be moisture-resistant, oil-resistant, neoprene-sheathed service cable designed for extra hard usage, Type SO, rated 600 volts at 90 degrees C continuous conductor temperature. Flexible heater cords shall be moisture-resistant, oil-resistant, neoprene and cotton sheathed service cable designed for extra hard usage, Type HSO, rated 600 volts at 90 degrees C continuous. Insulation shall be thermoplastic ethylene-propylene conforming to ICEA S-68-516. Neoprene shall conform to ASTM D 752. All flexible cords shall be UL listed.

2.3 INSTRUMENTATION AND THERMOCOUPLE EXTENSION WIRING

A. Instrumentation and low level DC signal wiring shall be shielded, twisted pair conductors. Single twisted pairs shall consist of 2, Class B stranded, No. 16 AWG annealed copper conductors, 1 white and 1 black, with 15 mils of PVC insulation rated for 600 volts and 90 degrees C minimum continuous conductor temperature. Pairs shall be twisted to a lay of 1.5 to 2.5 inches. A 0.35 mil by 0.50 mil aluminum-mylar tape shield with stranded, bare No. 18 AWG, tinned copper drain wire in contact with the aluminum side of the shield shall be applied helically around the twisted pair. An overall jacket of 90 degrees C black PVC at least 30 mils in thickness shall be applied to the outside. Shield coverage shall be full 100 percent. All instrumentation wiring shall be UL listed.

B. Twisted, Shielded Triad Instrumentation Cable for RTD circuits: Stranded copper conductors, size #16 AWG. Insulate conductors individually with color-coded PVC. Provide shield for each triad and tinned-copper drain wire. Provide flame-retardant PVC outer jacket. Cable shall be rated 600 volts and 90 degrees C. Cable shall be designed for noise rejection for use in process control signals.

2.4 AUDIO SIGNAL WIRING

A. Audio signal wiring for public address and sound systems shall be shielded, twisted pair instrumentation cable with 2 No. 16 AWG conductors constructed in accordance with the requirements of Part 2.3 of this section.

2.5 TELEPHONE AND COMMUNICATION WIRING

A. Indoor telephone and communication cable shall consist of solid, minimum No. 22 AWG, annealed copper conductors insulated and standard telephone color coded with polyethylene and twisted together in pairs. Pairs shall be cabled together and protected with a metal tape shield and a polyethylene or PVC jacket overall. Cable shall be suitable for installation in ducts.

B. Buried telephone cable shall be REA approved for aerial installation on messenger wire, installation in underground ducts, and direct burial. Cable shall consist of solid, minimum No. 22 AWG annealed copper conductors insulated and standard telephone color coded with polypropylene or polyethylene and twisted together in pairs. Each pair shall be twisted to a different lay length. Cable with more than 25 pairs shall be assembled from oscillated, bundled, 25-pair subunits. Bundled pairs shall be covered by a non-hygroscopic tape, an inner jacket of polyethylene, a shield of aluminum or tinned copper, and an outer jacket of black, high-molecular weight polyethylene copolymer. Cable core shall be completely filled with a nontoxic, petrolatum-polyethylene weatherproofing compound. Jacket shall be sequentially marked to indicate footage.

2.6 SPLICES AND TERMINATIONS

A. Splices, taps and attachment of fittings and lugs shall be electrically and mechanically secure, and approved solderless lugs and connectors shall be used. Lugs and connectors shall be top quality product of Burndy, O-Z, Thomas and Betts, or equal manufacturer. Conductors shall not bind at bushings. Lugs shall be of the correct sizes for the conductors joined and strands shall not be cut from a conductor.

B. Splices, taps, and terminations of cable rated 600 volts and less requiring tape shall be half lap and at least 3 layers. Taping shall be neatly done and form a permanent insulation equal in mechanical and electrical strength to the insulation of the conductor. Taping shall be as follows:

1. Rubber Insulation:

   a) Inner Layer: Okonite Rubber Tape, 3M “Scotchfil” Electrical Insulation Putty, Plymouth “Plysafe” Tape, or equal.

   b) Outer Layer: 3M “Scotch No. 88” Tape, Permacel No. 295 Tape, Slipknot Grey Tape, or equal.

   c) Thermoplastic Insulation: 3M “Scotch No. 88” Tape, Permacel No. 295 Tape, Slipknot Grey Tape, or equal.

2. Terminations at motor junction boxes shall be sealed with 3M "Scotchkote" Electrical Coating over the outer layer of tape. All splices 600 volts and less in No. 8 AWG and larger sizes shall be made using approved bolted connectors properly taped as specified herein.

C. For No. 10 AWG and smaller branch circuit and fixture conductors operating at 277 volts or less, live spring pressure connectors rated for 600 volts may be used for splices and junctions. When installed in a fixture, connectors shall be rated for 1,000 volts.

2.7 GROUND RODS

A. Ground rods shall be Copperweld, sectional type. Ground rods shall be UL listed and REA approved and shall conform to ANSI C33.8.

B. Connections between grounding conductors and grounding rods shall be mechanical if above ground, thermal if underground.

PART 3 EXECUTION

3.1 INSTALLATION

A. All interconnecting wiring shall be installed in approved conduit or cable trays and connected as shown on the Drawings and/or specified herein. Unless otherwise shown or specified, all wiring shall be run in conduit.

B. Unless otherwise shown on the Drawings, wiring shall be run by the most direct route keeping overall circuit length to a minimum.

C. Instrumentation and low level signal wiring shall not be located in the same conduit as motor wiring, feeder wiring, branch circuit wiring, or control wiring. Control wiring shall not be located in the same conduit as feeder wiring, or instrumentation wiring.

D. All control and circuit wiring in cabinets, boxes, gutters, etc. shall be neatly tied and held using nylon cable ties and mounting brackets.

E. After installation, conductors shall not have dents, scars, cuts, pressure indentations, abraded areas, etc.

F. Conductors 600 volts and below shall not be bent to a radius less than 12 times the cable diameter. Conductors above 600 volts shall not be bent to a radius of not less than 24 times the cable diameter.

G. Wiring run in metallic conduits shall be arranged such that there are an equal number of conductors of each phase in each conduit. Under no circumstances shall metallic conduits contain one single conductor or several conductors of only one phase. This requirement shall not apply to single, bare grounding conductors run in conduit to grounding rods or grids.

H. Conductors may be coated with talc, soapstone, Ideal "Yellow 77" or "Wire Lube", Electro-Compound "Y-ER EAS," or equal, to facilitate pulling into raceways, but in no case may they be greased or coated with any substance injurious to conductor insulation and jacket. Pulling tension shall be exerted primarily on the strongest component of conductors, normally the metallic conductors themselves and not on the insulation jacket. When installing cable in conduit with pulling eye attached to copper conductor, the tension shall not exceed 0.008 pound per circular mil area of the conductor nor 5,000 pounds, whichever is smaller. When a basket grip is used over the outer jacket of the cable, the maximum pulling tension shall not exceed 0.008 pound per circular mil area of the conductor nor 1,000 pounds, whichever is smaller. In no case shall pulling tensions recommended by the wire manufacturer be exceeded. The maximum sidewall pressure exerted on the insulation and sheath at a cable bend shall not exceed 300 pounds per foot of conduit bending radius. Conductors shall not be pulled "through" any outlet, condulet or box. Separate "pulls" shall be made on each side of such point.

I. Unless otherwise specified, splices shall be made at outlet or conduit boxes, pull or junction boxes, manholes, or vaults. No splice shall be drawn into a conduit. Splices in wiring rated 600 volts and below shall be made with enough spare wire for 2 splices to be remade with the wire at the same location.

J. All instrumentation and thermocouple extension wire shields shall be grounded. Shields on individual circuits shall be electrically continuous and shall be grounded at only 1 point in the circuit. Shields on thermocouple extension wire shall be grounded at the thermocouple only.

K. Surge suppressors shall be installed with the shortest line lead possible, but in no case longer than 18 inches unless otherwise shown on the drawings.

L. Inside manholes, all cables are to have racks with insulator supports. Supports are to be within 6 inches of each side of a splice and spaced not farther than 3 feet apart.

M. All conductors are to be identified. Branch circuits, motor feeders, and lightning wiring shall be identified by color coding consistent with the existing facility. If the facility is new, the color code shall be as follows:

	277/480V	120/208/240V
Phase A	Brown	Black
Phase B	Orange	Red
Phase C	Yellow	Blue
Neutral	Grey	White
Ground	Bare	Bare or Green

N. The color coding on No. 8 AWG and smaller conductors shall be continuous in length. No taping, painting or other means of coding will be acceptable. Conductors No. 6 AWG and larger and conductors operating above 600 volts shall be black with color coded tape visible at each point of access or view.

O. All circuits shall be identified at each termination and at all accessible locations such as manholes, hand holes, and pull-boxes. A circuit name shall be assigned based on the equipment at the load end of the circuit. Add a suffix letter if necessary to make the circuit number unique. Utilize sleeves for conductor sizes #2 AWG and smaller, and marker plates attached with nylon tie cords for larger conductor sizes. Taped-on markers or markers relying on adhesives shall not be allowed.

P. Conductors used for temporary construction power shall not be used for the permanent installation, and the permanent conductor system shall not be used for construction power unless authorized in writing by the Engineer. Circuit protective devices shall never be temporarily bypassed.

Q. Cables shall be pulled and installed without splices. Splices shall only be made with the Engineer's approval.

R. Apply fireproofing tape to cables in hand holes and manholes, and in other locations such as vaults, throughout their exposed length. Follow the tape manufacturer's installation instructions closely.

3.2 TESTING

A. Perform visual and mechanical inspection of each individual exposed power cable #6 AWG and larger for physical damage, correct terminations in accordance with the Drawings, cable bends in accordance with bending radius requirements, proper circuit identification, proper lug type, tightness of bolted connections with proper torque level per NETA ATS, Table 10.12 or manufacturer's specifications, and proper grounding.

B. Perform Insulation Resistance Testing of all conductors #6 AWG and larger with respect to ground and each adjacent conductor. Apply 1,000 volts dc for one minute on 600 volts insulated conductors in accordance with NETA. Minimum

insulation resistance values shall not be less than 50 meg-ohms. Investigate all deviations between adjacent phases.

C. Perform Continuity test by ohmmeter method to ensure proper cable connections of all conductors #6 AWG and larger.

END OF SECTION

SECTION 26 05 26

GROUNDING

PART 1 GENERAL

1.1 STANDARDS

A. All electrical systems shall be grounded in accordance with the National Electrical Code, Local Codes, these Specifications and the contract drawings.

PART 2 PRODUCTS

2.1 CABLE AND EQUIPMENT

A. Use green colored and bare stranded copper conductors.

B. Use approved ground clamp manufactured for such purpose.

C. Use approved grounding electrodes and rod.

D. Make permanent ground connection with thermoweld method.

PART 3 EXECUTION

3.1 GENERAL

A. In general, alternating current circuits of 600 volts and below, surge suppressors, conductor raceway systems, and platform steel framework shall be effectively and permanently connected to a grounding system by means of copper conductors having cross section as required by the National Electrical Code and of capacity sufficient to ensure continuity and continued effectiveness of the ground connections under conditions of excess current. If some of the equipment to be grounded is not covered herein by detailed instructions or is not shown completely and clearly on the Drawings, such provisions of the National Electrical Code as may apply are to be considered minimum requirements for the work.

B. All metallic conduit systems, whether used for power or lighting wiring, shall be installed in such a manner as to produce electrical continuity and shall be bound together at one or more points and connected to the building system ground, except that isolated sections of conduit not exceeding 4 feet in length are not to be grounded or bonded unless specifically called for.

C. Rigid metal conduit systems made up with fittings, boxes, and apparatus housings having fully-threaded hubs need no additional provisions for continuity of ground. If the conduit system contains cutouts, pull boxes, junction boxes, switchboxes, etc., to which the conduit is fastened by means of locknuts and bushings, such interruptions in the grounding continuity shall be eliminated by bonding the conduit to the housings or by separately grounding each box and conduit sections, etc., that are so isolated. Grounding wedge lugs shall be used between all bushing and metal boxes. Paint and other non-conducting material shall be removed from the surface of conduit, fittings, and metal housings prior to connecting grounding clamps, straps, or other devices.

D. Equipment Grounding: Panel, starters, lighting fixtures, motor control center, etc., for power and lighting constitute the fundamental center of the associated distribution systems. As such, the metallic enclosures, frames, and other noncurrent carrying metal parts of this equipment shall be connected by one or more grounding conductors to the grounding system. Install a ground connection from the ground bus of switchgears, MCCs, and other electrical panels with ground bus to the ground grid.

E. All motor frames shall be grounded. The ground conductor shall be run inside the conduit containing the power conductors. In the case of most 3-phase circuits, this means a fourth conductor in each branch circuit. The grounding conductor may be as large as the power conductor or as small as allowed by Section 250 of the NEC but shall not be smaller than No. 12 AWG. The grounding conductor shall be stranded, with green insulation through No. 4 AWG; larger sizes may be bare stranded. Ground connection at the motor shall be terminal lug or servit post inside motor conduit box and the other end connected to the ground bus in the motor control center.

F. Transformer Grounding: Bond the neutrals of outdoor substation transformers and distribution transformers within buildings to system ground network, and any additional grounding electrodes shown near the transformers. Connect the case of the transformer to the grounding system as well.

G. In making ground connections, the surfaces to all parts that will touch shall be thoroughly cleaned to ensure making good electrical contacts.

H. All clamped joints shall be made up firmly. Thermal joints shall be equal to CadWeld Type TA. Where exposed to mechanical injury, the grounding conductor shall be suitably protected by pipe or other substantial guard. If guards are iron pipe or other magnetic material, the grounding conductor shall be electrically connected to both ends of the guard to reduce impedance of the circuit.

I. Grounding conductors shall be without splice or joint if applicable and shall be straight and short except that when laid underground they shall be laid slack to prevent their being readily broken unless otherwise mechanically protected.

J. No fuse, switch, circuit breaker, or similar disconnecting devices shall be inserted in the grounding conductor or connection throughout the entire installation.

K. Grounding conductors shall be medium hard drawn, stranded bare copper wire sized as required by the National Electrical Code Article 250. Conductors Size No. 6 and smaller may be solid; Size No. 4 and larger shall be stranded. Ground wire shall be carried in conduit to the grounding point.

L. Ground rods where required, shall be of copper-clad steel not less than ¾-inch in diameter, 10 feet long or as shown on the Contract Drawings, and driven full length into the earth. The maximum resistance of a single driven ground shall not exceed 5 ohms under normally dry conditions. If this resistance cannot be obtained with a single rod, a minimum of 2 additional rods shall be installed not less than 10 feet on center. Connections between grounding conductors and ground rods shall be mechanical if exposed, thermal if buried.

M. Except where specifically indicated otherwise, all exposed noncurrent-carrying metallic parts of electrical equipment, raceway systems, and neutral conductor of the wiring system shall be grounded. The ground connection shall be made at the main service equipment and shall be extended to driven rods on the exterior of the building.

N. All neutral conductor shall be continuous throughout the system and shall be grounded only at the point of origin of the service neutral.

O. All receptacles shall have provision for grounding conductor connection, and shall be grounded to the grounding conductor and outlet box.

P. All exposed steel columns, tanks, ladders, towers, and elevated platform shall be effectively grounded using No. 4/0 or larger bare copper grounding conductors and driven ground rods. Where multiple columns or tanks must be grounded, ground points shall be interconnected by minimum No. 4/0 bare copper grounding conductors buried approximately 18 inches below finished grade.

Q. Anchor bolts securing exposed electrical equipment, structures, metal enclosures, and tanks located outdoors shall be electrically connected to the steel reinforcement in the concrete foundation or footing. Connection shall consist of minimum No. 2/0 bare copper conductors and mechanical grounding clamps.

R. Surge arrestor ground terminals shall be connected to the equipment ground bus. Ground paths for lightning and surge arresters and capacitors shall be kept as short and direct as practical. If possible, arresters shall be connected in direct shunt relationship to the equipment terminals. Supporting brackets shall be connected directly to the equipment frame.

S. Grounding resistors, where specified, shall have a resistance within the boundary limits specified in IEEE Standard 142 in order to minimize transient overvoltages

during ground faults. Ground fault current shall not be less than that required to operate protective devices or 25 amps, whichever is greater.

T. Lightning and surge arresters used with grounded-wye systems which do not have effectively grounded neutrals as defined by IEEE Standard 100 shall have a voltage rating not less than the maximum phase-to-phase voltage of the system.

U. The grounding system equivalent resistance shall not exceed 5 ohms for the entire system under normally dry conditions unless otherwise specified. After the grounding system has been installed and all connections made, tests shall be made by the Electrical Contractor to determine the resistance to earth. If the resistance of the entire system exceeds the specified maximum, additional ground rods shall be driven to reduce the resistance to this value.

V. Gas piping or piping conveying flammable liquids shall not be used as grounding electrodes.

W. The use of salts or electrolytes to reduce earth resistance shall not be permitted.

X. Permanently connect the green ground conductor to each receptacle junction box (self-tapping screw).

Y. Install a ground rod inside each manhole. Connect any metallic raceway and all noncurrent-carrying metal parts to the ground rod with a No. 6 AWG (min.) copper conductor. Similarly, provide a ground rod for every pole-mounted site lighting and make grounding connections.

Z. Bond the standby generator neutral to the grounding system with a properly sized grounding conductor. Ground the generator frame to the ground grid.

AA. Ground metallic fences when used to enclose electrical equipment.

3.2 TESTING

A. Ground resistance testing shall be done in accordance with IEEE standard 81-1993 to confirm that the resistance of the grounding system is 10 ohms or less (test shall not be run within 72 hours of last rain fall). Ground resistance testing shall be done with the power off and the grounding electrode conductor isolated from the utility, and the service to prevent coupling. The testing equipment shall use the fall of potential method of earth resistance measurement. The test equipment must be designed to reject the effects of stray ac and dc currents on readings.

B. A test report shall be submitted to the engineer and included in the O & M manual for the project. The report shall include but not be limited to:

1. Date of test

2. Time of day

3. Weather condition (ex. 82oF, 82% RH, cloudy)
4. Date of last rain fall ≥ ½" in a 24 hour period
5. Soil type
6. Minimum of five (5) readings
7. A plot of all readings indicating a level spot in the curve at the system resistance.

C. All ground resistance testing shall be done in the presence of the Engineer. If test measurements indicate a grounding system resistance of greater than 10 ohms, additional grounding cable shall be buried in locations and at the direction of the Engineer. Ground resistance testing as described herein shall be repeated after the additional ground cable has been installed. The installation of grounding cable and repeat testing shall be done until the 10 ohm grounding system resistance has been achieved

D. Test equipment for ground resistance measurement shall be Vibroground by Associated Research, Megger null balance by Biddle, or alternate approved by the Engineer.

END OF SECTION

SECTION 26 05 34

CONDUIT

PART 1 GENERAL

1.1 SCOPE

A. Work covered by this section includes furnishing all labor, equipment, and materials required to install electrical conduit and fittings as specified herein and/or shown on the Drawings.

B. The Contractor's attention is called to the fact that all conduits and conduit fittings are not necessarily shown completely on the Drawings, as the Drawings are more or less schematic. However, the Contractor shall furnish and install all conduits and conduit fittings indicated or required for the proper connection and operation of the equipment.

1.2 SHOP DRAWINGS AND ENGINEERING DATA

A. Shop drawings and engineering data shall be submitted.

1.3 STORAGE AND PROTECTION

A. Store and protect conduit and fittings in accordance with the manufacturer's recommendations.

PART 2 PRODUCTS

2.1 GENERAL

A. Unless otherwise shown or specified, all conduits shall be rigid metal. See the paragraph on Conduit Application for additional information.

B. Conduit terminations at electrical equipment such as electric motors, dry type transformers and heaters shall be made using liquid-tight, flexible metal conduit.

C. Damaged, dented, flattened, or kinked conduit shall not be used.

2.2 RIGID METAL CONDUIT

A. Rigid metal conduit shall be heavy wall, mild steel conduit conforming to ANSI C80.1 and Federal Specification WW-C-581, hot dip galvanized both inside and out. All conduits shall bear the approved stamp of the Underwriters Laboratories.

B. Rigid metal conduit shall be by Allied Tube & Conduit, Republic, or equal.

2.3 RIGID NONMETALLIC CONDUIT

A. Rigid nonmetallic conduit for voltages 600V and less shall be Schedule 40 heavy wall polyvinyl chloride (PVC) electrical conduit rated for 90 degrees C conductors and conforming to NEMA TC-2, Type EPC-40-PVC. It shall be listed by Underwriters Laboratories in conformance with the National Electrical Code. Conduit fittings, elbows, and joint cement shall be produced by the same manufacturer as the conduit. Conduits shall be as manufactured by Carlon, Allied Tube and Conduit, Borg-Warner, or equal.

B. Rigid nonmetallic conduit for voltages higher than 600V shall be polyvinyl chloride (PVC) power duct rated for 90 degrees C conductors and conforming to NEMA TC-6, Type EB. Conduit fittings, elbows, and joint cement shall be produced by the same manufacturer as the conduit. Conduit shall be as manufactured by Carlon, Olin, or equal.

2.4 PLASTIC COATED RIGID METAL CONDUIT

A. Rigid metal conduit prior to application of plastic coating shall conform to Part 2.2, Rigid Metal Conduit, of this section.

B. Plastic coating shall be polyvinyl chloride (PVC) bonded to the metal a uniform thickness of 40 mils the full length of the conduit except the threads. The bond between the metal and PVC coating shall be equal or greater than the tensile strength of the PVC coating.

C. A coupling shall be furnished loose with each length of conduit and shall have a PVC sleeve extending 1 pipe diameter, or 2-inches, whichever is least, beyond the end of the coupling. Elbows shall have the same thickness of PVC coating as on the conduit. All threaded conduit and elbow ends shall have plastic thread protectors.

D. The rigid steel galvanized PVC coated conduit and fittings shall be KorKap as manufactured by Plastic Applicators, Houston, TX; Plasti-Bond as manufactured by Pittsburgh Std. Div. of Robroy Industries, Verone, PA.; or equal.

E. PVC-coated rigid conduit shall meet the ASTM D870 Boil Test.

2.5 RIGID ALUMINUM CONDUIT

A. Rigid aluminum conduit shall be manufactured of 6063 alloy in temper designation T-1. The fittings shall be of the same alloy.

B. All conduits shall bear the approved stamp of the Underwriters Laboratories and be manufactured to ANSI C80.5 and Federal Specification WW-C-540c.

C. Rigid Aluminum conduit shall be by Republic, Allied Tube and Conduit, or equal.

2.6 LIQUID-TIGHT FLEXIBLE METAL CONDUIT

A. Flexible conduit shall have an oil-resistant, liquid-tight jacket in combination with flexible metal reinforcing tubing and shall be designed for use with waterproof fittings. An integral ground wire shall be included. Flexible conduit shall be American Brass Sealtite Type UA as manufactured by Electric-Flex Company; Flexible Metallic Conduit as manufactured by Ideal Industries, Inc; or equal. Only Underwriter's Laboratories approved fittings shall be used.

2.7 CONDUIT FITTINGS AND BUSHINGS

A. Wherever conduits terminate in sheet steel boxes, double bonding type locknuts and bushings shall be used except when terminating in cast hubs. All bushings shall be insulated metallic type, equal to O. Z. Electrical Manufacturing Company, Type B; T & B Company, 1200 Series; Appleton Electric Company, Type BU-I; or equal.

B. Where conduits terminate in steel or cast NEMA 4 enclosures with no factory-installed threaded hubs, a threaded hub shall be installed equal to Myers Electric Products, Inc., Type ST or STG; Appleton Electric Company, Type HUB; Crouse-Hinds, Type HUB; or equal.

C. All conduits terminating at motor control centers shall be suitably grounded to the motor control center ground bus using grounded type insulated bushings equal to O. Z. Electrical Manufacturing Company, BLB or IGB; Appleton, Type BIB; Thomas and Betts, 3800 Series; or equal.

D. Conduit expansion fittings shall be O. Z. Electrical Manufacturing Company, Type EX with Bonding Jumper, Type XJ; Appleton, Type SJ with Type XJB4 Bonding Jumpers; Crouse-Hinds, Type XJ with GC100 Bonding Jumper; or equal.

E. All outdoor conduit penetrations shall enter the enclosures, panels, junction boxes from the bottom side. Top and side penetrations are not permitted without the Engineer's approval.

F. All outdoor conduit hubs shall be watertight Myers hubs.

2.8 CONDUIT BOXES

A. Exposed conduit boxes and pulling elbows shall be of die-cast, copper-free aluminum with threaded body and removable neoprene-gasketed cover. Conduit boxes shall conform to Federal Specification W-C-586a and shall be Crouse-Hinds "Condulet," Appleton "Unilet Form 85," or equal.

PART 3 EXECUTION

3.1 GENERAL

A. Minimum size conduit shall be 3/4 inch aboveground and 1 inch below ground except where noted otherwise, and no conduit shall have more than 40 percent of its internal area occupied by conductors.

B. During construction all installed conduits shall be temporarily plugged, capped, or otherwise protected from the entrance of dust, trash, moisture, etc., and any conduits that may become clogged shall be replaced. No conductor shall be pulled in until all work that might cause damage to the conduit or conductors has been completed.

C. Conduit connections to sheet metal enclosures shall be securely fastened by double lock nuts inside and outside and shall have grounding bushings.

D. Conduit straps or brackets secured to concrete, brick, or masonry shall be by means of expansion bolts, toggle bolts, or approved drill anchors. No wood plugs will be permitted.

E. Conduits supported from building walls shall be installed with at least 1/4-inch clearance from the wall using pipe spacers equal to Appleton Electric Company, T & B Company, Steel City, or equal. Clamp back to prevent the accumulation of dirt and moisture behind the conduit.

F. Unless otherwise shown or specified, exposed rigid conduit shall be installed parallel or at right angles to structural members, surfaces, and building walls.

G. Two or more conduits in the same general routing shall be parallel with symmetrical bends.

H. Conduits shall be at least 12 inches from high temperature piping, ducts, and flues.

I. Conduit installed horizontally shall allow headroom of at least 7 feet, except where it may be installed along structures, piping, equipment, or in other areas where headroom cannot be maintained because of other considerations.

J. Wherever necessary conduit boxes and pulling elbows shall be inserted in the lines. Gaskets shall be used to ensure a dust and watertight installation on all conduit boxes and fittings.

K. All bends and turns in conduits shall have a bend radius of not less than 6 times the internal diameter of the conduit. Bends shall be made using an approved bender to provide smooth bends with no kinks, dents, or flattening.

L. All concealed conduit shall be placed in walls, floors, ceilings, or slabs at the proper time in accordance with the progress of the work. The Contractor shall cooperate in every respect in meeting schedules and shall not delay the structural work unnecessarily. Conduits embedded in concrete shall be blocked and braced in place by use of adequate conduit separators to prevent displacement during pouring of the concrete. Where conduit interferes with structural steel, steel reinforcement, or in the opinion of the Engineer occupies too much space in the slab, the conduits shall be rearranged or installed exposed as directed by the Engineer. No additional payment will be made for such rearrangement of conduit whether or not additional conduit or fittings might be required.

M. Conduit wall seals with water stops shall be installed in outside walls below grade for all incoming or outgoing underground conduit emerging directly into the building area. The conduit wall seals shall have a pressure ring and sealing grommet to ensure a watertight installation.

N. Conduit expansion fittings and ground bonding jumpers shall be installed on all conduits passing through building expansion joints to provide movement in the conduit system.

O. Where groups of conduits terminate together or pass through floors, provide template to hold conduits in proper relation to each other and to building.

P. Conduits shall be plugged or capped with plastic caps during construction to protect threads and prevent entrance of dirt and water.

Q. Conduits shall be adequately supported at intervals as required by the National Electrical Code. One to two exposed conduits running parallel to each other may be supported by strap anchors, or 1-hole clamps (walls only). Exposed conduits larger than 2 inches or groups of more than 2 conduits run parallel shall be supported by means of minimum 12 gauge, slotted steel channels fitted with 2-piece, bolted pipe clamps. All conduit supports, clamps, straps and brackets shall be stainless steel for corrosion resistance.

R. Runs of conduit shall not contain more than four 90-degree bends (360-degrees total) between conduit boxes panelboards, or terminations. In general and to the extent practical length of conduit runs between conduit boxes or similar means of access shall not exceed 100 feet.

S. Exposed service entrance conduits and main feeder conduits shall be identified using stenciled letters at intervals not to exceed 20 feet. Size of letters shall be equal to one-half the diameter of the conduit or 2 inches, whichever is less.

T. In Class 1, Division 2 areas, the contractor is responsible for installing seal-off fittings as required by Articles 500, 501, and 502 of the National Electric Code. The drawings do not show seal off fittings and it is the contractor's responsibility to locate and install the seal-offs based on field routing of the conduit.

3.2 INSTALLATION OF RIGID METAL CONDUIT

A. Terminations and connections of rigid metal conduit shall be threaded. Conduits shall be reamed free of burrs and terminated with insulated metallic conduit bushings.

B. Conduit threads shall be coated with a petroleum base corrosion-inhibitor with low electrical contact resistance before assembly equal to Burndy Engineering Company, Inc., Penetrax "A" or equal screw thread lubricant (zinc-petroleum or zinc-chromate compounds are permissible).

C. All conduits shall be suitably grounded to the plant ground grid using grounded type insulated bushings, O. Z. Electrical Manufacturing Company, Type BLG or IGB, T & B Company, Appleton Electric Company, or equal.

D. Conduit across structural joints where structural movement is allowed shall have bonded, weathertight expansion and deflection fitting the same size as the conduit.

E. Support spacing for conduits 1 inch and smaller shall not exceed 6 feet, and conduits 1¼ inches and larger shall not exceed 10 feet. Supports shall be as specified under basic electrical materials and methods. Conduits 1½-inch and smaller may be supported by 1-hole conduit straps and 2 inches and larger shall be supported by 2-hole conduit straps. Conduit racks shall be as manufactured by Unistrut, Kindorf, or equal. Conduit racks shall be 316 stainless steel.

F. Conduit joints shall be made up tight using a pipe wrench. Channel lock pliers will not be permitted, and unions shall be used as necessary to aid in the installation. Conduits shall be cut square and the ends reamed smooth after threading to prevent injury to conductors. Conduit joints in concrete or exposed to weather or damp locations shall be drawn up tight and coated with insulating paint before casting in concrete or painting exposed conduit system.

G. Plastic-coated rigid metal conduit and fittings shall be installed in accordance with the manufacturer's specifications and recommendations. Any damage to the plastic coating shall be repaired in accordance with the manufacturer's requirements. The manufacturer shall certify the installers before installation can be started.

3.3 INSTALLATION OF RIGID NONMETALLIC CONDUIT

A. Field bending of polyvinyl chloride conduit shall be made with appropriate equipment. No torches or flame-type devices shall be used.

B. When joints are to be made with polyvinyl chloride conduit, the conduit shall be cut with a fine-tooth saw and deburred. Conduit ends shall be wiped clean of dust, dirt, and shavings and shall be dry. Solvent cement shall be applied to bond the joint. The joint should be watertight.

C. Polyvinyl chloride conduit shall be installed in accordance with the manufacturers' specifications and recommendations.

3.4 INSTALLATION OF LIQUID-TIGHT FLEXIBLE METAL CONDUIT

A. Terminations at motors shall be made with flexible liquid-tight metal conduit from conduit stub to terminal box; flexible connection shall be made as short as possible. Flexible conduit shall be Type UA, black. Underwriter's Laboratories approved flexible liquid-tight conduit connectors shall be as manufactured by Thomas and Betts Company, Appleton Electric Company, or equal.

B. Uncoated flexible metal conduit may be used for short connections between junction boxes and lighting fixtures or speakers installed in suspending ceiling systems. Flexible metal conduit shall be connected using Underwriters Laboratories approved grounding connectors.

3.5 INSTALLATION OF UNDERGROUND CONDUIT

A. All underground conduits shall be concrete-encased unless otherwise noted on the Drawings or directed by the Engineer. No conduit shall be concealed or encased until the Engineer has inspected the conduit for proper installation and accurate placement.

B. The Contractor shall be responsible for all excavating, draining trenches, forming of duct assembly and protective concrete envelope, backfilling, and removal of excess earth.

C. Underground conduit shall be installed with a minimum 3-inch per 100-foot downward slope for drainage. Drains shall be provided at all low points.

D. Bends and turns shall be made using long sweeps. Ninety-degree bends will be used only where required and shall be kept at a minimum.

E. Where rigid nonmetallic conduits emerge from underground, an adapter from rigid nonmetallic conduit to rigid metal conduit shall be installed and all exposed conduit shall be rigid metal conduit.

F. All rigid metal conduit risers shall be protected with 2 coats of a Bitumastic compound before concrete is poured from a point 12 inches below grade to a point not less than 6 inches above grade or surface of concrete. All stub-ups shall extend upward with one length of rigid metal conduit until after concrete is poured to assure vertical alignment.

G. Conduits shall be encased in concrete with 3-inch minimum concrete cover all around.

H. Concrete for concrete encasement shall be Class B concrete conforming to requirements of the section entitled "Cast-In-Place Concrete," of these Specifications. Longitudinal and lateral steel reinforcement shall be provided as shown on the Drawings.

I. All underground conduit runs for voltages less than 600 volts shall be at least 24 inches below grade and shall have a minimum conduit separation of 4 inches.

J. All underground conduit runs for voltages over 600 volts shall be at least 36 inches below grade and shall have a minimum conduit separation of 4 inches. Conduit shall have a minimum 4-inch concrete cover on all sides.

K. All underground conduit runs shall be rodded and a mandrel drawn through followed by a swab to clean out any obstructions that may cause cable abrasions. The mandrel shall be 12 inches in length and the diameter ½ inch less than the inside diameter of the conduit.

L. All underground conduit runs shall be marked by a strip of permanently colored red polyethylene tape, 0.004 inch thick and 6 inches wide, buried above the conduit and 6 inches below finished grade.

M. All spare conduits shall be provided with permanent waterproof caps at stub-ups and shall be furnished with a No. 8 aluminum pulling wire. Waterproof raceway tags shall be attached to the pulling cords, at each end and at each intermediate pulling point. The raceway tags shall identify the origin and destination of the conduit.

3.6 CONDUIT APPLICATIONS

A. Install the following conduit types, unless otherwise shown on the drawings.

1. Outdoors, Exposed (Not Buried): Rigid Aluminum
2. Indoors: n/a
3. Underground (Under Slabs-on-Grade, Encased or Embedded in Concrete): PVC Schedule 40
4. Transition Areas and Final Connections to Equipment:
   a) Motor Connections: Flexible metal, liquid-tight conduit.

b) Light Fixture Connections: Flexible metal non liquid-tight conduit in dry areas and liquid-tight in wet areas.

END OF SECTION

SECTION 31 20 00

EARTH MOVING

PART 1 GENERAL

1.01 SCOPE

A. This Section includes earthwork and related operations, including, but not limited to dewatering, excavating all classes of material encountered, pumping, draining and handling of water encountered in the excavations, handling, storage, transportation and disposal of all excavated and unsuitable material, construction of fills and embankments, backfilling around structures, compacting, all sheeting, shoring and bracing, preparation of subgrades, surfacing and grading, and any other similar, incidental, or appurtenant earthwork operations which may be necessary to properly complete the work.

B. The Contractor shall provide all services, labor, materials, and equipment required for all earthwork and related operations, necessary or convenient to the Contractor, for furnishing complete work as shown on the Drawings or specified in these Contract Documents.

1.02 RELATED SECTIONS

A. Geotechnical Report - Section 00 31 32 (If provided in bidding documents)

B. Site Clearing - Section 31 10 00

C. Trench Excavation and Backfill - Section 31 23 16

1.03 GENERAL

A. The elevations shown on the Drawings as existing are taken from the best existing data and are intended to give reasonably accurate information about the existing elevations. They are not precise and the Contractor shall become satisfied as to the exact quantities of excavation and fill required.

B. Earthwork operations shall be performed in a safe and proper manner with appropriate precautions being taken against all hazards.

C. All excavated and filled areas for structures, trenches, fills, topsoil areas, embankments, and channels shall be maintained by the Contractor in good condition at all times until final acceptance by the Owner. All damage caused by erosion or other construction operations shall be repaired by the Contractor using material of the same type as the damaged material.

D. The Contractor shall control grading in a manner to prevent surface water from running into excavations. Obstruction of surface drainage shall be avoided and means

shall be provided whereby storm water can be uninterrupted in existing gutters, other surface drains, or temporary drains. Free access must be provided to all fire hydrants and meters.

E. Tests for compaction and density shall be conducted by the Engineer or by an independent testing laboratory selected in accordance with Section 01450 of these Specifications.

1. The soils testing laboratory is responsible for the following:

   a. Field compaction testing shall be based on using the maximum dry density determined by the Standard Proctor Compaction Test in accordance with ASTM D 698.

   b. Determination of in-place backfill density shall be done in accordance with ASTM D 1556, "Density and unit weight of Soil In Place by the Sand-Cone Method", ASTM D 2937, "Density of Soil In Place by the Drive-Cylinder Method" or ASTM D 2922, "Density of Soil and Soil-Aggregate In Place by Nuclear Methods (Shallow Depth)".

   c. Field density tests for each lift; one test for each 5,000 square feet of fill or minimum one test per lift.

   d. Inspecting and testing stripped site, subgrades and proposed fill materials.

2. Contractor's duties relative to testing include:

   a. Notifying laboratory of conditions requiring testing.

   b. Coordinating with laboratory for field testing.

   c. Providing representative fill soil samples to the laboratory for test purposes. Provide 50 pound samples of each fill soil.

3. Inspection

   a. Earthwork operations, suitability of excavated materials for fill and backfill, and placing and compaction of fill and backfill is subject to inspection. Engineer will observe earthwork operations.

   b. Foundations and shallow spread footing foundations are required to be inspected by an engineer to verify suitable bearing and construction.

F. All earthwork operations shall comply with the requirements of OSHA Construction Standards, Part 1926, Subpart P, Excavations, Trenching, and Shoring, and Subpart O, Motor Vehicles, Mechanized Equipment, and Marine Operations, and shall be conducted in a manner acceptable to the Engineer.

G. It is understood and agreed that the Contractor has made a thorough investigation of the surface and subsurface conditions of the site and any special construction problems which might arise as a result of nearby watercourses and floodplains. The Contractor shall be responsible for providing all services, labor, equipment, and materials necessary or convenient to the Contractor for completing the work within the time specified in these Contract Documents.

H. Safety

Perform all trench excavation and backfilling activities in accordance with the Occupational Safety and Health Act of 1970 (PL 91-596), as amended. The Contractor shall pay particular attention to the Safety and Health Regulations Part 1926, Subpart P "Excavation, Trenching & Shoring" as described in OSHA publication 2226.

PART 2 PRODUCTS

2.01 SOILS CLASSIFICATIONS

Bedding materials listed here include a number of processed materials plus the soil types defined according to the Unified Soil Classification System (USCS) in ASTM D 2487, Standard Method for Classification of Soils for Engineering Purposes. (See below for description of soil classification). These materials are grouped into five broad categories according to their suitability for this application:

A. Class I - Angular, 1/4 to 1 1/2 inches (6 to 40 mm) graded stone, including such as coral, slag, cinders, crushed shells and crushed stone. Note - The size range and resulting high voids ratio of Class I material make it suitable for use to dewater trenches during pipe installation. This permeable characteristic dictates that its use be limited to locations where pipe support will not be lost by migration of other embedment materials into the Class I material. When such migration is possible, the material's minimum size range should be reduced to finer than 1/4 inch (6 mm) and the gradation properly designed to limit the size of the voids.

B. Class II - Coarse sands and gravels with maximum particle size of 1 1/2 inch (40 mm), including variously graded sands and gravels containing small percentages of fines, generally granular and non-cohesive, either wet or dry. Soil Types GW, GP, SW and SP are included in this class. Note - Sands and gravels which are clean or borderline between clean and with fines should be included. Coarse-grained soils with less than 12% but more than 5% fines are neglected in ASTM D2487 and the USCS and should be included. The gradation of Class II material influences its density and pipe support strength when loosely placed. The gradation of Class II material influences its density and pipe support strength when loosely placed. The gradation of Class II material may be critical to the pipe support and stability of the foundation and embedment if the material is imported and is not native to the trench excavation. A gradation other than well graded, such as uniformly graded or gap graded, may permit loss of support by migration into void spaces of a finer grained natural material from the trench wall and foundation.

C. Class III - Fine sand and clayey (clay filled) gravels, including fine sands, sand-clay mixtures and gravel-clay mixtures. Soil Types SM, GC, SM, and SC are included in this class.

D. Class IV - Silt, silty clays and clays, including inorganic clays and silts of not to high plasticity and liquid limits. Soil Types MH, ML, CH, and CL are included in

this class. Note- Caution should be used in the design and selection of the degree and method of compaction for Class IV soils because of the difficulty in properly controlling the moisture content under field conditions. Some Class IV soils with medium to high plasticity and with liquid limits greater than 50% (CH, MH, CH-MH) exhibit reduced strength when wet and should only be used for bedding, haunching and initial backfill in arid locations where the pipe embedment will not be saturated by ground water, rainfall and/or exfiltration from the pipeline system. Class IV soils with low to medium plasticity and with liquid limits lower than 50% (CL, ML, CL-ML) also require careful consideration in design and installation to control moisture content but need not be restricted in use to arid locations.

E. Class V - This class includes the organic soils OL, OH, and PT as well as soils containing frozen earth, debris, rocks larger than 1 1/2 inch (40 mm) in diameter, and other foreign materials. These materials are not recommended for bedding, haunching or initial backfill.

DESCRIPTION OF EMBEDMENT MATERIAL CLASSIFICATIONS

SOIL CLASS	SOIL TYPE	DESCRIPTION MATERIAL CLASSIFICATION
Class I Soils *	---	Manufactured angular, granular material, 3/4 to 1 1/2 inches (6 to 40 mm) size, including materials having regional significance such as crushed stone, or rock, broken coral, crushed slag, cinders, or crushed shells.
Class II Soil **	GW	Well-graded gravels and gravel-sand mixtures, little or no fines. 50% or more retained on No. 4 sieve. More than 95% retained on No. 200 sieve. Clean..
	GP	Poorly graded gravels and gravel-sand mixtures, little or no fines. 50% or more retained on No. 4 sieve. More than 95% retained on No. 200 sieve. Clean
	SW	Well-graded sands and gravely sands, little or no fines. More than 50% passes No. 4 sieve. More than 95% retained on No. 200 sieve. Clean.
	SP	Poorly graded sands and gravelly sand, little or no fines. More than 50% passes No. 4 sieve. More than 95% retained on No. 200 sieve. Clean.
Class III Soil ***	GM	Silty gravels, gravel-sand-silt mixtures. 50% or more retained on No. 200 sieve.
	GC	Clayey gravels, gravel-sand-clay mixtures. 50% or more retained on No. 4 sieve. More than 50% retained on No. 200 sieve.

	SM	Silty sands, sand-silt mixtures. More than 50% passes No. 4 sieve. More than 50% retained on No. 200 sieve.
	SC	Clayey sands, sand-clay mixtures. More than 50% passes No. 4 sieve. More than 50% retained on No. 200 sieve.
Class IV Soils	ML	Inorganic silts, very fine sands, rock flour, silty or clayey fine sands. Liquid limit 50% or less. 50% or more passes No. 200 sieve.
	CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays. Liquid limit 50% or less. 50% or more passes No. 200 sieve.
	MH	Inorganic silts, micaceous or diatomaceous fine sands or silts, elastic silts. Liquid limit greater than 50%. 50% or more passes No. 200 sieve.
	CH	Inorganic clays of high plasticity, fat clays. Liquid limit greater than 50%. 50% or more passes No. 200 sieve.
Class V Soils	OL	Organic silts and organic silty clays of low plasticity. Liquid limit 50% or less. 50% or less. 50% or more passes No. 200 sieve.
	OH	Organic clays of medium to high plasticity. Liquid limit 50% or less. 50% or more passes No. 200 sieve.
	PT	Peat, muck and other highly organic soils.

* Soils defined as Class I materials are not defined in ASTM D2487.

** In accordance with ASTM D2487, less than 5% pass No. 200 sieve.

*** In accordance with ASTM D2487, more than 12% pass No. 200 sieve. Soils with 5% to 12% pass No. 200 sieve fall in borderline classification, e.g. GP-GC.

2.02 FILL MATERIAL

A. Sand Fill: Material shall consist of a clean sand with a fineness modulus of 1.6 to 3.1 and containing not more than 10 percent by weight finer than No. 200 U.S. Standard Sieve.

B. Earth Fill: Material shall consist of inorganic material free of roots, cobbles and boulders and classified as SM, ML, SC, or CL by ASTM D2487-85 "Standard Methods for Classification of Soils for Engineering Purposes". Earth Fill shall also conform to the following:

1. Liquid Limit = 50 maximum
2. Plasticity Index = 20 maximum
3. Dry Unit Weight = 90 pcf minimum maximum density

C. Coarse Aggregate (Crushed Stone): Coarse aggregate shall conform to the Georgia Department of Transportation Standard Specifications for Construction of Road and Bridges, Table 800.01 H, Size No. 57.

2.03 UNSUITABLE SITE FILL MATERIAL

Material which does not conform to the above classifications (soil classification SP, SW.GM, CH, MH, OH, OL, and PT) may be used as Site Fill material in areas identified on the drawings as "spoil areas", in areas with no structures and or roads and other non-critical areas.

2.04 SHEETING, BRACING AND TIMBERING

A. Sheeting, Bracing and Timbering: The Contractor shall furnish, place and maintain all sheeting, bracing and timbering required to properly support trenches and other excavations in open cut and to prevent all movement of the soil, pavement, structures, or utilities outside of the trench or pit.

1. General

a. Cofferdams and bracing design, including computations, shall be prepared before commencing construction operations. Drawings and design computations shall be signed and sealed by a professional engineer registered in the State of Georgia. The drawings and design computations shall be submitted to the Engineer for informational purposes only.

b. Sheeting, bracing and timbering shall be so placed as to allow the work to be constructed to the lines and grades shown on the Drawings and as ordered by the Engineer.

c. If at any time the method being used by the Contractor for supporting any material or structure in or adjacent to any excavation is not reasonably safe, the Contractor shall provide additional bracing and support necessary to furnish the added degree of safety.

d. All sheeting in contact with the concrete or masonry shall be cut off as directed by the Engineer and left in place.

2. Timber: Timber may be substituted for steel sheet piling when approved by the Engineer. Timber for shoring, sheeting or bracing shall be sound and free of large or loose knots, and in good condition. Size and spacing shall be in accordance with OSHA regulations.

3. Steel Sheet Piling: Steel sheet piling shall be the continuous interlock type. The weight, depth, and section modulus of the sheet piling shall be sufficient to restrain the loads of earth pressure and surcharge from existing foundations and/or live loads. Procedure for installation and bracing shall be so scheduled and coordinated with the removal of the earth that the ground under existing structures shall be protected against lateral movement at all times. The Contractor shall provide closure and sealing between sheet piling and existing facilities. Steel piling shall be removed, unless otherwise directed by the Engineer.

4. Remove bracing and sheeting in units when backfill reaches the point necessary to protect the structures and adjacent property. Leave sheeting in place when, in the opinion of the Engineer, it cannot be safely removed. Cut off sheeting left in place at least two feet below the surface.

2.05 FILTER FABRIC

A. Filter fabric associated with bedding shall be a UV stabilized, spunbonded, continuous filament, needle punched, polypropylene, nonwoven geotextile.

B. The fabric shall have an equivalent open size (EOS or AOS) of 120 - 70. The fabric shall also conform to the minimum property values listed in the following table:

Fabric Property	Unit	Test Procedure	Minimum Value
Grab Strength	lbs.	ASTM D 4632	160
Grab Elongation	%	ASTM D 4632	>50
Tear Strength	lbs.	ASTM D 4533	60
Puncture Resistance	lbs.	ASTM D 4833	115
Permittivity	sec^{-1}	ASTM D 4491	1.5
Water Flow Rate	gpm/ft^2	ASTM D 4491	100
UV Resistance (500 hrs)	%	ASTM D 4355	>80

C. Filter fabric shall be Mirafi 160N, DuPont SF 65, or equal.

2.06 CONCRETE

Concrete for initial backfill or encasement shall have a compressive strength of not less than 3,000 psi, with not less than 5.5 bags of cement per cubic yard and a slump between

3 and 5-inches. Ready-mixed concrete shall be mixed and transported in accordance with ASTM C 94. Reinforcing steel shall conform to the requirements of ASTM A 615, Grade 60.

2.07 FLOWABLE FILL

Flowable fill, where required for backfill, shall meet the requirements of Georgia Department of Transportation Standard Specifications, Section 600 for Excavatable or Non-Excavatable type.

PART 3 EXECUTION

3.01 GENERAL

A. Safety: Comply with local regulations and with the provisions of the "Manual of Accident Prevention in Construction" of the Associated General Contractors of America, Inc., Occupational Safety and Health Act and all other applicable safety regulations.

B. Topsoil

1. Remove all topsoil to a depth at which subsoil is encountered, from all areas under buildings, pavements, and from all areas which are to be cut to lower grades or filled.
2. With the Engineer's approval, topsoil to be used for finish grading may be stored on the site.
3. Other topsoil may be used for fill in non-critical areas with approval of the Engineer.
4. Properly dispose of all excess topsoil in the designated area.

C. Bracing and Sheeting

1. Furnish, put in place, and maintain all sheeting, bracing, and shoring as may be required to properly support the sides of all excavations and to prevent all movement of earth which could in any way injure the work, adjacent property or workers.
2. Properly support all excavations where necessary to conform to all pertinent rules and regulations and these Specifications, even though, such locations are not indicated on the Drawings.
3. Exercise care in the removal of sheeting, shoring, bracing and timbering to prevent collapse or caving of the excavation faces being supported and damage to the work and adjacent property.
4. Do not leave any sheeting or bracing in the trench or excavation after completion of the work, unless approved by the Engineer.

D. Obstructions

1. Remove and dispose of all boulders, sidewalks, driveways, pavement, pipes, and the like, as required for the performance of the work.

2. Exercise care in excavating around catch basins, inlets and manholes so as to not disturb or damage these structures.

3. Avoid removing or loosening castings or pushing dirt into catch basins, inlets and manholes.

4. Damaged or displaced structures or casting shall be repaired, replaced and dirt entering the structures during the performance of the work shall be removed at no additional cost to the Owner.

E. Utilities to be Abandoned

1. When pipes, conduits, sewers, or other structures are removed from the trench, leaving dead ends in the ground, such ends shall be fully plugged or sealed with brick and non-shrink grout.

2. Abandoned structures such as manholes or chambers shall be entirely removed.

3. All materials from abandoned utilities shall be removed from the site.

4. All salvageable materials shall become the property of the Owner.

5. All equipment to be salvaged is noted in the Specifications and shall be turned over to the Owner at a designated location.

F. Extra Earth Excavation

1. In case soft or excessively wet material which, in the opinion of the Engineer, is not suitable, is encountered below the final subgrade elevation of an excavation or underneath a structure, the Engineer may order the removal of this material and its replacement with crushed stone, filter fabric, or other suitable material in order to make a suitable foundation for the construction of the structure.

G. Cutting Paved Surfaces and Similar Improvements

1. Remove existing pavement as necessary for installing pipe utilities and appurtenances or as otherwise shown on the Drawings.

2. Before removing any pavement, mark the pavement neatly, paralleling pipe lines and existing street lines. Space the marks the width of the trench.

3. Break asphalt pavement along the marks using rotary saws or other suitable tools. Break concrete pavement along the marks by use of scoring with a rotary saw and breaking below the score by the use of jackhammers or other suitable tools.

4. Do not pull pavement with machines until completely broken and separated from pavement to remain.

5. Do not disturb or damage the adjacent pavement. If the adjacent pavement is

disturbed or damaged, remove and replace the damaged pavement. No additional payment will be made for removing and replacing damaged adjacent pavement.

6. Remove and replace sidewalks disturbed by construction for their full width and to the nearest undisturbed joint.

7. The Contractor may tunnel under curbs that are encountered. Remove and replace any curb disturbed by construction to the nearest undisturbed joint.

3.02 EXCAVATION

A. Method

1. All excavation shall be by open cut from the surface except as indicated on the Drawings.

2. All excavations for pipe appurtenances and structures shall be made in such a manner, and to such depth and width, as will give ample room for building the structures, and for bracing, sheeting, and supporting the sides of the excavation, for pumping and draining groundwater which may be encountered, and for the removal from the excavation of all materials excavated.

3. Take special care so that the soil below the bottom of the structure to be built is left undisturbed.

B. Grades: Excavate to grades indicated on the Drawings. Where excavation grades are not indicated on the Drawings, excavate as required to accommodate installation.

C. Disposal of Excavated Material

1. Remove and properly dispose of all excavated material not needed to complete filling, backfilling and grading.

2. Dispose of excess earth and rock excavated materials at locations on-site designated by the Engineer. Off-site disposal of all other material shall be and in accordance with all requirements of federal, state, county, and municipal regulations. No debris of any kind shall be deposited in any stream or body of water, or on any street. No debris shall be deposited on any private property, except by written consent of the property owner. In no case shall any material be shoved onto abutting private properties, or be buried in embankments or trenches on the Project.

3.03 EXCAVATING FOR STRUCTURES

A. Earth Excavation: Earth excavation shall include all substances to be excavated other than rock. Earth excavation for structures shall be to limits not less than two feet outside wall lines, to allow for formwork and inspection, and further as necessary to permit the trades to install their work. All materials loosened or disturbed by excavation shall be removed from surfaces to receive concrete or crushed stone.

B. Excavation for Foundations: Footings and slabs on grades shall rest on undisturbed earth, rock or compacted materials to insure proper bearing.

1. Unsuitable Foundation Material: Any material, in the opinion of the Engineer, which is unsuitable for foundation shall be removed and replaced with compacted crushed stone, or with compacted fill material as directed by the Engineer. No determination of unsuitability will be made until all requirements for dewatering are satisfactorily met.

2. Foundation in Rock: Foundations for a structure shall be on similar materials. Should excavation for a foundation be partially in rock, the Contractor shall undercut that portion of the rock 12-inches and bring the excavation to grade with compacted crushed stone.

3. Pipe Trenches Beneath Structures: Where piping or conduit passes beneath footings or slabs resting on grade, trenches shall be excavated to provide a minimum 6-inch clearance from all surfaces of the pipe or conduit. The trench shall be backfilled to the base of the structure with concrete.

4. Unauthorized Excavation: Care shall be taken that excavation does not extend below bottom levels of footings or slabs on earth or rock. Should the excavation, through carelessness or neglect, be carried below such levels, the Contractor shall fill in the resulting excess excavation with concrete under footings and compacted crushed stone or other approved material under slabs. Should excavation be carried beyond outside lines of footings such excess excavation shall be filled with concrete, or formwork shall be provided, as directed by the Engineer.

C. Unsuitable Bearing

1. If suitable bearings for foundations are not encountered at the elevations indicated on the Drawings, immediately notify the Engineer.

2. Do not proceed further until instructions are received.

3.04 DEWATERING REQUIREMENT

A. The Contractor may use any dewatering method he deems feasible so long as it results in working in the dry and stable soil conditions.

B. The Contractor shall conform and meet all conditions, obtain necessary permits and requirements of the regulatory agencies that have jurisdiction.

C. It is the intent of these specifications that an adequate dewatering system be installed to lower and control the groundwater in order to permit excavation, construction, grading and the placement of fill materials, all to be performed under dry conditions. The dewatering system shall be adequate to pre-drain the water-bearing strata above and below the bottom of the excavation.

D. The Contractor shall be solely responsible for the arrangement, location and depths of dewatering system necessary to accomplish the work described under this section of the specifications. The dewatering shall be accomplished in a manner that will

reduce the hydrostatic head below any excavation to the extent that the water level in the construction area are a minimum of three (3) feet below the prevailing excavation surface and any surface to be compacted; will prevent the loss of fines, seepage, boils, quick conditions, or softening of the foundation strata; will maintain stability of the sides and bottom of the excavation; and will result in all construction operations being performed in the dry.

E. The Contractor shall promptly dispose of all water removed from the excavations in such a manner as will not endanger public health, damage public or private property, or affect adversely any portion of the work under construction or completed by him or any other Contractor. Contractor shall obtain written permission from the Owner for any property involved before digging ditches or constructing water courses for the removal of water.

F. The disposal of water from the dewatering system shall meet the requirements of all regulatory agencies having jurisdiction.

G. If the dewatering requirements are not satisfied due to inadequacy or failure of the dewatering system, then loosening of the foundation strata, or instability of the slopes, or damage to the foundations or structures may occur. The supply of all labor and materials, and the performance of all work necessary to carry out additional work for reinstatement of the structures of foundation soil resulting from such inadequacy or failure shall be undertaken by the Contractor subject to the approval of the Engineer, and at no additional expense to the Owner.

3.05 ROCK EXCAVATION

A. Definition of Mass Rock (only for payment purposes where payment is on a unit quantity basis): Any material which cannot be excavated with a single-tooth ripper drawn by a crawler tractor having a minimum draw bar pull rated at not less than 56,000 pounds (comparable to Caterpillar D 8K or comparable to Caterpillar 973 front-end loader, and occupying an original volume of at least one cubic yard). The Engineer shall be the sole determinate as to the limits to which the material is classified as rock.

B. Definition of Trench Rock (only for payment purposes where payment is on a unit quantity basis): Any material which cannot be excavated with a backhoe having a bucket curling force rated at not less than 25,700 pounds (Caterpillar Model 225 or equivalent), and occupying an original volume of at least one-half (1/2) cubic yards.

C. Excavation: Where rock is encountered within excavation for structures, it shall be excavated to the lines and grades indicated on the Drawings or as otherwise directed by the Engineer. The Contractor shall be responsible for obtaining any blasting permits required.

D. Blasting: Blasting operations shall be conducted in accordance with all existing ordinances and regulations. All structures shall be protected from the effects of the blast. Blasting shall be performed and supervised by qualified and licensed workers. Dispose of excavated rock in accordance with applicable federal, state, county and local regulations. All blasting within 750 ft of an inhabited structure and or roadway

must be siesmic monitored for ground and air vibrations. Peak Particle Velocity shall be measured at nearest structure and shall be 0.5 inch per second or less during blasts. Shots must be covered with at least 6 feet of earthen and synthetic cover (blasting mats). Bore hole diameter must not exceed 4" in diameter. Blast hole cannot exceed 20 feet of solid rock with single delay detonator (in terms, if drill depth exceeds more than 20 feet in depth, decking must be done, accomplish by using multiple detonators in the blast hole. The blast holes must be stemmed with gravel, 89/57 stone. Pre-blast inspections are required. Inspections shall be via an engineer that includes inspection of structure, and pictures of any existing damage or cracks that structure may have prior to blasting.

E. If excess excavation is made or the material becomes disturbed so as to require removal below final subgrade elevations or beyond the prescribed limits, the resulting space shall be refilled with concrete in accordance with Section 2.07 of this Specification

F. Measurement for Payment

All rock excavation shall be paid for as an incidental part of the item on which the work is done except where a separate, unqualified item for rock excavation is indicated in the BID FORM or where rock excavation is ORDERED as an EXTRA by the OWNER, by WRITTEN ORDER. Where payment for rock excavation is established by the BID FORM or ORDERED as an EXTRA by the OWNER, CONTRACTOR shall be paid only for the quantity of rock removed, measured as follows:

1. For all masonry structures such as buildings, tanks, vaults, catch basins, manholes and the like, the horizontal rock measurement shall be made to include 2-1/2 feet from the outside face of finished vertical sidewall of such structure and the vertical rock measurement shall be made from the top elevation of the rock, before disturbed or removed, to the elevation of the under or lower side of the bottom concrete slab of the structure. Any projection below the bottom slab of any structure required for sump, well, or other pertinent construction shall be measured separately.

2. For installation of pipe lines and fittings the horizontal rock measurement shall be the nominal outside diameter of the pertinent pipe plus 16-inches, except, however, that no horizontal measurement shall be considered to be less than 27-inches; the vertical rock measurement shall be made from the top elevation of the rock, before disturbance or removal, to an elevation of 9-inches below the bottom outside surface of the pipe for pipe having a diameter of 8-inches through 24-inches, and to an elevation of 12-inches below the bottom outside surface of the pipe for all pipe having a diameter greater than 24-inches.

G. Excess Rock Excavation

If rock excavated beyond the limits of payment indicated on the Drawings, specified, or authorized in writing by the OWNER, the excess excavation whether resulting from overbreakage or other causes, shall be backfilled, by and at the expense of the CONTRACTOR.

H. Shattered Rock

If rock below normal depth is shattered due to drilling or blasting operations and such shattered rock is unfit for foundations, the shattered rock shall be removed and the excavation shall be backfilled as described above in EXCESS ROCK EXCAVATION. All such removal and backfilling shall be done at the expense of the CONTRACTOR.

3.06 COMPACTION

A. Fill materials supporting roadways, parking areas, sidewalks, structures, and buildings and backfill around structures shall be compacted to 95 percent of the standard proctor density. The top 12-inches of fill materials supporting structures, concrete pads, pavement, curb and gutter shall be compacted to 98 percent of the standard proctor density. Fill placed for general site grading shall be compacted to 90 percent of the standard proctor density.

B. Compaction of embankments shall be by vibratory sheepsfoot or pad-foot rollers with staggered, uniformly spaced knobs and suitable cleaning devices. The projected area of each knob and the number and spacing of the knobs shall be such that the total weight of the roller and ballast when distributed over the area of one row of knobs shall be 250 psi. Placement and compaction of materials shall extend at least 5 feet beyond the final contours sufficiently to insure compaction of the material at the resulting final surface. Final contours shall then be achieved by a tracked bulldozer shaping the face of the embankment.

C. Compaction of backfill next to walls shall be accomplished with hand-powered tamping equipment. The backfill shall be placed in 8-inch maximum lifts, with each lift compacted to 95 percent of standard proctor density.

D. If tests indicate that density of fill is less than that specified, the area shall be, as directed by the Engineer, either recompacted or undercut, filled, and compacted until specified density is achieved.

3.07 FILL

B. Controlled Fill

1. The fill for roadways, parking areas, walks, structures, and building slabs on grade shall be controlled fill.

2. After the existing ground or excavated area has been proofrolled and examined by the Engineer, all holes and other irregularities shall be filled and compacted before the main fill is placed.

3. The fill shall be placed in even layers not exceeding 8-inches in depth and shall be thoroughly compacted as herein specified.

4. If an analysis of the soil being placed shows a marked difference from one

location to another, the fill being placed shall not be made up of a mixture of these materials.

5. Each different type of material shall be handled continuously so that field control of moisture and density may be based upon a known type of material.

6. No fill shall be placed following a heavy rain without first making certain on isolated test areas that compaction can be obtained without damage to the already compacted fill.

B. Proofrolling

1. All areas where roadways, parking areas, sidewalks, structures, and buildings are to be constructed on cut areas, compacted fill, and other areas where indicated on the Drawings, shall be proofrolled to detect soft spots prior to the placement of fill material or building foundations.

2. Proofrolling shall be performed using a fully loaded tandem-axle dump truck 20 tons or other suitable pneumatic tired equipment over the subgrade before the subgrade is shaped.

3. Proofrolling shall be witnessed by the Engineer.

4. Subgrade shall be proofrolled with 10 overlapping passes of the roller. Depressions that develop during the proofrolling operation shall be filled with suitable material and those filled areas shall be proofrolled with six passes of the roller. If, after having been filled and proofrolled, the subgrade areas that still "pump" or "rut", shall be further evaluated by a geotechnical engineer, and remedial work be determined based on the conditions found at locations under structures or pavement. The contractor shall execute remedial work determined by the geotechnical engineer to achieve a subgrade acceptable to the Engineer.

5. After the proofrolled subgrade has been accepted by the Engineer, the surface of the subgrade shall be finish rolled with a smooth steel wheel roller weighing not less than 10 tons. Finished surface of the subgrade shall be within a tolerance of 1/4-inch at every point.

6. Conduits, pipes, culverts, and underdrains shall be neither disturbed nor damaged by proofrolling operations. Rollers shall neither pass over, nor approach closer than five feet to, conduits, pipes, culverts, and underdrains unless the tops of those products are deeper than three feet.

C. Placement

1. Prior to placement of any material in embankments, the area within embankment limits shall be stripped of topsoil and all unsuitable materials removed in accordance with this Section. The area shall then be scarified to a depth of at least 6-inches.

2. Fill materials shall be placed in continuous, approximately horizontal layers extending the full width of the embankment cross-section and the full dimension of the excavation where practical and having an uncompacted

thickness of not over 8-inches.

D. Final Grading: Upon completion of construction operations, the area shall be graded to finish contour elevations and grades shown on the Drawings. Graded areas shall be made to blend into conformation with remaining ground surfaces. All surfaces shall be left smooth and free to drain.

E. Excess Material: Surfaces and slopes of waste fills shall be left smooth and free to drain.

F. Moisture

1. Fill materials shall be placed at optimum moisture content within practicable limits, but not less or more than two percent of optimum. Optimum moisture shall be maintained by sprinkling the layers as placed or by allowing materials to dry before placement.

2. If fill material is too wet, provide and operate approved means to assist the drying of the fill until suitable for compaction.

3. If fill material is too dry, provide and operate approved means to add moisture to the fill layers.

3.08 BACKFILLING

A. Backfill carefully to restore the ground surface to its original condition. Dispose of excess material in accordance with this Section.

B. Compact backfill underlying roadways, parking areas, sidewalks, structures and buildings in accordance with the requirements of Article 3.06 of this Section.

C. Backfilling Around Structures

1. General

a. Remove debris from excavations before backfilling.

b. Do not backfill against foundation walls until so directed by the Engineer nor until all indicated perimeter insulation and/or waterproofing is in place.

c. Protect such insulation and/or waterproofing during filling operations.

d. Do not backfill against water retaining structures until successful leakage tests have been completed.

e. Wherever possible, backfilling shall be simultaneous on both sides of walls to equalize lateral pressures.

f. Do not backfill against walls until all permanent construction is in place to furnish lateral support on both top and bottom of wall.

g. Backfilling against walls shall take place after all the concrete in the affected members has attained the specified strengths.

h. To prevent excessive lateral pressure on external walls, large

compaction equipment shall not be allowed within a zone wall footing.

2. Materials: Backfill material placed against structures built or encountered during the work of this Section shall be suitable fill material. No broken concrete, bricks or similar materials will be permitted as backfill.

3.09 GRADING

A. General: Perform all rough and finish grading required to attain the elevations indicated on the Drawings. Perform finish grading to an accuracy of ±0.10 foot.

B. Treatment After Completion of Grading

1. After grading is completed, permit no further excavation, filling or grading, except with the approval of the Engineer.

2. Use all means necessary to prevent the erosion of freshly graded areas during construction and until such time as permanent drainage and erosion control measures have been installed.

3.10 SETTLEMENT

A. The Contractor shall be responsible for all settlement of backfill, fills and embankments which may occur within one year after final acceptance of the Work by the Owner.

B. The Contractor shall make, or cause to be made, all repairs or replacements made necessary by settlement within 30 days after receipt of written notice from the Engineer or Owner.

3.11 CLEAN-UP

A. Leave unused materials in a neat, compact stockpile.

B. Remove unused stockpiled materials, leave area in a clean and neat condition. Grade stockpile area to prevent standing surface water.

C. Leave borrow areas in a clean and neat condition. Grade to prevent standing surface water.

END OF SECTION

SECTION 31 23 16

TRENCH EXCAVATION AND BACKFILL

PART 1 GENERAL

1.01 SCOPE

A. The work under this Section consists of furnishing all labor, equipment and materials and performing all operations in connection with the trench excavation and backfill required to install the site utilities, including all pipelines, electrical conduits, and duct banks as shown on the plans and as specified.

B. Excavation shall include the removal of any tree stumps, brush, debris or other obstacles which remain after the clearing and grubbing operations, which may obstruct the work, and the excavation and removal of all earth, rock or other materials to the extent necessary to install the pipe and appurtenances in conformance with the lines and grades shown on the plans and as specified.

C. Backfill shall include the filling and compaction of the trenches and excavations up to the surrounding ground surface or road grade at crossing.

D. The trench is divided into five specific areas:

1. Foundation: The area beneath the bedding, sometimes also referenced to as trench stabilization.

2. Bedding: The area above the trench bottom (or foundation) and below the bottom of the barrel of the pipe.

3. Haunching: The area above the bottom of the barrel of the pipe up to a specified height above the bottom of the barrel of the pipe.

4. Initial Backfill: The area above the haunching material and below a plane 12-inches above the top of the barrel of the pipe.

5. Final Backfill: The area above a plane 12-inches above the top of the barrel of the pipe.

E. The choice of method, means, techniques and equipment rests with the Contractor. The Contractor shall select the method and equipment for trench excavation and backfill depending upon the type of material to be excavated and backfilled, the depth of excavation, the amount of space available for operation of equipment, storage of excavated material, proximity of man-made improvements to be protected, available easement or right-of-way and prevailing practice in the area.

1.02 RELATED SECTIONS

A. Geotechnical report: Section 00 31 32 (If Provided in bidding documents)

B. Site Clearing: Section 31 10 00.

C. Earth Moving 30 20 00.

1.03 GENERAL

A. The elevations shown on the Drawings as existing are taken from the best existing data and are intended to give reasonably accurate information about the existing elevations. They are not precise and the Contractor shall become satisfied as to the exact quantities of excavation and fill required.

B. Earthwork operations shall be performed in a safe and proper manner with appropriate precautions being taken against all hazards.

C. All excavated and filled areas for structures, trenches, fills, topsoil areas, embankments, and channels shall be maintained by the Contractor in good condition at all times until final acceptance by the Owner. All damage caused by erosion or other construction operations shall be repaired by the Contractor using material of the same type as the damaged material.

D. The Contractor shall control grading in a manner to prevent surface water from running into excavations. Obstruction of surface drainage shall be avoided and means shall be provided whereby storm water can be uninterrupted in existing gutters, other surface drains, or temporary drains. Free access must be provided to all fire hydrants and meters.

E. Tests for compaction and density shall be conducted by the Engineer or by an independent testing laboratory selected in accordance with Section 01 45 29 of these Specifications.

1. The soils testing laboratory is responsible for the following:

   a. Field compaction testing shall be based on using the maximum dry density determined by the Standard Proctor Compaction Test in accordance with ASTM D 698.

   b. Determination of in-place backfill density shall be done in accordance with ASTM D 1556, “Density and unit weight of Soil In Place by the Sand-Cone Method”, ASTM D 2937, “Density of Soil In Place by the Drive-Cylinder Method” or ASTM D 2922, “Density of Soil and Soil-Aggregate In Place by Nuclear Methods (Shallow Depth)”.

   c. Test frequency for trenches and confined areas of 1 test per two foot vertical lift for every 100 linear feet.

   d. Inspecting and testing stripped site, subgrades and proposed fill materials.

2. Contractor's duties relative to testing include:

   a. Notifying laboratory of conditions requiring testing.

   b. Coordinating with laboratory for field testing.

   c. Providing representative fill soil samples to the laboratory for test

purposes. Provide 50 pound samples of each fill soil.

3. Inspection

   a. Earthwork operations, suitability of excavated materials for fill and backfill, and placing and compaction of fill and backfill is subject to inspection. Engineer will observe earthwork operations.

   b. Foundations and shallow spread footing foundations are required to be inspected by an engineer to verify suitable bearing and construction.

F. All earthwork operations shall comply with the requirements of OSHA Construction Standards, Part 1926, Subpart P, Excavations, Trenching, and Shoring, and Subpart O, Motor Vehicles, Mechanized Equipment, and Marine Operations, and shall be conducted in a manner acceptable to the Engineer.

G. It is understood and agreed that the Contractor has made a thorough investigation of the surface and subsurface conditions of the site and any special construction problems which might arise as a result of nearby watercourses and floodplains. The Contractor shall be responsible for providing all services, labor, equipment, and materials necessary or convenient to the Contractor for completing the work within the time specified in these Contract Documents.

H. Safety

Perform all trench excavation and backfilling activities in accordance with the Occupational Safety and Health Act of 1970 (PL 91-596), as amended. The Contractor shall pay particular attention to the Safety and Health Regulations Part 1926, Subpart P "Excavation, Trenching & Shoring" as described in OSHA publication 2226.

PART 2 PRODUCTS

2.01 SOILS CLASSIFICATIONS

Bedding materials listed here include a number of processed materials plus the soil types defined according to the Unified Soil Classification System (USCS) in ASTM D 2487, Standard Method for Classification of Soils for Engineering Purposes. (See below for description of soil classification). These materials are grouped into five broad categories according to their suitability for this application:

A. Class I - Angular, 1/4 to 1 1/2 inches (6 to 40 mm) graded stone, including such as coral, slag, cinders, crushed shells and crushed stone. Note - The size range and resulting high voids ratio of Class I material make it suitable for use to dewater trenches during pipe installation. This permeable characteristic dictates that its use be limited to locations where pipe support will not be lost by migration of other embedment materials into the Class I material. When such migration is possible, the material's minimum size range should be reduced to finer than 1/4 inch (6 mm)

and the gradation properly designed to limit the size of the voids.

B. Class II - Coarse sands and gravels with maximum particle size of 1 1/2 inch (40 mm), including variously graded sands and gravels containing small percentages of fines, generally granular and non-cohesive, either wet or dry. Soil Types GW, GP, SW and SP are included in this class. Note - Sands and gravels which are clean or borderline between clean and with fines should be included. Coarse-grained soils with less than 12% but more than 5% fines are neglected in ASTM D2487 and the USCS and should be included. The gradation of Class II material influences its density and pipe support strength when loosely placed. The gradation of Class II material influences its density and pipe support strength when loosely placed. The gradation of Class II material may be critical to the pipe support and stability of the foundation and embedment if the material is imported and is not native to the trench excavation. A gradation other than well graded, such as uniformly graded or gap graded, may permit loss of support by migration into void spaces of a finer grained natural material from the trench wall and foundation.

C. Class III - Fine sand and clayey (clay filled) gravels, including fine sands, sand-clay mixtures and gravel-clay mixtures. Soil Types SM, GC, SM, and SC are included in this class.

D. Class IV - Silt, silty clays and clays, including inorganic clays and silts of not to high plasticity and liquid limits. Soil Types MH, ML, CH, and CL are included in this class. Note- Caution should be used in the design and selection of the degree and method of compaction for Class IV soils because of the difficulty in properly controlling the moisture content under field conditions. Some Class IV soils with medium to high plasticity and with liquid limits greater than 50% (CH, MH, CH-MH) exhibit reduced strength when wet and should only be used for bedding, haunching and initial backfill in arid locations where the pipe embedment will not be saturated by ground water, rainfall and/or exfiltration from the pipeline system. Class IV soils with low to medium plasticity and with liquid limits lower than 50% (CL, ML, CL-ML) also require careful consideration in design and installation to control moisture content but need not be restricted in use to arid locations.

E. Class V - This class includes the organic soils OL, OH, and PT as well as soils containing frozen earth, debris, rocks larger than 1 1/2 inch (40 mm) in diameter, and other foreign materials. These materials are not recommended for bedding, haunching or initial backfill.

DESCRIPTION OF EMBEDMENT MATERIAL CLASSIFICATIONS

SOIL CLASS	SOIL TYPE	DESCRIPTION MATERIAL CLASSIFICATION
Class I Soils *	---	Manufactured angular, granular material, 3/4 to 1 1/2 inches (6 to 40 mm) size, including materials having regional significance such as crushed stone, or rock, broken coral, crushed slag, cinders, or crushed shells.

SOIL CLASS	SOIL TYPE	DESCRIPTION MATERIAL CLASSIFICATION
Class II Soil **	GW	Well-graded gravels and gravel-sand mixtures, little or no fines. 50% or more retained on No. 4 sieve. More than 95% retained on No. 200 sieve. Clean.
	GP	Poorly graded gravels and gravel-sand mixtures, little or no fines. 50% or more retained on No. 4 sieve. More than 95% retained on No. 200 sieve. Clean.
	SW	Well-graded sands and gravely sands, little or no fines. More than 50% passes No. 4 sieve. More than 95% retained on No. 200 sieve. Clean.
	SP	Poorly graded sands and gravelly sand, little or no fines. More than 50% passes No. 4 sieve. More than 95% retained on No. 200 sieve. Clean.
Class III Soil ***	GM	Silty gravels, gravel-sand-silt mixtures. 50% or more retained on No. 200 sieve.
	GC	Clayey gravels, gravel-sand-clay mixtures. 50% or more retained on No. 4 sieve. More than 50% retained on No. 200 sieve.
	SM	Silty sands, sand-silt mixtures. More than 50% passes No. 4 sieve. More than 50% retained on No. 200 sieve.
	SC	Clayey sands, sand-clay mixtures. More than 50% passes No. 4 sieve. More than 50% retained on No. 200 sieve.
Class IV Soils	ML	Inorganic silts, very fine sands, rock flour, silty or clayey fine sands. Liquid limit 50% or less. 50% or more passes No. 200 sieve.
	CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays. Liquid limit 50% or less. 50% or more passes No. 200 sieve.
	MH	Inorganic silts, micaceous or diatomaceous fine sands or silts, elastic silts. Liquid limit greater than 50%. 50% or more passes No. 200 sieve.

SOIL CLASS	SOIL TYPE	DESCRIPTION MATERIAL CLASSIFICATION
	CH	Inorganic clays of high plasticity, fat clays. Liquid limit greater than 50%. 50% or more passes No. 200 sieve.
Class V Soils	OL	Organic silts and organic silty clays of low plasticity. Liquid limit 50% or less. 50% or less. 50% or more passes No. 200 sieve.
	OH	Organic clays of medium to high plasticity. Liquid limit 50% or less. 50% or more passes No. 200 sieve.
	PT	Peat, muck and other highly organic soils.

* Soils defined as Class I materials are not defined in ASTM D2487.

** In accordance with ASTM D2487, less than 5% pass No. 200 sieve.

*** In accordance with ASTM D2487, more than 12% pass No. 200 sieve. Soils with 5% to 12% pass No. 200 sieve fall in borderline classification, e.g. GP-GC.

2.02 PIPE BEDDING CLASSES

A. Class A Bedding shall consist of a continuous concrete cradle as determined by the Engineer.

B. Class B Bedding: The pipe shall be bedded with No. 57 stone bedding material placed on the trench foundation. The bedding shall have a minimum thickness beneath the pipe of 4 inches or one-eighth of the outside diameter of the pipe, whichever is greater, and shall extend up the side to the springline. Initial backfill from the pipe horizontal centerline to a level not less than 12 inches above the top of the pipe and shall be bedding material or carefully placed native soil, compacted to 90% of Standard Proctor Density. The final backfill of the soil to ground surface shall be compacted to the specified density.

C. Class C Bedding: The pipe shall be bedded in No. 57 stone bedding material placed on the trench foundation. The bedding shall have a minimum thickness beneath the pipe of 4 inches or one-eighth of the outside diameter of the pipe, whichever is greater, and shall extend up the sides of the pipe one-sixth the outside diameter of the pipe. Initial backfill between the top of haunching and a point 12 inches above the top of pipe shall be compacted to 90% of Standard Proctor Density. The final backfill of the soil to ground surface shall be compacted to the specified density.

D. Crushed stone utilized for bedding and haunching shall meet the requirements of the Georgia Department of Transportation Specification 800.01, Group I (limestone, marble or dolomite) or Group II (quartzite, granite or gneiss). Stone size shall be between No. 57 and No. 4, inclusive.

2.03 TRENCH FOUNDATION MATERIALS

When unsuitable material is encountered and extends more than 6 inches below the pipe. Crushed stone shall be utilized for trench foundation (trench stabilization) and shall meet the requirements of the Georgia Department of Transportation Specification 800.01, Group I (limestone, marble or dolomite) or Group II (quartzite, granite or gneiss). Stone size shall be between No. 57 and No. 4, inclusive or Class I material.

2.04 FILTER FABRIC

A. Filter fabric associated with bedding shall be a UV stabilized, spunbonded, continuous filament, needle punched, polypropylene, nonwoven geotextile.

B. The fabric shall have an equivalent open size (EOS or AOS) of 120 - 70. The fabric shall also conform to the minimum property values listed in the following table:

Fabric Property	Unit	Test Procedure	Minimum Value
Grab Strength	lbs.	ASTM D 4632	160
Grab Elongation	%	ASTM D 4632	>50
Tear Strength	lbs.	ASTM D 4533	60
Puncture Resistance	lbs.	ASTM D 4833	115
Permittivity	sec^{-1}	ASTM D 4491	1.5
Water Flow Rate	gpm/ft^2	ASTM D 4491	100
UV Resistance (500 hrs)	%	ASTM D 4355	>80

C. If ordered by the Engineer, the filter fabric manufacturer shall furnish the services of a competent factory representative to supervise and/or inspect the installation of pipe. This service will be furnished for a minimum of 10 days during initial pipe installation.

D. Filter fabric shall be Mirafi 160N, DuPont SF 65, or equal.

2.05 BEDDING AND HAUNCHING MATERIALS

A. Crushed stone utilized for bedding and hunching shall meet the requirements of the Georgia Department of Transportation Specification 800.01, Group I (limestone, marble or dolomite) or Group II (quartzite, granite or gneiss). Stone size shall be between No. 57 and No. 4, inclusive.

B. Earth materials shall be suitable materials selected from the trench excavation. Suitable materials shall be clean and free of rock larger than 2-inches at its largest dimension, organics, cinders, stumps, limbs, frozen earth or mud, man-made wastes and other unsuitable materials. Should the material excavated from the trench be saturated, the saturated material may be used as earth material, provided it is allowed to dry properly and it is capable of meeting the specified compaction requirements.

When necessary, earth bedding and haunching materials shall be moistened to facilitate compaction by tamping.

2.06 INITIAL BACKFILL

A. Initial backfill material shall be earth materials or crushed stone as specified for bedding and haunching materials. Soil shall be tamped to 90% of Standard Proctor Density (ASTM D698).

B. Earth materials utilized for initial backfill shall be suitable materials selected from materials excavated from the trench. Suitable materials shall be clean and free of rock larger than 2-inches at its largest dimension, organics, cinders, stumps, limbs, frozen earth or mud, man-made wastes and other unsuitable materials. Should the material excavated from the trench be saturated, the saturated material may be used as earth material, provided it is allowed to dry properly and it is capable of meeting the specified compaction requirements. When necessary, initial backfill materials shall be moistened to facilitate compaction by tamping. If materials excavated from the trench are not suitable for use as initial backfill material, provide select material conforming to the requirements of this Section.

2.07 FINAL BACKFILL

A. Final backfill material shall be general excavated earth materials, shall not contain rock larger than 2-inches at its greatest diameter, cinders, stumps, limbs, man-made wastes and other unsuitable materials. If materials excavated from the trench are not suitable for use as final backfill material, provide select material conforming to the requirements of this Section.

B. In areas not used for streets or driveways, carefully refill in layers not exceeding 8 inches in thickness and thoroughly tamp with hand tamps to one foot above the top of the pipe. Finish filling by machine without tamping. As trench settles, bring back to grade by adding more material. Maintain trenches in safe condition at all times. Restore all special grassing and shrubbery, fences, etc., to original condition. The remaining backfill shall be thoroughly compacted in 8 inch layers to at least 95% (percent) of the Standard Proctor Density (ASTM D698).

C. In streets, roadways and driveways, carefully refill in layers not exceeding 8 inches in thickness and thoroughly tamp with hand tamps to one foot above the top of the pipe. The remaining backfill shall be thoroughly compacted in 8 inch layers to at least 98% (percent) of the Standard Proctor Density (ASTM D698).

D. Backfilling and tamping work in state highway right-of-ways and streets under jurisdiction of the State Highway Department will be in accordance with the State of Georgia Department of Transportation "Policy and Procedure for Accommodation of Utilities".

2.08 CONCRETE

Concrete for bedding, haunching, initial backfill or encasement shall have a compressive strength of not less than 3,000 psi, with not less than 5.5 bags of cement per cubic yard and a slump between 3 and 5-inches. Ready-mixed concrete shall be mixed and transported in accordance with ASTM C 94. Reinforcing steel shall conform to the requirements of ASTM A 615, Grade 60.

2.09 FLOWABLE FILL

Flowable fill, where required for trench backfill, shall meet the requirements of Georgia Department of Transportation Standard Specifications, Section 600 for Excavatable or Non-Excavatable type.

PART 3 EXECUTION

3.01 EXAMINATION

A. Identify required lines, levels, contours, and datum locations.

B. Locate, identify, and protect utilities that remain and protect from damage. The contractor is required to contact the Utilities Protection Center, Inc. in the State of Georgia call 811 prior to any excavation or construction. Additional information is available at www.gaupc.com. The contractor shall first, Call Before You Dig. Second, Wait the Required Amount of Time. Third, Respect the Marks and Lastly, Dig With Care.

C. Notify utility company to remove and relocate utilities.

3.02 TRENCH EXCAVATION

A. Notify of unexpected subsurface conditions and discontinue affected Work in area until notified to resume work.

B. Slope banks of excavations deeper than 4 feet to angle of repose or less until shored.

C. Do not interfere with 45 degree bearing splay of foundations.

D. Cut trenches O.D of pipe plus two feet minimum or O.D. of pipe plus four feet maximum wide enough to allow installation and inspection of utilities.

E. Hand trim excavations. Remove loose matter.

F. Remove large stones and other hard matter which could damage piping or impede consistent backfilling or compaction.

G. Remove lumped subsoil, boulders, and rock up to 1/3 cu yd (0.25 cu m) measured by volume.

H. Remove excavated material that is unsuitable for re-use from site.

I. Stockpile excavated material to be re-used in areas designated on site.

J. Remove excess excavated material from site.

K. In areas not used for streets and in unpaved streets, maximum trench width shall be the pipe diameter plus 24 inches. Protect all trees, shrubs and structures. Protect all fences and replace those damaged/removed with like kind. Keep work and equipment within easement limits. Repair and replace any damage.

L. Paved streets shall have a maximum trench width of pipe diameter plus 24 inches. Shore and brace trench walls as necessary to prevent damage to existing paving. Do not cut existing sidewalk, or curb and gutter without approval by the Engineer. Use rubber tired equipment only on streets. Repair and replace all damage. Saw cut all pavements for smooth edge on replacement.

3.03 DEWATERING REQUIREMENT

A. The Contractor may use any dewatering method he deems feasible so long as it results in working in the dry and stable soil conditions.

B. The Contractor shall conform and meet all conditions, obtain necessary permits and requirements of the regulatory agencies that have jurisdiction.

C. It is the intent of these specifications that an adequate dewatering system be installed to lower and control the groundwater in order to permit excavation, construction, grading and the placement of fill materials, all to be performed under dry conditions. The dewatering system shall be adequate to pre-drain the water-bearing strata above and below the bottom of the excavation.

D. The Contractor shall be solely responsible for the arrangement, location and depths of dewatering system necessary to accomplish the work described under this section of the specifications. The dewatering shall be accomplished in a manner that will reduce the hydrostatic head below any excavation to the extent that the water level in the construction area are a minimum of two (2) feet below the prevailing excavation surface and any surface to be compacted; will prevent the loss of fines, seepage, boils, quick conditions, or softening of the foundation strata; will maintain stability of the sides and bottom of the excavation; and will result in all construction operations being performed in the dry.

E. The Contractor shall promptly dispose of all water removed from the excavations in such a manner as will not endanger public health, damage public or private property, or affect adversely any portion of the work under construction or completed by him or any other Contractor. Contractor shall obtain written permission from the Owner for any property involved before digging ditches or constructing water courses for the removal of water.

F. The disposal of water from the dewatering system shall meet the requirements of all regulatory agencies having jurisdiction.

G. If the dewatering requirements are not satisfied due to inadequacy or failure of the dewatering system, then loosening of the foundation strata, or instability of the

slopes, or damage to the foundations or structures may occur. The supply of all labor and materials, and the performance of all work necessary to carry out additional work for reinstatement of the structures of foundation soil resulting from such inadequacy or failure shall be undertaken by the Contractor subject to the approval of the Engineer, and at no additional expense to the Owner.

3.04 ROCK EXCAVATION

A. Definition of Mass Rock (only for payment purposes where payment is on a unit quantity basis): Any material which cannot be excavated with a single-tooth ripper drawn by a crawler tractor having a minimum draw bar pull rated at not less than 56,000 pounds (comparable to Caterpillar D 8K or comparable to Caterpillar 973 front-end loader, and occupying an original volume of at least one cubic yard). The Engineer shall be the sole determinate as to the limits to which the material is classified as rock.

B. Definition of Trench Rock (only for payment purposes where payment is on a unit quantity basis): Any material which cannot be excavated with a backhoe having a bucket curling force rated at not less than 25,700 pounds (Caterpillar Model 225 or equivalent), and occupying an original volume of at least one-half (1/2) cubic yards.

C. Excavation: Where rock is encountered within excavation for structures, it shall be excavated to the lines and grades indicated on the Drawings or as otherwise directed by the Engineer. The Contractor shall be responsible for obtaining any blasting permits required.

D. Blasting: Blasting operations shall be conducted in accordance with all existing ordinances and regulations. All structures shall be protected from the effects of the blast. Blasting shall be performed and supervised by qualified and licensed workers. Dispose of excavated rock in accordance with applicable federal, state, county and local regulations. All blasting within 750 ft of an inhabited structure and or roadway must be siesmic monitored for ground and air vibrations. Peak Particle Velocity shall be measured at nearest structure and shall be 0.5 inch per second or less during blasts. Shots must be covered with at least 6 feet of earthen and synthetic cover (blasting mats). Bore hole diameter must not exceed 4” in diameter. Blast hole cannot exceed 20 feet of solid rock with single delay detonator (in terms, if drill depth exceeds more than 20 feet in depth, decking must be done, accomplish by using multiple detonators in the blast hole. The blast holes must be stemmed with gravel, 89/57 stone. Pre-blast inspections are required. Inspections shall be via an engineer that includes inspection of structure, and pictures of any existing damage or cracks that structure may have prior to blasting.

E. If excess excavation is made or the material becomes disturbed so as to require removal below final subgrade elevations or beyond the prescribed limits, the resulting space shall be refilled with concrete in accordance with Section 2.08 of this Specification

F. Measurement for Payment

All rock excavation shall be paid for as an incidental part of the item on which the work is done except where a separate, unqualified item for rock excavation is indicated in the BID FORM or where rock excavation is ORDERED as an EXTRA by the OWNER, by WRITTEN ORDER. Where payment for rock excavation is established by the BID FORM or ORDERED as an EXTRA by the OWNER, CONTRACTOR shall be paid only for the quantity of rock removed, measured as follows:

1. For all masonry structures such as buildings, tanks, vaults, catch basins, manholes and the like, the horizontal rock measurement shall be made to include 2-1/2 feet from the outside face of finished vertical sidewall of such structure and the vertical rock measurement shall be made from the top elevation of the rock, before disturbed or removed, to the elevation of the under or lower side of the bottom concrete slab of the structure. Any projection below the bottom slab of any structure required for sump, well, or other pertinent construction shall be measured separately.

2. For installation of pipe lines and fittings the horizontal rock measurement shall be the nominal outside diameter of the pertinent pipe plus 16-inches, except, however, that no horizontal measurement shall be considered to be less than 48-inches; the vertical rock measurement shall be made from the top elevation of the rock, before disturbance or removal, to an elevation of 9-inches below the bottom outside surface of the pipe for pipe having a diameter of 8-inches through 24-inches, and to an elevation of 12-inches below the bottom outside surface of the pipe for all pipe having a diameter greater than 24-inches.

G. Excess Rock Excavation

If rock excavated beyond the limits of payment indicated on the Drawings, specified, or authorized in writing by the OWNER, the excess excavation whether resulting from overbreakage or other causes, shall be backfilled, by and at the expense of the CONTRACTOR.

H. Shattered Rock

If rock below normal depth is shattered due to drilling or blasting operations and such shattered rock is unfit for foundations, the shattered rock shall be removed and the excavation shall be backfilled as described above in EXCESS ROCK EXCAVATION. All such removal and backfilling shall be done at the expense of the CONTRACTOR.

3.05 SHEETING, BRACING AND SHORING

A. Trench Shield: A trench shield or box may be used to support the trench walls. The use of a trench shield does not necessarily preclude the additional use of bracing and sheeting. When trench shields are used, care must be taken to avoid

disturbing the alignment and grade of the pipe or disrupting the haunching of the pipe as the shield is moved. When the bottom of the trench shield extends below the top of the pipe, the trench shield will be raised in 6-inch increments with specified backfilling occurring simultaneously. At no time shall the trench shield be "dragged" with the bottom of the shield extending below the top of the pipe or utility.

B. Remove bracing and sheeting in units when backfill reaches the point necessary to protect the utility and adjacent property. Leave sheeting in place when in the opinion of the Engineer it cannot be safely removed or is within three feet of an existing structure, utility, or pipeline. Cut off any sheeting left in place at least two feet below the surface.

C. Sheet piling within three feet of an existing structure or utility shall remain in place, unless otherwise directed by the Engineer.

3.06 TRENCH FOUNDATION AND STABILIZATION

A. The bottom of the trench shall provide a foundation to support the utility and its specified bedding. The trench bottom shall be graded to support the utility and bedding uniformly throughout its length and width.

B. If, after dewatering as specified above, the trench bottom is spongy, or if the trench bottom does not provide firm, stable footing and the material at the bottom of the trench will still not adequately support the utility, the trench will be determined to be unsuitable.

C. If in the opinion of the Engineer the undisturbed material at the trench bottom constitutes an unstable pipe foundation, then the Contractor shall replace such unstable materials with crushed stone.

D. If the crushed stone does not provide adequate foundation, then the trench shall be excavated to a depth of at least two feet below the specified trench bottom. The over excavation shall be filled with No. 4 foundation stone to the bottom of the bedding stone or the over excavation shall be lined with filter fabric, with the fabric being supported along the sides of the trench to a point above the top of the utility. The trench shall then be filled with No. 57 foundation stone to the top of the pipe and the filter fabric shall be overlapped above the pipe and stone.

3.07 BEDDING AND HAUNCHING

A. Prior to placement of bedding material, the trench bottom shall be free of any water, loose rocks, boulders or large dirt clods.

B. Bedding material shall be placed to provide uniform support along the bottom of the pipe and to maintain the pipe at the proper elevation. The initial layer of bedding placed to receive the pipe shall be brought to the grade and dimensions indicated on the Drawings. All bedding shall extend the full width of the trench bottom. The pipe shall be placed and brought to grade by tamping the bedding material or by removal

of the excess amount of the bedding material under the pipe. Adjustment to grade line shall be made by scraping away or filling with bedding material. Wedging or blocking up of pipe shall not be permitted. Applying pressure to the top of the pipe, such as with a backhoe bucket, to lower the pipe to the proper elevation or grade shall not be permitted. Each pipe section shall have a uniform bearing on the bedding for the length of the pipe, except at joints.

C. At each joint, excavate bell holes of ample depth and width to permit the joint to be assembled properly and to relieve the pipe bell of any load.

D. After the pipe section is properly placed, add the haunching material to the specified depth. The haunching material shall be shovel sliced, tamped, vigorously chinked or otherwise consolidated to provide uniform support for the pipe barrel and to fill completely the voids under the pipe, including the bell hole. Prior to placement of the haunching material, the bedding shall be clean and free of any water, loose rocks, boulders or dirt clods.

E. Gravity Pipelines and Accessories: Lay PVC (plastic pipe) gravity sewer pipe with minimum Class B bedding. Lay all other gravity sewer pipelines with Class C bedding, unless shown or specified otherwise. All trenches under paving, concrete, etc. shall be placed in Class B bedding only.

F. Bedding for storm drain piping shall be as specified in Section 33 40 00 Storm Drainage Piping.

G. Manholes: Excavate to a minimum of 12-inches below the planned elevation of the base of the manhole. Place and compact crushed stone bedding material to the required grade before constructing the manhole.

H. Pressure Mains

Bedding and haunching for pressure pipe shall be with Class II or III soils compacted to 90% of standard proctor density. All trenches under paving, concrete, etc. shall be placed in Class B bedding only.

I. Excessive Width and Depth

3. If the trench is excavated in excess of the pipe diameter plus two feet, provide the next higher bedding type.

4. If the trench is excavated to excessive depth, provide foundation stone to the bottom of the bedding material.

J. Compaction: Bedding and haunching materials under pipe, manholes and accessories shall be compacted to a minimum of 95 percent of the maximum dry density, unless shown or specified otherwise.

3.08 CONCRETE ENCASEMENT FOR PIPELINES

Where concrete encasement is shown on the Drawings for pipelines not under structures, excavate the trench to provide a minimum of 6-inches clearance from the bell of the pipe. Lay the pipe to line and grade on concrete blocks. In lieu of bedding, haunching and

initial backfill, place concrete to the full width of the trench and to a height of not less than 6-inches above the pipe bell. Do not backfill the trench for a period of at least 24 hours after concrete is placed.

3.09 CONCRETE ENCASEMENT FOR ELECTRICAL DUCT BANKS

A. Install top of duct bank minimum 18-inches below finished grade with plastic warning tape 12-inches below finished grade.

B. Terminate conduit in end bell at manhole entries.

C. Stagger conduit joints in concrete encasement 6-inches minimum.

D. Provide minimum 3-inch concrete cover at bottom, top, and sides of duct bank. Use suitable separators and chairs installed not greater than four feet on center to provide conduit spacing as indicated. Securely anchor conduit to prevent movement during concrete placement.

E. Where duct bank passes beneath footings or slabs, excavate to provide a minimum of 6-inches clearance between the conduits and the structure. Backfill to the base of the structure with concrete.

3.10 INITIAL BACKFILL

A. Fill up to subgrade elevations unless otherwise indicated.

B. Employ a placement method that does not disturb or damage other work.

C. Systematically fill to allow maximum time for natural settlement. Do not fill over porous, wet, frozen or spongy subgrade surfaces.

D. Maintain optimum moisture content of fill materials to attain required compaction density.

E. Granular Fill: Place and compact materials in equal continuous layers not exceeding 6 inches compacted depth.

F. Soil Fill: Place and compact material in equal continuous layers not exceeding 8 inches compacted depth.

G. Correct areas that are over-excavated.

1. Thrust bearing surfaces: Fill with concrete.

2. Other areas: Use general fill, flush to required elevation, compacted to minimum 98 percent of standard proctor dry density.

H. Compaction Density Unless Otherwise Specified or Indicated:

1. Under paving, slabs-on-grade, and similar construction: 98 percent of standard proctor density.

2. At other locations: 95 percent of standard proctor density.

3.11 FINAL BACKFILL

A. Backfill to contours and elevations indicated using suitable materials.

B. Employ a placement method that does not disturb or damage other work.

C. Systematically fill to allow maximum time for natural settlement. Do not fill over porous, wet, frozen or spongy subgrade surfaces.

D. Maintain optimum moisture content of fill materials to attain required compaction density.

E. Granular Fill: Place and compact materials in equal continuous layers not exceeding 6 inches compacted depth.

F. Soil Fill: Place and compact material in equal continuous layers not exceeding 8 inches compacted depth.

G. Slope grade away from building minimum 2 inches in 10 ft, unless noted otherwise. Make gradual grade changes. Blend slope into level areas.

H. Compaction Density Unless Otherwise Specified or Indicated:

1. Under paving, slabs-on-grade, and similar construction: 98 percent of standard proctor density.

2. At other locations: 95 percent of standard proctor density.

I. Reshape and re-compact fills subjected to vehicular traffic.

3.12 TOLERANCES

A. Top Surface of General Backfilling: Plus or minus 1 inch from required elevations.

B. Top Surface of Backfilling Under Paved Areas: Plus or minus 1 inch from required elevations.

3.13 CLEAN-UP

A. Leave unused materials in a neat, compact stockpile.

B. Remove unused stockpiled materials, leave area in a clean and neat condition. Grade stockpile area to prevent standing surface water.

C. Leave borrow areas in a clean and neat condition. Grade to prevent standing surface water.

END OF SECTION

SECTION 32 12 00

FLEXIBLE PAVING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Aggregate base course.

B. Single course bituminous concrete paving.

C. Double course bituminous concrete paving.

D. Surface sealer.

1.02 RELATED SECTIONS

A. Section 33 05 13 - Manholes and Structures

B. Section 32 11 00 – Base Courses

1.03 SUBMITTALS

A. Material Certificates: Provide copies of materials certificates signed by material producer and Contractor, certifying that each material item complies with, or exceeds, specified requirements.

B. Mix Design: Submit proposed mix design for each type of asphalt for review and acceptance prior to begging work.

1.04 REFERENCES

A. AI MS-2 - Mix Design Methods for Asphalt Concrete and Other Hot-Mix Types; The Asphalt Institute; latest edition.

B. AI MS-19 - A Basic Asphalt Emulsion Manual; The Asphalt Institute; latest edition.

C. ASTM D 946 - Standard Specification for Penetration-Graded Asphalt Cement for Use in Pavement Construction; 1982 (Reapproved 1999) or latest edition.

D. Georgia Department of Transportation Standard Specifications Construction of Roads and Bridges; latest edition.

1.05 SITE CONDITIONS

A. Weather Limitations:

1. Apply prime and tack coats when ambient temperature is above 50 deg. F (10 deg. C), and when temperature has not been below 35 deg. F (1 deg. C) for 12 hours immediately prior to application. Do not apply when base is wet or contains an excess of moisture.

2. Construct asphalt concrete surface course when atmospheric temperature is above 40 deg. F (4 deg. C), and when base is dry. Base course may be placed when air temperature is above 30 deg. F (-1 deg. C) and rising.

B. Grade Control: Establish and maintain required lines and elevations.

1.06 QUALITY ASSURANCE

A. Perform Work in accordance with Georgia Department of Transportation (GDOT) standard specifications, latest edition.

B. Mixing Plant: Conform to GDOT standard specifications, latest edition.

C. Obtain materials from same source throughout.

1.07 REGULATORY REQUIREMENTS

Conform to applicable code for paving work on public property.

PART 2 PRODUCTS

2.01 MATERIALS

A. Asphalt Cement: GDOT Section 400, ASTM D 946.

B. Aggregate for Base Course: GDOT Standards. Section 802

C. Aggregate for Binder Course: In accordance with GDOT standards. Section 802.

D. Aggregate for Wearing Course: In accordance with GDOT standards. Section 802.

E. Fine Aggregate: In accordance with GDOT standards. Section 802

F. Mineral Filler: Finely ground particles of limestone, hydrated lime or other mineral dust, free of foreign matter.

G. Primer: In accordance with GDOT standards, AASHTO M 82 (ASTM D 2027) MC-30, MC-70 or MC-250 .

H. Tack Coat: Homogeneous, medium curing, liquid asphalt. Conforming to Section 413 of the Georgia Department of Transportation Standard Specification.

2.02 ASPHALT PAVING MIXES AND MIX DESIGN

A. Use dry material to avoid foaming. Mix uniformly.

B. Base Course: 8” Graded Aggregate Base (GAB).

C. Binder Course: 2” (220 lb/sy) 19 mm Superpave or as directed by the Engineer.

D. Wearing Course: 2” (220 lb/sy) 12.5 mm Superpave or as directed by the Engineer.

E. Submit proposed mix design of each class of mix for review prior to beginning of work.

2.03 SOURCE QUALITY CONTROL

Test mix design and samples in accordance with AI MS-2.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that compacted subgrade is dry and ready to support paving and imposed loads.

B. Verify gradients and elevations of base are correct.

3.02 BASE COURSE

A. Place and compact base course and demonstrate satisfactory proof roll prior to proceeding with asphalt work.

B. Section 32 11 00 - Base Courses forms the base construction for work of this section.

3.03 PREPARATION - PRIMER

A. Apply primer in accordance with manufacturer's instructions.

B. Apply primer on aggregate base or subbase at uniform rate of 0.15 to 0.30 gal/sy.

C. Apply primer to contact surfaces of curbs, gutters, and existing asphalt.

D. Use clean sand to blot excess primer.

3.04 PREPARATION - TACK COAT

A. Apply tack coat in accordance with manufacturer's instructions.

B. Apply tack coat on asphalt or concrete surfaces over subgrade surface at uniform rate of 0.05 to 0.10 gal/sy.

C. Apply tack coat to contact surfaces of curbs, gutters and existing asphalt.

D. Coat surfaces of manhole frames with oil to prevent bond with asphalt pavement. Do not tack coat these surfaces.

3.05 PLACING ASPHALT PAVEMENT

A. General: Place asphalt concrete mixture on prepared surface, spread and strike-off. Spread mixture at minimum temperature of 280 to 325 degrees F. Place inaccessible and small areas by hand. Place each course to required grade, cross-section, and compacted thickness. Place asphalt binder course approximately 72 hours after applying primer.

B. Joints: Make joints between old and new pavements, or between successive days' work, to ensure continuous bond between adjoining work. Construct joints to have same texture, density and smoothness as other sections of asphalt concrete course. Clean contact surfaces and apply tack coat.

C. Place binder course to 2 inch compacted thickness, or as shown on the plans.

D. Place wearing course to 2 inches compacted thickness, or as shown on the plans.

E. Install gutter drainage grates and frames in correct position and elevation.

3.06 ROLLING

A. Begin rolling when mixture will bear roller weight without excessive displacement.

B. Compact mixture with hot hand tampers or vibrating plate compactors in areas inaccessible to rollers.

C. Accomplish breakdown or initial rolling immediately following rolling of joints and outside edge. Check surface after breakdown rolling, and repair displaced areas by loosening and filling, if required, with hot material.

D. Follow breakdown rolling as soon as possible, while mixture is hot. Continue second rolling until mixture has been thoroughly compacted.

E. Perform finish rolling while mixture is still warm enough for removal of roller marks. Continue rolling until roller marks are eliminated and course has attained maximum density.

F. Remove and replace paving areas mixed with foreign materials and defective areas. Cut-out such areas and fill with fresh, hot asphalt concrete. Compact by rolling to maximum surface density and smoothness.

G. After final rolling, do not permit vehicular traffic on pavement until it has cooled and hardened.

H. Erect barricades to protect paving from traffic until mixture has cooled enough not to become marked.

3.07 WHEEL STOPS

Secure wheel stops to asphalt concrete surface with not less than two 3/4" diameter galvanized steel dowels embedded in precast concrete at 1/3 points. Size length of dowel to penetrate at least 6" into asphalt concrete. Drill placement holes oversize and embed dowels in hot bituminous grout material.

3.08 REMOVE AND REPLACE PAVEMENT

Pavement and base course which must be removed for constructing sewers, manholes, force mains, water lines, and all other appurtenances in streets shall be replaced with the paving section shown on the drawings or match the existing pavement section. The pavement shall be removed to neat lines cut by a masonry saw. The top 18 inches of subgrade material immediately under the paving base and also road should shall be carefully removed and kept separate from the rest of the excavated material. This material shall be placed in the top 18 inches of the backfill. Further compaction shall be accomplished by leaving the backfilled trench open to traffic while maintaining the surface with crushed stone or gravel. Settlement in trenches shall be refilled with crushed stone or gravel, and such maintenance shall continue until replacement of pavement.

3.09 TOLERANCES

A. Flatness: Maximum variation of 1/4 inch (6 mm) measured with 10-foot (3 m) straight edge.

B. Compacted Thickness: Within 1/4 inch (6 mm) of specified or indicated thickness.

C. Variation from True Elevation: Within 1/2 inch (12 mm).

3.10 FIELD QUALITY CONTROL

A. See Section 01 45 29 – Testing Laboratory Services.

B. Thickness: In-place compacted thickness of hot-mix asphalt courses will be determined according to ASTM D 3549. In-place compacted thickness will not be acceptable if exceeding following allowable variation from required thickness:

1. Base Course: 1/2", plus or minus.
2. Surface Course: 1/4", plus or minus.
3. Surface Smoothness: Test finished surface of each asphalt concrete course for smoothness, using 10' straightedge applied parallel with, and at right angles to centerline of paved area. Surfaces will not be acceptable if exceeding the following tolerances for smoothness.
4. Base Course Surface: 1/2".

5. Wearing Course Surface: 1/4".

6. Crowned Surfaces: Test with crowned template centered and at right angle to crown. Maximum allowable variance from template, 1/4".

7. Check surface areas at intervals as directed by Engineer.

C. Provide field inspection and testing. Take samples and perform tests in accordance with AI MS-2. The density shall be at least 98% (ninety-eight percent) of the laboratory determined density.

D. In-Place Density: Testing agency will take samples of uncompacted paving mixtures and compacted pavement according to [**ASTM D 979**] [**or**] [**AASHTO T 168**].

1. Reference maximum theoretical density will be determined by averaging results from four samples of hot-mix asphalt-paving mixture delivered daily to site, prepared according to ASTM D 2041, and compacted according to job-mix specifications.

2. In-place density of compacted pavement will be determined by testing core samples according to ASTM D 1188 or ASTM D 2726.One core sample will be taken for every 1000 sq. yd. (836 sq. m) or less of installed pavement, with no fewer than 4 cores taken or as directed by the Engineer.

3. Or a field density of in-place compacted pavement may be determined by nuclear method according to ASTM D 2950 and correlated with ASTM D 1188 or ASTM D 2726.

3.11 PROTECTION

Immediately after placement, protect pavement from mechanical injury for 1 days or until surface temperature is less than 140 degrees F (60 degrees C).

END OF SECTION

SECTION 32 92 19

SEEDING

PART 1 GENERAL

1.01 SCOPE

This section pertains to seeding work, including preparing the seedbed, furnishing and placing of topsoil, seed and other required materials for a complete installation to the limits of construction and specified herein. Seeding operations shall be performed on all newly graded earth areas not otherwise specified covered by structures, pavements and/or surfacings, riprap, sod, sprigging, walkways, and other items of a similar nature; on all cleared and/or grubbed areas which are to remain as finish grade surfaces and not to be excavated or embankments constructed thereon; on all existing off site and on site turfed earth surfaces which are disturbed by construction operations and which are to remain as finish grade surfaces; and at all other locations which may be designated on the drawings or specified herein. The contractor shall follow the GA DOT Standard Specifications Construction of Roads and Bridges Section 700, 882, 890 and 891 latest edition and/or pages 6-35 thru 6-60 of the Manual for Erosion and Sediment Control in Georgia (1975 and as amended in the latest edition).

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Erosion and Sedimentation Control - Section 02370

B. Sodding – Section 02921 (If Indicated on the Drawings)

PART 2 PRODUCTS

2.01 TOPSOIL

Topsoil for planting shall be a rich friable loam containing a large amount of humus and shall be original surface sandy loam, topsoil of good rich, uniform quality, free from any material such as hard clods, stiff clay, hardpan, partially disintegrated stone, pebbles larger than 1/2-inch in diameter, lime, cement, bricks, ashes, cinders, slag, concrete, bitumen or its residue, boards, sticks, chips, or other undesirable material harmful or unnecessary to plant growth. Topsoil shall be reasonably free from perennial weeds and perennial weed seeds, and shall not contain objectionable plant material, toxic amounts of either acid or alkaline elements or vegetable debris undesirable or harmful to plant life. Bermuda grass roots in topsoil will not be accepted, unless otherwise approved by the Engineer.

Topsoil shall be natural topsoil without admixture of subsoil material, and shall be classifiable as loam, silt loam, clay loam, or a combination thereof.

2.02 GRASS SEED

All seeds shall be labeled in accordance with U.S.D.A. Rules and Regulations. Seeds shall be packaged in suitable containers in accordance with the Georgia Seed Laws, Rules and Regulations currently in effect. No seed shall be used which has become molded, wet or otherwise damaged. Seed shall be tested by the Georgia Department of Agriculture for the purity and germination within six months prior to the date of sowing.

1. Grass seed on level or slightly sloping ground shall consist of the following for the planting dates specified:

   (a) March 1 to June 30

Common Bermuda (hulled)	10 lbs./acre
Tall Fescue	50 lbs./acre

   (b) August 1 to November 1

Tall Fescue	50 lbs./acre
Common Bermuda (unhulled)	10 lbs./acre

   (c) November 1 to March 1

Common Bermuda (unhulled)	10 lbs./acre

2. Grass seed on slopes 3:1 or steeper and infrequently mowed areas shall consist of the following for the planting dates specified:

   (a) March 1 to June 15

Weeping Lovegrass	5 lbs./acre
Sericea Lespedeza (scarified)	60 lbs./acre

   (b) August 1 to November 1

Tall Fescue	50 lbs./acre
Sericea Lespedeza (unscarified)	75 lbs./acre

   (c) November 1 to March 1

Common Bermuda (unhulled)	10 lbs./acre
Sericea Lespedeza (unscarified)	75 lbs./acre

When as directed by the Engineer, an approved quick growing species of grass seed such as rye, Italian rye, millet or other cereal grass, shall be applied at a rate of 30 lbs./acre in conjunction with and in addition to the seed mixture specified above.

2.03 SPRIGS

Bermuda, common, healthy living stolons native to locality of project. Plant on day of removal from growing location. Plant sprigs from March 15 to July 15.

2.04 MULCH

A. Dry Mulch: Dry mulch shall be straw or hay, consisting of oat, rye or wheat straw, or of pangola, peanut, coastal Bermuda or Bahia grass hay. Only undeteriorated

mulch which can be readily cut into the soil shall be used. Application rate shall be 2 ½ tons per acre.

B. Mulch for hydroseeding: This material shall consist of wood cellulose fiber applied at 500 lbs./acre with dye color equal to Weyerhauser Company, or Conway Corporation material used for "hydroseeding" and suitable for this purpose.

2.05 FERTILIZER

Fertilizer shall be of an accepted and approved commercial brand. Fertilizer shall be a ready mixed material containing the soil nutrients as specified and in a suitable form compatible with the equipment used to achieve uniform distribution of the fertilizer. The fertilizer mixture shall contain the following nutrients expressed in per cent of the total weight: 6% nitrogen, 12% available phosphoric acid, and 12% water soluble potash (6-12-12) analysis. Container tags shall have the name and address of the manufacturer, the brand name, net weight, and chemical composition of analysis. Fertilizer shall be applied at 1500 lbs./acre.

2.06 LIME

Agricultural lime shall be within the specifications of the Georgia Department of Agriculture. Ground limestone is calcitic or dolomitic limestone ground so that 90 percent of the material shall pass a 10-mesh sieve, not less that 50 percent will pass through a 50-mesh sieve and at least 25% shall pass a 100-mesh sieve. Lime shall be applied as indicated by soil test, or the rate of 1 to 2 tons per acre.

2.07 WATER

The water used in the grassing operations may be obtained from any approved spring, pond, lake, stream or municipal water system. The water shall be free of excess and harmful chemicals, acids, alkalies, or any substance which might be harmful to plant growth or obnoxious to traffic.

2.08 SOD

Shall be healthy living, disease and weed free grass that has been freshly cut.

PART 3 EXECUTION

3.01 HYDROSEEDING

A. The materials for grassing shall consist of a thoroughly mixed slurry of grass seed, fertilizer, lime and mulch as specified. The application rate for wood fiber mulch shall be approximately 500 lbs./acre. All materials shall be discharged within one hour after being combined in the hydroseeder.

B. Each kind of leguminous seed shall be inoculated separately with the appropriate commercial culture according to instructions of the manufacturer of the material. All inoculated seed shall be protected from the sun and shall be planted the same day it is inoculated.

C. Equipment for mixing and applying the slurry shall be especially designed for this purpose. It shall be capable of applying a uniform mixture over the entire area to be seeded. The slurry mixture shall be agitated during application to keep the ingredients thoroughly mixed. A suitable metering device to determine the rate of application and assist in obtaining uniform coverage of the grassed areas shall be incorporated as part of the equipment.

D. Ground preparation for hydroseeding shall be the same as for conventional seeding.

E. Hydroseeding shall not be performed when windy weather prevents even distribution; when the prepared surface is crusted; or when the ground is frozen, wet or otherwise in a non-tillable condition.

3.02 CONVENTIONAL SEEDING

A. Grading and Shaping

Grade and shape to finish contours and to allow practical use of equipment.

B. Seedbed Preparation

1. Broadcast plantings:

a. Tillage as a minimum shall: adequately loosen the soil to a depth of 4 to 6 inches; alleviate compaction; incorporate lime and fertilizer; smooth and firm the soil; allow for the proper placement of seed, sprigs, or plants; and allow for the anchoring of straw or hay mulch if a disk is to be used.

b. Tillage may be done with any suitable equipment.

c. Tillage may be done on the contour where feasible.

d. On slopes too steep for the safe operation of tillage equipment, the soil surface will be pitted or trenched across the slope with appropriate hand tools to provide a place 6 to 8 inches apart in which seed may lodge and germinate.

2. Individual plants:

a. Where individual plants are to be set, the soil will be well prepared by excavating holes, opening furrows, or dibble planting.

b. For nursery stock plants, holes shall be large enough to accommodate roots without crowding.

3.03 SPRIGS

Separate or shred and broadcast over area prepared for planting at 40 cu. ft. per acre. Harrow into ground with disc turned straight.

3.04 LIME/FERTILIZER APPLICATION

Lime and fertilizer will be applied uniformly during land preparation so that it will be mixed with the soil during seedbed preparation. On steep surfaces, scarify slope prior to broadcasting lime and fertilizer.

3.05 PLANTING

A. Seeding will be done on a freshly prepared and firmed seedbed. For broadcast planting, use a cultipacker-seeder, drill, rotary seeder, other mechanical seeder, or hand seeding to distribute the seed uniformly over the area to be treated. Cover the seed lightly with a cultipacker or other suitable equipment.

B. No-till seeding is permissible into annual cover crops when planting is done following maturity of the cover crop or if the temporary cover stand is sparse enough to allow adequate growth of the permanent species.

C. No-till seeding must be done with appropriate no-till seeding equipment. The seed must be uniformly distributed and planted at the proper depth.

3.06 MULCHING

All seeded areas shall be mulched. Soil retention blankets, erosion control netting, and other manufactured materials may be required in addition to mulch on unstable soils and concentrated flow areas. Mulch shall be spread uniformly within 24 hours after seeding.

3.07 WATER, MAINTENANCE AND RESEEDING

A. Contractor shall be responsible for maintaining the proper moisture content of the soil to insure adequate plant growth until a satisfactory stand of grass is obtained. Watering shall be performed to maintain an adequate water content in the soil.

B. **The Contractor shall mow and maintain all seeded areas without additional payment until final acceptance of the work by the Owner, and any regrading, refertilizing, reliming, reseeding or remulching shall be done at his own expense.** Seeding work shall be repeated on defective areas until a satisfactory uniform stand of grass is accomplished. A satisfactory stand of grass is defined as grass that covers at least 98% of the total area with no bare spots larger than one square foot and bare spots shall be scattered such that bare areas do not comprise more than 1/100 of any given area. **Damage resulting from erosion, gulleys, washouts, or other causes shall be repaired by filling with topsoil, compacting, and repeating the seeding work at the Contractor's expense.**

3.08 SODDING

See Section 02921 Sodding for additional sod requirements. Smooth grade the specified area to be planted. Apply amendments and fertilizer requirements as determined in soil test. Planting area shall be free of stumps, roots, large stone over 4" diameter, and any other debris. Apply fertilizer and rake into the soil surface. Lightly wet soil surface if dry. Lay the sod at right angles to any major water flow. Sod shall be pinned and secured on slopes greater than 6:1. Sod joints shall be staggered between rows. Sod shall be watered after installation each day.

END OF SECTION

SECTION 33 05 05

BURIED PIPING INSTALLATION

PART 1 GENERAL

1.01 DESCRIPTION

A. Scope:

1. CONTRACTOR shall provide all labor, materials, equipment, and incidentals as shown, specified, and required to install and test all buried piping, fittings, and specials. The Work includes the following:

   a. All types and sizes of buried piping, except where buried piping installations are specified under other Sections or other contracts.

   b. Unless otherwise shown or specified, this Section includes all buried piping Work required, beginning at the outside face of structures or structure foundations, including piping beneath structures, and extending away from structures.

   c. Work on or affecting existing buried piping.

   d. Installation of all jointing and gasket materials, specials, flexible couplings, mechanical couplings, harnessed and flanged adapters, sleeves, tie rods, cathodic protection, and other Work required for a complete, buried piping installation.

   e. Supports, restraints, and thrust blocks.

   f. Pipe encasements, with the exception of piping embedded in concrete within a structure or foundation specified under Section 40 05 05, Exposed Piping Installation.

   g. Field quality control, including testing.

   h. Cleaning and disinfecting.

   i. Incorporation of valves, meters, and special items shown or specified into piping systems in accordance with the Contract Documents and as required.

B. Coordination:

1. Review installation procedures under this and other Sections and coordinate installation of items to be installed with or before buried piping Work.

2. Coordinate with appropriate piping Sections of Division 40, Process Integration.

3. Notify other contractors in advance of installing buried piping to provide them with sufficient time for installing items included in their contracts to be installed with or before buried piping installation Work.

1.02 REFERENCES

A. Standards referenced in this Section are:

1. ASME Boiler and Pressure Vessel Code.
2. ASME B31.3, Process Piping.
3. American Society for Non-Destructive Testing (ASNT), ASNT-TC-1A, Recommended Practice, Personnel Qualification, and Certification in Non-destructive Testing.
4. ASTM B32, Specification for Solder Metal.
5. ASTM C12, Practice for Installing Vitrified Clay Pipe Lines.
6. ASTM C425, Specification for Compression Joints for Vitrified Clay Pipe and Fittings.
7. ASTM C828, Test Method for Low-Pressure Air Test of Vitrified Clay Pipe Lines.
8. ASTM C924, Practice for Testing Concrete Pipe Sewer Lines by Low-Pressure Test Method.
9. ASTM D2321, Practice for Underground Installation of Thermoplastic Pipe for Sewers and other Gravity-Flow Applications.
10. ASTM D2774, Practice for Underground Installation of Thermoplastic Pressure Piping.
11. ASTM D4174, Practice for Cleaning, Flushing and Purification of Petroleum Fluid Hydraulic Systems.
12. ASTM F1417, Test Method for Installation Acceptance of Plastic Gravity Sewer Lines using Low-Pressure Air.
13. ASTM F2164, Standard Practice for Field Leak Testing of Polyethylene (PE) Pressure Piping Systems Using Hydrostatic Pressure.
14. ANSI/AWWA C105, Polyethylene Encasement for Ductile-Iron Pipe Systems.
15. ANSI/AWWA C111, Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
16. ANSI/AWWA C206, Field Welding of Steel Water Pipe.
17. ANSI/AWWA C600, Installation of Ductile-Iron Water Mains and Their Appurtenances.
18. ANSI/AWWA C603, Installation of Asbestos-Cement Pressure Pipe.

19. ANSI/AWWA C605, Underground Installation of Polyvinyl Chloride (PVC) Pressure Pipe and Fittings for Water.
20. ANSI/AWWA C606, Grooved and Shouldered Joints.
21. ANSI/AWWA C651, Disinfecting Water Mains.
22. AWWA M9, Concrete Pressure Pipe.
23. AWWA M11, Steel Water Pipe - A Guide for Design and Installation.
24. AWWA M23, PVC Pipe - Design and Installation.
25. AWWA M41, Ductile-Iron Pipe and Fittings.
26. AWWA M45, Fiberglass Pipe Design.
27. AWWA M55, PE Pipe - Design and Installation.
28. ASCE 37, Design and Construction of Sanitary and Storm Sewers.
29. American Concrete Pipe Association, Concrete Pipe Handbook.
30. Chlorine Institute, Inc., Piping Systems for Dry Chlorine, Pamphlet No. 6.
31. NFPA 24, Standard for the Installation of Private Fire Service Mains and Their Appurtenances.

1.03 QUALITY ASSURANCE

A. Regulatory Requirements:

1. Comply with requirements and recommendations of authorities having jurisdiction over the Work.
2. Obtain required permits for Work in roads, rights of way, railroads, and other areas of the Work.

1.04 SUBMITTALS

A. Action Submittals: Submit the following:

1. Shop Drawings:
    a. Laying schedules for concrete pipe and piping with restrained joints.
    b. Details of piping, specials, joints, harnessing and thrust blocks, and connections to piping, structures, equipment, and appurtenances.
2. Product Data:
    a. Manufacturer’s literature and specifications, as applicable, for products specified in this Section.
3. Testing Procedures:

a. Submit proposed testing procedures, methods, apparatus, and sequencing. Obtain ENGINEER's approval prior to commencing testing.

B. Informational Submittals: Submit the following:

1. Certificates:

a. Certificate signed by manufacturer of each product certifying that product conforms to applicable referenced standards.

2. Field Quality Control Submittals:

a. Results of each specified field quality control test.

C. Closeout Submittals: Submit the following:

1. Record Documentation:

a. Maintain accurate and up-to-date record documents showing modifications made in the field, in accordance with approved submittals, and other Contract modifications relative to buried piping Work. Submittal shall show actual location of all piping Work and appurtenances at same scale as the Drawings.

b. Show piping with elevations referenced to Project datum and dimensions from permanent structures. For each horizontal bend in piping, include dimensions to at least three permanent structures, when possible. For straight runs of piping provide offset dimensions as required to document piping location.

c. Include profile drawings with buried piping record documents when the Contract Documents include piping profile drawings.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Delivery:

1. Deliver materials to the Site to ensure uninterrupted progress of the Work.

2. Upon delivery inspect pipe and appurtenances for cracking, gouging, chipping, denting, and other damage and immediately remove from Site and replace with acceptable material.

B. Storage:

1. Store materials to allow convenient access for inspection and identification. Store material off ground using pallets, platforms, or other supports. Protect packaged materials from corrosion and deterioration.

2. Pipe and fittings other than PVC and CPVC may be stored outdoors without cover. Cover PVC and CPVC pipe and fittings stored outdoors.

C. Handling:

1. Handle pipe, fittings, specials, and accessories carefully in accordance with pipe manufacturer's recommendations. Do not drop or roll material off trucks. Do not drop, roll or skid piping.

2. Avoid unnecessary handling of pipe.

3. Keep pipe interiors free from dirt and foreign matter.

4. Protect interior linings and exterior coatings of pipe and fittings from damage. Replace pipe and fittings with damaged lining regardless of cause of damage.

PART 2 PRODUCTS

2.01 MATERIALS

A. Piping materials are specified in the Buried Piping Schedule at end of this Section. Piping materials shall conform to Specifications for each type of pipe and piping appurtenances in applicable Sections of Division 40, Process Interconnections.

B. General:

1. Pipe Markings:

a. Factory-mark each length of pipe and each fitting with designation conforming to those on approved laying schedules.

b. Manufacturer shall cast or paint on each length of pipe and each fitting pipe material, diameter, and pressure or thickness class.

C. Polyethylene Encasement:

1. Polyethylene may be supplied in tubes or sheets.

2. Polyethylene encasement materials shall be in accordance with ANSI/AWWA C105.

D. Cathodic Protection:

1. Bonding Cables: Bonding cable and test lead wires shall be not less than No. 6 AWG, Type CP copper cathodic protection cable, with low density, high molecular weight polyethylene insulation.

2. Test Lead Stations: Provide test lead stations where shown and indicated in the Contract Documents. Standard connection boxes for test lead stations shall be plastic terminal boxes, 18 inches long and five-inch inside diameter, with locking cast iron lid with "CP TEST" cast into cover. Inside terminal box shall be terminal block with seven terminals. Terminal box shall be manufactured by C.P. Test Services "NM-7" or equal.

2.02 BURIED PIPING IDENTIFICATION

A. Polyethylene Underground Warning Tape for Metallic Pipelines:

1. Tracer tape shall be of inert, acid- and alkali-resistant, polyethylene, four mils thick, six inches wide, suitable for direct burial. Tape shall be capable of stretching to twice its original length.

2. Message shall read, "CAUTION [insert customized name of pipe service, i.e., "POTABLE WATER", "SANITARY SEWER", "CHLORINE GAS", or other service as appropriate, as indicated in the Buried Pipe Schedule at the end of this Section] PIPE BURIED BELOW", with bold letters approximately two inches high. Messages shall be printed at maximum intervals of two feet. Tape shall be custom colored the same as pipeline colors specified for associated pipe service in Section 09 91 00, Painting.

3. Manufacturer: Provide products of one of the following:

   a. Brady Corporation

   b. Seton Identification Products

   c. Marking Services, Inc.

   d. Or equal.

B. Detectable Underground Warning Tape for Non-Metallic Pipelines:

1. Tape shall be of inert, acid- and alkali-resistant, polyethylene, five mils thick, six inches wide, with aluminum backing, and have 15,000 psi tensile strength and 80 percent elongation capability. Tape shall be suitable for direct burial.

2. Message shall read, "CAUTION [insert customized name of pipe service, i.e., "POTABLE WATER", "SANITARY SEWER", "CHLORINE GAS", or other appropriate service, as indicated in the Buried Pipe Schedule at the end of this Section] PIPE BURIED BELOW" with bold letters approximately two inches high. Messages shall be printed at maximum intervals of two feet. Tape shall be custom colored the same as the pipeline colors as specified for the associated pipe service in Section 09 91 00, Painting.

3. Manufacturer: Provide products of one of the following:

   a. Brady Corporation

   b. Seton Identification Products

   c. Marking Services, Inc.

   d. Or equal.

PART 3 EXECUTION

3.01 INSTALLATION

A. General:

1. Install piping as shown, specified, and as recommended by pipe and fittings manufacturer.

2. In event of conflict between manufacturer's recommendations and the Contract Documents, request interpretation from ENGINEER before proceeding.

3. ENGINEER will observe excavations and bedding prior to laying pipe by CONTRACTOR. Notify ENGINEER in advance of excavating, bedding, pipe laying, and backfilling operations.

4. Minimum cover over buried piping shall be (--1--) feet, unless otherwise shown or approved by ENGINEER.

5. Earthwork is specified in Section 31 23 16.

6. Excavation in excess of that required or shown, and that is not authorized by ENGINEER shall be filled at CONTRACTOR's expense with granular material furnished, placed, and compacted in accordance with Section 31 05 16, Aggregates for Earthwork.

7. Comply with NFPA 24 for "Outside Protection", where applicable to water piping systems used for fire protection.

B. Manufacturer's Installation Specialist:

1. Provide services of competent installation specialist of pipe manufacturer when pipe installation commences for:

a. Concrete pipe.

b. FRP pipe.

c. Thermoplastic pipe.

2. Retain installation specialist at the Site for minimum of (2--) days (eight hours per day at the Site) or until competency of pipe installation crew has been satisfactorily demonstrated.

C. Separation of Sewers and Potable Water Piping:

1. Horizontal Separation:

a. Where possible, existing and proposed potable water mains and service lines, and sanitary, combined, and storm sewers shall be separated horizontally by clear distance of at least ten feet.

b. If local conditions preclude the specified clear horizontal separation, installation will be allowed if potable water main is in separate trench or on undistributed earth shelf on one side of sewer

and with bottom of potable water main at least 18 inches above top of sewer.

c. Exception:

1) Where it is not possible to provide minimum horizontal separation described above, construct potable water main of cement-lined ductile iron pipe with restrained push-on joint or restrained mechanical joint pipe complying with public water supply design standards of authority having jurisdiction. Hydrostatically test water main and sewer as specified in this Section prior to backfilling. Hydrostatic test pressure at crossing shall be at least 150 psi.

2. Vertical Separation:

a. Provide minimum vertical distance of 18 inches between outside of potable water main and outside of sewer when sewer crosses over potable water main.

b. Center a section of potable water main pipe at least 17.5 feet long over sewer so that sewer joints are equidistant from potable water main joints.

c. Provide adequate structural support where potable water main crosses under sewer. At minimum, provide compacted select backfill for ten feet on each side of crossing.

d. Exceptions:

1) Where it is not possible to provide minimum vertical separation described above, construct potable water main of cement-lined ductile iron pipe with restrained push-on joint or restrained mechanical joint pipe. Hydrostatically test water main and sewer as specified in this Section, prior to backfilling. Hydrostatic test pressure at crossing shall be at least 150 psi.

2) Encase either potable water main or sewer in watertight carrier pipe extending ten feet on each side of crossing, measured perpendicular to potable water main.

D. Plugs:

1. Temporarily plug installed pipe at end of each day of work or other interruption of pipe installation to prevent entry of animals, liquids, and persons into pipe, and entrance or insertion of deleterious materials into pipe.

2. Install standard plugs in bells at dead ends, tees, and crosses. Cap spigot and plain ends.

3. Fully secure and block plugs, caps, and bulkheads installed for testing to withstand specified test pressure.

4. Where plugging is required for phasing of the Work or subsequent connection of piping, install watertight, permanent type plugs, caps, or bulkhead acceptable to ENGINEER.

E. Bedding Pipe: Bed pipe as specified and in accordance with details on the Drawings.

1. Trench excavation and backfill, and bedding materials shall conform to Section 31 23 16, as applicable.

2. Where ENGINEER deems existing bedding material unsuitable, remove and replace existing bedding with approved granular material furnished, placed, and compacted in accordance with Section 31 05 16, Aggregates for Earthwork. Payment for additional excavation and providing granular material will be made under the unit price payment items in the Contract.

3. Where pipe is installed in rock excavation, provide minimum of three inches of granular bedding material underneath pipe smaller than four-inch nominal diameter, and minimum of six inches of granular bedding material underneath pipes four-inch nominal diameter and larger.

4. Excavate trenches below bottom of pipe by amount shown and indicated in the Contract Documents. Remove loose and unsuitable material from bottom of trench.

5. Carefully and thoroughly compact pipe bedding with hand held pneumatic compactors.

6. Do not lay pipe until ENGINEER approves bedding condition.

7. Do not bring pipe into position until preceding length of pipe has been bedded and secured in its final position.

F. Laying Pipe:

1. Conform to manufacturer's instructions and requirements of standards and manuals listed below, as applicable:

a. Ductile Iron Pipe: ANSI/AWWA C600, ANSI/AWWA C105, AWWA M41.

b. Concrete Pipe: AWWA M9.

c. Steel Pipe: ANSI/AWWA C206, AWWA M11.

d. Thermoplastic Pipe: ASTM D2321, ASTM D2774, ANSI/AWWA C605, AWWA M23, AWWA M45, AWWA, M55.

e. Vitrified Clay Pipe: ASTM C12.

f. Sanitary and Storm Sewers: ASCE 37.

2. Install pipe accurately to line and grade shown and indicated in the Contract Documents, unless otherwise approved by ENGINEER. Remove and reinstall pipes that are not installed correctly.

3. Slope piping uniformly between elevations shown.

4. Keep groundwater level in trench at least (--1--) inches below bottom of pipe before laying pipe. Do not lay pipe in water. Maintain dry trench conditions until jointing and backfilling are complete. Keep clean and protect interiors of pipe, fittings, valves, and appurtenances.

5. Start laying pipe at lowest point and proceed towards higher elevations, unless otherwise approved by ENGINEER.

6. Place bell and spigot-type pipe so that bells face the direction of laying, unless otherwise approved by ENGINEER.

7. Place concrete pipe containing elliptical reinforcement with minor axis of reinforcement in vertical position.

8. Excavate around joints in bedding and lay pipe so that pipe barrel bears uniformly on trench bottom.

9. Deflections at joints shall not exceed 75 percent of amount allowed by pipe manufacturer, unless otherwise approved by ENGINEER.

10. For PVC and CPVC piping with solvent welded joints, 2.5-nch diameter and smaller, and copper tubing, snake piping in trench to compensate for thermal expansion and contraction.

11. Carefully examine pipe, fittings, valves, and specials for cracks, damage, and other defects while suspended above trench before installation. Immediately remove defective materials from the Site and replace with acceptable products.

12. Inspect interior of all pipe, fittings, valves, and specials and completely remove all dirt, gravel, sand, debris, and other foreign material from pipe interior and joint recesses before pipe and appurtenances are moved into excavation. Bell and spigot-type mating surfaces shall be thoroughly wire brushed, and wiped clean and dry immediately before pipe is laid.

13. Field cut pipe, where required, with machine specially designed for cutting the type of pipe being installed. Make cuts carefully, without damage to pipe, coating or lining, and with smooth end at right angles to axis of pipe. Cut ends on push-on joint type pipe shall be tapered and sharp edges filed off smooth. Do not flame-cut pipe.

14. Do not place blocking under pipe, unless specifically approved by ENGINEER for special conditions.

15. Touch up protective coatings in manner satisfactory to ENGINEER prior to backfilling.

16. Notify ENGINEER in advance of backfilling operations.

17. On steep slopes, take measures acceptable to ENGINEER to prevent movement of pipe during installation.

18. Thrust Restraint: Where required, provide thrust restraint conforming to Article 3.3 of this Section.

19. Exercise care to avoid flotation when installing pipe in cast in-place concrete, and in locations with high groundwater.

G. Polyethylene Encasement:

1. Provide polyethylene encasement for ductile iron piping to prevent contact between pipe and surrounding bedding material and backfill.

2. Polyethylene encasement installation shall be in accordance with ANSI/AWWA C105.

H. Jointing Pipe:

1. Ductile Iron Mechanical Joint Pipe:

a. Immediately before making joint, wipe clean the socket, plain end, and adjacent areas. Taper cut ends and file off sharp edges to provide smooth surface.

b. Lubricate plain ends and gasket with soapy water or manufacturer's recommended pipe lubricant, in accordance with ANSI/AWWA C111, just prior to slipping gasket onto plain end of the joint assembly.

c. Place gland on plain end with lip extension toward the plain end, followed by gasket with narrow edge of gasket toward plain end.

d. Insert plain end of pipe into socket and press gasket firmly and evenly into gasket recess. Keep joint straight during assembly.

e. Push gland toward socket and center gland around pipe with gland lip against gasket.

f. Insert bolts and hand-tighten nuts.

g. If deflection is required, make deflection after joint assembly and prior to tightening bolts. Alternately tighten bolts approximately 180 degrees apart to seat gasket evenly. Bolt torque shall be as follows:

Pipe Diameter (inches)	Bolt Diameter (inches)	Range of Torque (ft-lbs)
3	5/8	45 to 60
4 to 24	3/4	75 to 90
30 to 36	1	100 to 120
42 to 48	1.25	120 to 150

h. Bolts and nuts, except those of stainless steel, shall be coated with two coats, minimum dry film thickness of eight mils each, of high build solids epoxy or bituminous coating manufactured by Tnemec, or equal.

i. Restrained mechanical joints shall be in accordance with Section 40 23 00, Wastewater Process Piping.

2. Ductile Iron Push-On Joint Pipe:

   a. Prior to assembling joints, thoroughly clean with wire brush the last eight inches of exterior surface of spigot and interior surface of bell, except where joints are lined or coated with a protective lining or coating.

   b. Wipe clean rubber gaskets and flex gaskets until resilient. Conform to manufacturer's instructions for procedures to ensure gasket resiliency when assembling joints in cold weather.

   c. Insert gasket into joint recess and smooth out entire circumference of gasket to remove bulges and to prevent interference with proper entry of spigot of entering pipe.

   d. Immediately prior to joint assembly, apply thin film of pipe manufacturer's recommended lubricant to surface of gasket that will come in contact with entering spigot end of pipe, or apply a thin film of lubricant to outside of spigot of entering pipe.

   e. For assembly, center spigot in pipe bell and push pipe forward until spigot just makes contact with rubber gasket. After gasket is compressed and before pipe is pushed or pulled in the rest of the way, carefully check gasket for proper position around the full circumference of joint. Final assembly shall be made by forcing spigot end of entering pipe past gasket until spigot makes contact with base of the bell. When more than a reasonable amount of force is required to assemble the joint, remove spigot end of pipe to verify proper positioning of gasket. Do not use gaskets that have been scored or otherwise damaged.

   f. Maintain an adequate supply of gaskets and joint lubricant at the Site when pipe jointing operations are in progress.

3. Ductile Iron Proprietary Joints:

   a. Install pipe that utilizes proprietary joints for restraint specified in Section 40 23 00, Wastewater Process Piping, or other such joints, in accordance with manufacturer's instructions.

4. Ductile Iron Flanged Joints:

   a. Assemble flanged joints using ring-type gaskets, thickness as recommended by pipe manufacturer but not less than 1/8-inch thick, for raised face flanges. Use full face gaskets for flat face flanges, unless otherwise approved by ENGINEER or recommended by pipe manufacturer. Gaskets shall be suitable for service intended in accordance with manufacturer's ratings and instructions. Gaskets shall be properly centered.

b. Bolts shall be tightened as recommended by the manufacturer in sequence that ensures equal distribution of bolt loads.

c. Length of bolts shall be uniform. Bolts shall not project beyond the nut more than 1/4-inch when fully tightened. Bolts shall not fall short of the nut when fully taken up. Ends of bolts shall be machine cut and neatly rounded. Do not use washers.

d. Prior to assembly, lubricate bolt threads and gasket faces.

e. After assembly, coat all bolts and nuts, except those of stainless steel, with two coats, minimum dry film thickness of eight mils each, of high-build epoxy or bituminous coating manufactured by Tnemec, or equal.

5. Prestressed Concrete Cylinder Pipe Joints:

a. Immediately before making the joint, completely clean bell and spigot surfaces to be jointed.

b. Apply lubricant supplied by pipe manufacturer to sealing surfaces of bell, spigot, and gasket. After lubrication, install gasket in spigot groove and ensure that stretch in the gasket is equalized.

c. After pipe is lowered into place, align spigot and bell so that spigot will squarely enter the bell.

d. Before joint is fully assembled, check position of gasket in bell using methods recommended by pipe manufacturer and accepted by ENGINEER.

e. If gasket is in correct position around entire circumference of the bell, remove temporary joint stoppers, if used, and insert pipe completely into bell. If gasket is not in proper location, open the joint and reinstall using a new gasket.

f. Where joint opening is required to make grade or alignment adjustment, joint shall first be installed completely closed, then opened as necessary on one side. Joint openings shall not be greater than 75 percent of maximum opening recommended by pipe manufacturer.

g. Strap diaper to outside of completed joint, straddling the external joint recess. Pour grout mix consisting of portland cement and sand in proportions recommended by pipe manufacturer to completely fill external joint recess. In lieu of joint diaper, CONTRACTOR may, with written approval of pipe manufacturer, use polyurethane foam joint protector with unhydrated portland cement dispersed throughout protector. Protector shall have the cross-sectional shape required for the type of joint being installed and shall be formed in loop to fit size of pipe on which it is to be used.

h. Point interior joint recess of pipe 24-inch nominal diameter and larger with portland cement/sand mortar mixed in proportions recommended by pipe manufacturer. Strike off grout smooth with interior face of pipe. For pipes that convey sewage or non-potable water, interior surfaces of steel joint ring shall be protected by butyl rubber mastic joint filler, supplied or recommended by pipe manufacturer, applied to bell socket just prior to joining the pipe such that mastic squeezes out to fill internal joint recess.

i. Coat exterior exposed steel portions of pipe, flanges, couplings, bolts and nuts with two coats each eight-mils minimum dry film thickness, of high-build epoxy or bituminous coating manufactured by Tnemec, or equal.

j. Maintain sufficient quantity of joint lubricant, gaskets, joint diapers, and joint fillers at the Site at all times.

k. Do not use gaskets that have been scored or otherwise damaged.

l. Where welded joints are required to handle thrust, steel spigot shall be cut at trailing edge of gasket groove to provide surface suitable for field-welding. Field-welded joints shall be full circumferential welds designed to take thrust at joint location. Provide minimum 3/16-inch weld. Exposed steel surface of pipe joints shall have temporary protection system of rust and corrosion inhibitor applied that need not be removed prior to welding. After welding is complete, joint protection shall be completed with interior and exterior cement mortar grouting.

6. Steel Pipe Joints:

a. Joints in steel pipe shall be bell and spigot when so specified for steel water pipe in accordance with AWWA C200, or butt welded or lap welded joints, except that mechanical couplings, or flanged connections shall be provided at connections to valves, meters, and similar equipment, and where shown or indicated in the Contract Documents. Mechanical couplings are specified in Section 40 23 00, Wastewater Process Piping.

b. Welding shall conform to ANSI/AWWA C206. When butt-welding or lap welding joints, weld pipe 36-inch diameter and larger both inside and outside of pipe.

c. Field welded lap joints shall have fillet welds both inside and outside. Outside weld may be seal weld.

d. After welding, coat the joint and surrounding damaged or uncoated area with same coating and thickness as shop-applied coating.

e. Where flanged connections or couplings are provided, flanges, couplings, bolts, and nuts, except when stainless steel, shall be coated with two coats, minimum dry film thickness of eight-mils

each, of high-build epoxy or bituminous coating manufactured by Tnemec, or equal.

f. Welds shall be free from embedded scale and slag and shall have tensile strength across weld not less than thinnest of connected sections.

g. Welds shall be watertight.

h. Provide cathodic protection at steel pipe joints as specified in this Section.

7. Thermoplastic Pipe Joints:

a. Solvent Cement Welded Joints:

1) Bevel pipe ends and remove all burrs before making joints. Clean pipe and fittings thoroughly. Do not attempt to make solvent cement joints if temperature is below 40 degrees F. Do not make solvent cement welded joints in wet conditions.

2) Use solvent cement supplied or recommended by pipe manufacturer.

3) Apply joint primer and solvent cement and assemble joints in accordance with recommendations and instructions of manufacturer of joint materials and pipe manufacturer.

4) Take appropriate safety precautions when using joint primers and solvent cements. Allow air to circulate freely through pipelines to allow solvent vapors to escape. Slowly admit water when flushing or filling pipelines to prevent compression of gases within pipes.

b. Bell and Spigot Joints:

1) Bevel pipe ends, remove all burrs, and provide a reference mark at correct distance from pipe end before making joints.

2) Clean spigot end and bell thoroughly before making the joint. Insert O-ring gasket while ensuring that gasket is properly oriented. Lubricate spigot with manufacturer's recommended lubricant. Do not lubricate bell and O-ring. Insert spigot end of pipe carefully into bell until reference mark on spigot is flush with bell.

8. Vitrified Clay Pipe Joints:

a. Use compression-type joints conforming to ASTM C425 for vitrified clay pipe.

b. Clean joint contact surfaces immediately prior to jointing. Use lubricants, primers, or adhesives recommended by pipe or joint manufacturer.

9. Copper Tubing Joints:

a. Soldered Joints:

1) Assemble copper tubing with soldered joints. Solder shall be 95-5 tin-antimony solder conforming to ASTM B32.

2) Ream or file pipe to remove burrs.

3) Clean and polish contact surfaces of joints.

4) Apply flux to both male and female ends.

5) Insert end of tube into full depth of fitting socket.

6) Heat joint evenly.

7) Form continuous solder bead around entire circumference of joint starting at the bottom.

b. Threaded Joints:

1) When open flames for soldering are impractical, or at unions and connections to equipment and appurtenances, assemble copper tubing with flared ends as permitted by authority having jurisdiction.

2) Ends of tubing shall be flared at an angle of 45 degrees with flaring tool recommended by pipe manufacturer. Flaring tool shall have same outside diameter as tube to be flared.

3) Tubing to be flared shall be soft temper or annealed prior to flaring.

4) End of tube shall be cut square and reamed to remove burrs.

5) Tube that is out-of-round shall be resized back to round.

6) Clean and polish contact surfaces of joints using an abrasive cloth.

7) Place flare nut over the end of tube with threads closest to end being flared.

8) Insert appropriate length of tube between flaring bar of flaring tool and position the yolk with flaring cone over tube end and clamp yoke in place.

9) Turn handle of yolk clockwise without over-tightening. Cracked or deformed tubes will be rejected.

10) Do not apply jointing compounds to mating surfaces of flare fitting and flared tube end before attaching flare nut to threaded connection.

10. Mechanical Coupling Joints:

a. Mechanical couplings include: sleeve-type flexible couplings, split flexible couplings, ANSI/AWWA C606 grooved or shouldered end couplings, plasticized PVC couplings, and other mechanical couplings specified in Section 40 23 00, Wastewater Process Piping.

b. Prior to installing and assembling mechanical couplings, thoroughly clean joint ends with wire brush to remove foreign matter.

c. For mechanical couplings that incorporate gaskets, after cleaning apply lubricant to rubber gasket or inside of coupling housing and to joint ends. After lubrication, install gasket around joint end of previously installed piece and mate joint end of subsequent piece to installed piece. Position gasket and place coupling housing around gasket and over grooved or shouldered joint ends. Insert bolts and install nuts tightly by hand. Tighten bolts uniformly to produce an equal pressure on all parts of housing. When housing clamps meet metal to metal, joint is complete and further tightening is not required.

d. For plasticized PVC couplings, loosen the stainless steel clamping bands and remove clamps from coupling. Slide coupling over plain ends of pipes to be joined without using lubricants. Place clamps over each end of coupling at grooved section and tighten with torque wrench to torque recommended by manufacturer.

11. HDPE Pipe Joints:

a. Bell and Spigot Joints:

1) Remove all burrs and provide reference mark at correct distance from pipe end. Place mark such that no more than 1/2-inch of machined spigot surface will be visible outside of bell after pipe has been joined.

2) Clean spigot end and bell thoroughly with soap and water before positioning gasket.

3) Lubricate spigot groove with manufacturer's recommended lubricant. Thoroughly clean gasket and place in spigot groove starting at bottom, ensuring that gasket fins face backwards toward pipe.

4) Thoroughly lubricate gasket with pipe manufacturer's recommended lubricant and equalize stretch in gasket by running screwdriver under gasket around its entire

circumference three times. Reposition gasket in groove after stretching.

5) Thoroughly clean and lubricate receiving bell. Align pipe as straight as possible and insert spigot end of pipe carefully into bell until reference mark on spigot is flush with bell.

6) If mechanical means are used to insert spigot end, protect with wood the end of pipe being pushed, to ensure even distribution of pressure.

b. Butt Fusion Welded Joints:

1) Install joints in accordance with manufacturer's instructions using hydraulic butt fusion machine or manual machine equipped with torque wrench. Equipment shall be able to achieve and maintain heating tool temperature range of 400 to 450 degrees F and an interface pressure of 60 to 90 psi.

2) Clean interior and exterior of pipe and fitting ends with clean, dry, lint-free cloth.

3) Align ends to be joined in the fusion machine without forcing ends into alignment. Adjust alignment as necessary and tighten clamps to prevent slippage.

4) Place facing tool between ends to be joined and face them to provide clean, smooth, parallel mating surface. If stops are present, face ends down to the stops. Remove all shavings after facing without touching ends.

5) Re-check alignment of ends and check for slippage against fusion pressure. There shall be no detectable gaps between ends. Align outside diameters.

6) Heating tool shall maintain pipe manufacture's recommended temperature range. Place the tool between ends to be joined. Move ends against heating tool to achieve full contact. Hold ends against heating tool without force until the following melt bead size is formed:

Pipe Diameter (inches)	Required Melt Bead Size (inches)
2 to 4	1/8 to 3/16
4 to 12	3/16 to 1/4
12 to 24	1/4 to 7/16
24 to 54	7/16 to 9/16

7) Upon forming proper melt bead size, quickly separate ends and remove heating tool. Quickly inspect melted ends and bring ends together applying joining force recommended by manufacturer, using 60 to 90 psi interfacial pressure to form double bead rolled over surface of pipe on both ends.

8) Hold joining force against ends until joint is cool to the touch. Cooling period shall be 30 to 90 seconds per inch of pipe diameter. Heavier wall thicknesses may require longer cooling times as recommended by pipe manufacturer.

9) Upon completing joint, inspect to verify double bead has been formed on both sides, uniformly rounded and consistent in size all around joint. Remove faulty joints and re-joint.

12. HDPE Double Containment Pipe (Containment and Carrier Pipe):

a. Install joints of double containment piping system in accordance with pipe manufacturer's instructions. Joints shall be butt fusion welded.

I. Backfilling:

1. Conform to applicable requirements of Section 31 23 16, Trench Excavation and Backfill.

2. Place backfill as Work progresses. Backfill by hand and use power tampers until pipe is covered by at least one foot of backfill.

J. Connections to Valves and Hydrants:

1. Install valves and hydrants as shown and indicated in the Contract Documents.

2. Provide suitable adapters when valves or hydrants and piping have different joint types.

3. Provide thrust restraint at all hydrants and at valves located at pipeline terminations.

K. Transitions from One Type of Pipe to Another:

1. Provide necessary adapters, specials, and connection pieces required when connecting different types and sizes of pipe or connecting pipe made by different manufacturers.

L. Closures:

1. Provide closure pieces shown or required to complete the Work.

3.02 TRACER TAPE INSTALLATION

A. Polyethylene Underground Warning Tape for Metallic Pipelines:

1. Provide polyethylene tracer tape for buried metallic piping, which includes pipe that is steel, ductile iron, cast iron, concrete, copper, and corrugated metal.

2. Provide tracer tape 12 to 18 inches below finished grade, above and parallel to buried pipe.

3. For pipelines buried eight feet or greater below finished grade, provide second line of magnetic tracer tape 2.5 feet above crown of buried pipe, aligned along pipe centerline.

4. Tape shall be spread flat with message side up before backfilling.

B. Detectable Underground Warning Tape for Non-Metallic Pipelines:

1. Provide polyethylene tracer tape with aluminum backing for buried, non-metallic piping, which includes pipe that is PVC, CPVC, polyethylene, HDPE, FRP, ABS, and vitrified clay.

2. Provide magnetic tracer tape 12 to 18 inches below finished grade, above and parallel to buried pipe.

3. For pipelines buried eight feet or greater below finished grade, provide second line of magnetic tracer tape 2.5 feet above crown of buried pipe, aligned along the pipe centerline.

4. Tape shall be spread flat with message side up before backfilling.

3.03 THRUST RESTRAINT

A. Provide thrust restraint on pressure piping systems where shown or indicated in the Contract Documents.

B. Thrust restraint may be accomplished by using restrained pipe joints, concrete thrust blocks, or harnessing buried pipe. Thrust restraints shall be designed for axial thrust exerted by test pressure specified in the Buried Piping Schedule at the end of this Section.

C. Place concrete thrust blocks against undisturbed soil. Where undisturbed soil does not exist, or for projects where the Site consists of backfill material, thrust restraint shall be provided by restrained pipe joints.

D. Restrained Pipe Joints:

1. Pipe joints shall be restrained by means suitable for the type of pipe being installed.

a. Ductile Iron, Push-on Joints and Mechanical Joints: Restrain with proprietary restrained joint system as specified in Section 40 23 00, Wastewater Process Piping; lugs and tie rods; or other joint restraint systems approved by ENGINEER.

b. Steel Pipe Joints: Provide butt welded joints, lap welded joints, flanged joints, or mechanical coupling connections as shown and specified in Buried Piping Schedule in this Section. Provide tie rods connected to lugs welded to the steel pipe for restraint at mechanical couplings.

c. Thermoplastic and HDPE Joints: Where bell and spigot type or other non restrained joints are utilized, provide tie rods across joint or other suitable joint restraint system, subject to the approval of ENGINEER.

d. Prestressed Concrete Cylinder Pipe Joints: Restrain utilizing clamp type restrained joint, snap ring-type restrained joint, or by welding. Concrete pipe requiring restraint shall have sufficient longitudinal steel reinforcement provided to handle thrust forces at maximum design stress of 12,500 psi. Thrust forces in longitudinales must be transmitted directly to steel joint bands using welded connections sufficient to carry stresses involved. No allowance for the concrete to handle tensile forces is allowed. Thrust restraint shall be in accordance with ANSI/AWWA Manual M9.

e. Joints for Concrete Pipe Other than Prestressed Concrete Cylinder Pipe: Restrain joints utilizing clamp type restrained joint or snap ring-type restrained joint.

E. Concrete Thrust Blocks:

1. Provide concrete thrust blocks on pressure piping at changes in alignment of 15 degrees or more, at tees, plugs and caps, and where shown or indicated in the Contract Documents. Construct thrust blocks of Class B concrete, conforming to 03 30 00, Cast-In-Place Concrete.

2. Install thrust blocks against undisturbed soil. Place concrete so that pipe and fitting joints are accessible for repair.

3. Concrete thrust block size shall be as shown on the Drawings or as approved by ENGINEER.

F. Harnessed lengths of buried pipe shall be as shown on the Drawings.

3.04 WORK AFFECTING EXISTING PIPING

A. Location of Existing Underground Facilities:

1. Locations of existing Underground Facilities shown on the Drawings should be considered approximate.

2. Determine the true location of existing Underground Facilities to which connections are to be made, crossed, and that could be disturbed, and determine location of Underground Facilities that could be disturbed during excavation and backfilling operations, or that may be affected by the Work.

B. Taking Existing Pipelines and Underground Facilities Out of Service:

1. Do not take pipelines or Underground Facilities out of service unless coordinated with Owners of Underground Facilities.

C. Work on Existing Pipelines or Underground Facilities:

1. Do not work on pipelines or Underground Facilities unless coordinated with Owners of Underground Facilities.

2. Install temporary plugs to prevent entry of mud, dirt, water, and debris into pipe.

3. Provide necessary adapters, sleeves, fittings, pipe, and appurtenances required to complete the Work.

4. Cut or tap piping or Underground Facilities as shown or required with machines specifically designed for cutting or tapping pipelines or Underground Facilities, as applicable.

3.05 FIELD QUALITY CONTROL

A. General:

1. Test all piping, except as exempted in the Buried Piping Schedule in this Section.

2. When authorities having jurisdiction are to witness tests, notify ENGINEER and authorities having jurisdiction in writing at least 48 hours in advance of testing.

3. Conduct all tests in presence of ENGINEER.

4. Remove or protect pipeline-mounted devices that could be damaged by testing.

5. Provide all apparatus and services required for testing, including:

a. Test pumps, compressors, hoses, calibrated gages, meters, test containers, valves, fittings, and temporary pumping systems required to maintain OWNER's operations.

b. Temporary bulkheads, bracing, blocking, and thrust restraints.

6. Provide air if an air test is required, power if pumping is required, and gases if gases are required.

7. Unless otherwise specified, OWNER will provide fluid required for hydrostatic testing. CONTRACTOR shall provide means to convey fluid for hydrostatic testing into piping being tested. CONTRACTOR shall provide fluid for other types of testing required.

8. Repair observed leaks and repair pipe that fails to meet acceptance criteria. Retest after repair.

9. Unless otherwise specified, testing shall include existing piping systems that connect with new piping system. Test existing pipe to nearest valve. Piping not installed by CONTRACTOR and that fails the test shall be repaired upon authorization of OWNER. Unless otherwise included in the Work, repair of existing piping or Underground Facilities will be paid as extra Work.

10. When testing existing chlorine gas and sulfur dioxide gas systems to nearest isolation valve, provide a tee in the line adjacent to valve. Branch outlet on tee shall be provided with valve and used for cleaning, testing, draining, and drying the pipe. Unless otherwise indicated, existing chlorine or sulfur dioxide system shall not be shut down during testing or for installing tee and valve. Prior to placing pipeline in service, valve on branch outlet of tee shall be plugged or sealed with blind flange or threaded plug. Repair damage to system resulting from this Work at no extra cost to OWNER.

B. Test Schedule:

1. Refer to the Buried Piping Schedule in this Section for type of test required and required test pressure.

2. Unless otherwise specified, required test pressures are at lowest elevation of pipeline segment being tested.

3. For piping not listed in Buried Piping Schedule in this Section:

a. Hydrostatically test pipe that will convey liquid at a pressure greater than five psig. Provide process air pipe test for pipe that will convey air or gas under pressure or vacuum, except chlorine gas, which requires separate test.

b. Use exfiltration testing, low-pressure air testing, or vacuum testing for other piping.

c. Disinfect for bacteriological testing piping that conveys potable water.

4. Test Pressure:

a. Use test pressures listed in Buried Piping Schedule in this Section.

b. If test pressure is not listed in Buried Piping Schedule, or if test is required for piping not listed in the Buried Piping Schedule, test pressure will be determined by ENGINEER based on maximum anticipated sustained operating pressure and methods described in applicable ANSI/AWWA manual or standard that applies to the piping system.

C. Hydrostatic Testing:

1. Preparation for Testing:

a. For thermoplastic pipe and fiberglass pipe, follow procedures described in Section 7 of ANSI/AWWA Standard C605.

b. For HDPE pipe, follow procedures described in ASTM F2164. Test duration, including time to pressurize, time for initial expansion, time at test pressure, and time to depressurize, shall not exceed eight hours. If re-testing of a test section or pipeline is required, at least eight hours shall elapse between tests.

c. For steel pipe, follow procedures described in ANSI/AWWA Manual M11. Wetting period is not required for pipe that is not cement-lined.

d. For other piping follow procedures described in ANSI/AWWA Manual M9, except that minimum wetting period required immediately prior to testing for asbestos cement pipe shall be 24 hours rather than the 48 hours prescribed for concrete pipe. Wetting period is not required for pipe that is not cement mortar-lined.

e. Prior to testing, ensure that adequate thrust protection is in place and joints are properly installed.

f. Piping for Hydraulic Fluid, Lube Oil, and Diesel Fuel: Hydrostatically test system using the fluid with which system will function permanently. Allowable leakage is zero. For fluid power systems, pipe manufacturer shall supervise installation and testing of system components, including field piping.

2. Test Procedure:

a. Fill pipeline slowly to minimize air entrapment and surge pressures. Fill rate shall not exceed one foot of pipe length per second in pipe being tested.

b. Expel air from pipe as required. Obtain approval of ENGINEER prior to tapping pipe for expelling air.

c. Examine exposed joints and valves, and make repairs to eliminate visible leakage.

d. After specified wetting period, add fluid as required to pressurize line to required test pressure. Maintain test pressure for a stabilization period of ten minutes before beginning test.

e. HDPE Pipe: After filling pipeline, gradually pressurize pipe to test pressure and maintain required test pressure for three hours for pipe to expand. During expansion, add fluid to maintain required test pressure. Begin timed test period after expansion period and other requirements are met.

f. Timed test period shall not begin until after pipe has been filled, exposed to required wetting period, air has been expelled, and pressure stabilized.

g. Timed Test Period: After stabilization period, maintain test pressure for at least two hours. During timed testing period, add fluid as required to maintain pressure within five psig of required test pressure. For HDPE pipe, after three hour expansion phase, reduce test pressure by ten psig and do not add liquid. Test pressure shall then remain steady for one hour, indicating no leakage.

h. Pump from test container to maintain test pressure. Measure volume of fluid pumped from test container and record on test report. Record pressure at test pump at 15 minute intervals for duration of test.

3. Allowable Leakage Rates: Leakage is defined as the quantity of fluid supplied to pipe segment being tested to maintain pressure within five psi of test pressure during timed test period. Allowable leakage rates for piping are:

a. No Leakage: Pipe with flanged, welded, fused, threaded, soldered, or brazed joints.

b. Rates based on formula or table in ANSI/AWWA Manual M41:

1) Metal and fiberglass pipe joined with rubber gaskets as sealing members, including the following joint types:

a) Bell and spigot and push-on joints.

b) Mechanical joints.

c) Bolted sleeve type couplings.

d) Grooved and shouldered couplings.

c. Rates based on make-up allowance in ANSI/AWWA Manual M9:

1) Prestressed concrete cylinder pipe and other types of concrete pipe joined with O-ring rubber gasket sealing members.

d. Rates based on formula or table in ANSI/AWWA C605:

1) Plastic pipe joined with O-ring gasket sealing members.

e. Rates based on formula or table in ANSI/AWWA C603:

1) Asbestos-cement pipe.

D. Exfiltration Testing:

1. Plug and bulkhead ends and lateral connections of pipe segment to be tested and admit fluid until the pipe is full. Admit fluid slowly to

minimize air entrapment. Groundwater level shall be below the pipe during exfiltration test.

2. Before measuring leakage, allow fluid to wet pipe interior for the following period:

   a. Concrete Pipe: 48 hours.

   b. Cement Mortar-lined Pipe: 24 hours.

   c. Asbestos-cement Pipe: 24 hours.

   d. Other Pipe: Wetting period not required.

3. Maintain hydrostatic head during test to equal an elevation two feet above present and future maximum groundwater elevation at pipe segment tested. ENGINEER will determine test water surface elevation for each pipe segment.

4. Provide minimum hydrostatic head during test of two feet above crown of upstream end of pipe segment tested.

5. Add fluid from test container or from metered supply as required to maintain test water level within three inches of test head throughout the test.

6. Test duration shall be at least two hours.

7. Allowable Leakage Rates:

   a. Leakage is defined as the quantity of fluid that must be supplied to pipe segment tested to maintain hydrostatic head within three inches of test head during the test after pipe has been filled and exposed to required wetting period, plus quantity required to refill to original head at end of test.

   b. Leakage shall not exceed that allowed by authority having jurisdiction.

D. Sewer Testing with Low Pressure Air:

1. Plug and bulkhead ends and lateral connections of pipe segment to be tested.

2. Required test pressure shall be increased by an amount equal to the elevation of groundwater above invert of lowest point of pipe segment being tested.

3. Test in accordance with requirements of authority having jurisdiction.

4. If there are no Laws and Regulations covering the test, use test procedures described in the following standards:

   a. Thermoplastic and HDPE Pipe: ASTM F1417.

   b. Concrete Pipe: ASTM C924.

   c. Clay Pipe: ASTM C828.

D. Vacuum Testing:

1. Plug and bulkhead ends and lateral connections of pipe segment or manhole to be tested.

2. Following set-up of test apparatus, draw vacuum of ten inches of mercury on pipe segment or manhole being tested.

3. Start test upon reaching specified test vacuum. Test duration shall be 15 minutes.

4. Record vacuum drop at end of test. If vacuum drop is greater than one inch of mercury, pipe segment or manhole fails the test and shall be repaired and retested. If vacuum drop is less than one inch of mercury, pipe segment or manhole passes the test.

E. Vertical Deflection Test for Thermoplastic, FRP, and HDPE Pipe:

1. Conduct vertical deflection test at least thirty days after backfill has been placed.

2. Manually pull pin-type vertical gauge mounted on sled through pipe. Gauge shall be manufactured by Quality Test Products, or equal. Set gauge so that sled will stop if vertical deflection of pipe exceeds five percent. Excavate and re-install piping that fails deflection test, and retest.

3. Use rigid ball or mandrel for deflection test, which shall have diameter of at least 95 percent of base inside diameter or average inside diameter of piping, depending on which is specified in applicable ASTM standard, including appendix, to which pipe is manufactured. Perform test without mechanical pulling devices. Re-install and retest pipe segments that exceed deflection of five percent.

F. Televised Inspection:

1. Televise the following:

- Gravity sewer from existing SSMH at abandoned reuse pump station to existing Parshall Flume prior to connection of proposed 14" DIP to Filter.

- Existing gravity sewer downstream of proposed aerobic digestor decant.

2. Televise completed sewer and appurtenant structures, including manholes and chambers, and provide to ENGINEER copy of video on digital video disc (DVD). Repair apparent leaks and re-televise the pipe until acceptance by ENGINEER.

3. Inspection shall be performed by Subcontractor certified in Pipeline Assessment Certification Program (PACP) by National Association of Sewer Service Companies (NASSCO). Provide copy of PACP certification prior to starting inspection. Televising shall conform to coding and reporting standards and guidelines specified in PACP. Use

same standards for lateral inspections, regardless of whether conducted using cleanout-launched or mainline-launched lateral camera. Identify report annotations, pipe conditions, and pipe defects in accordance with PACP. Severity ratings shall be calculated in accordance with PACP.

4. Camera for main line shall be pan-and-tilt, radial viewing, pipe inspection camera that pans plus-or-minus 275 degrees and rotates 360 degrees. Use camera with an accurate footage counter that displays on television monitor exact distance of camera from centerline of starting manhole. Use camera with height adjustment so that lens is always centered at one-half inside diameter or higher, in pipe being televised. Provide lighting system that allows features and condition of pipe to be clearly seen. Camera shall operate in 100 percent humidity. Camera, television monitor, and other components of video system produce a minimum 450-line resolution colored video picture. Picture quality and definition shall be satisfactory to ENGINEER. Camera for lateral televising shall be fixed and capable of moving from main line 80 feet up lateral, and conform in other respects to requirements for main line camera.

5. Repair apparent leaks in pipe Work in manner satisfactory to ENGINEER without additional cost to OWNER and re-televise the pipe.

G. Process Air Pipe Testing:

1. General:

   a. Test pipe before backfilling pipe trench.

   b. Maintain groundwater level below bottom of trench until test is successfully completed.

   c. Required test pressure is listed in Buried Piping Schedule.

2. Preparation for Testing:

   a. Provide temporary tie rods at expansion joints as required.

   b. Verify that pipe supports, where present, are secure.

   c. Test one pipe segment at a time. Use temporary blind flanges and isolators as required.

   d. Install corporation cocks for filling and relieving air. Provide temporary automatic pressure relief valve and pressure gauge with range suitable for test pressure.

3. Test Procedure:

   a. Pressurize pipe segment being tested with air to required test pressure. Maintain pressure for at least two hours.

   b. Apply soapy water solution to all joints to check for leakage, indicated by presence of bubbles, while test pressure is maintained.

   c. Allowable Leakage: Zero

4. Repair and retest pipelines that fail test.

5. After testing is complete remove temporary measures provided for testing and provide Type 304 stainless steel threaded plugs at taps used for testing.

H. Chlorine Piping:

1. Scope: Applicable to chlorine gas piping and liquid chlorine piping systems that are under vacuum or positively pressurized.

2. General:

a. Complete testing includes pressure testing, drying, and air or nitrogen leak testing as specified, and service gas leak testing. Pressure-test system after cleaning.

b. Complete testing prior to backfilling trench. Maintain groundwater level below bottom of trench until test is successfully completed.

c. Relative to chlorine testing, the term "plastic piping" includes the following types of pipe: PVC, CPVC, ABS, FRP, polypropylene (PP), PTFE, PFA, PVDF, ethylene chlorotrifluoroethylene (ECTFE), and ethylene tetrafluoroethylene (ETFE).

d. Do not attempt to repair leaks until pressure has dissipated from system.

e. Repair and retest system until successful test is performed.

f. When piping is filled with chlorine, take appropriate precautions relative to safety and minimizing potential for leaks.

3. Evaporator-supplied Systems:

a. Disconnect vent from discharge side of pressure relief valve of each evaporator, plug resultant opening, inspect, and secure all joints, close valves that discharge to atmosphere, and open all inline valves. Open valve in bypass line around pressure reducing valve on downstream side of each evaporator to provide through-path around valve.

b. Test system as specified in this Section.

c. After testing, restore equipment, valves, and piping to pre-test positions and close inline valves. Reconnect vent line to downstream side of pressure relief valve of each evaporator and close valve in bypass line around pressure reducing valve on downstream side of each evaporator.

4. Pressure Testing:

a. Fill pipe with water and hydrostatically test in accordance with Paragraph 3.5.C of this Section.

b. Hydrostatic test pressure shall be in accordance with the Buried Piping Schedule in this Section. When hydrostatic test pressure is not specified in Buried Piping Schedule, for pressure piping use test pressure of 1.5 times maximum operating pressure to which system may be subjected. If not otherwise specified in the Buried Piping Schedule, hydrostatically test vacuum piping to at least 25 psig.

c. After hydrostatic testing, replace all moisture absorbing gaskets and valve packing.

d. Steel Pipe: If drying after hydrostatic testing is impractical or cannot be accomplished, test steel piping by either pneumatic testing or alternate testing (weld examination) in accordance with Chlorine Institute Pamphlet No. 6. When performing pneumatic test, implement precautions to safeguard personnel and minimize risk.

5. Drying:

a. Dry out chlorine piping systems prior to placing in service. Drying is required for all piping regardless of whether water has been purposely introduced to system.

b. Steel Pipe: Accomplish drying by passing steam through piping from high end of system until piping is heated to approximately 200 degrees F unless lower temperature is required to protect system from damage. While steaming, allow condensate and foreign matter to drain from pipe. Disconnect steam supply and drain pockets and low spots in pipe. While pipe is still warm, blow dry, oil-free air with dew point of -40 degrees F or below, or nitrogen, through pipe until exiting air dew point is equal to supply air dew point. Valves shall be at half-open position during drying. Valves removed temporarily from system during drying must be free of moisture before being re-installed.

c. Plastic Pipe: Dry gas piping only. Drain and remove all water and moisture from system. After draining, “pig” the pipe to remove excess water. Dry system with air or nitrogen in accordance with requirements for steel pipe, except that steam shall not be used on plastic pipe.

6. Air or Nitrogen Leak Testing:

a. Do not leak-test plastic piping with nitrogen or air.

b. Use nitrogen gas or oil-free dry air to test steel piping. Gradually introduce nitrogen or dry air and pressurize to 50 psig. Maintaining this pressure while testing all joints along pipe for leaks with soapy water solution. When system is free from leaks at this pressure, increase test pressure in increments of approximately 50 psig up to the lower of either 150 psig or 110 percent of

maximum system operating pressure. After each increase in pressure, check for leaks using soapy water solution and implement corrective action as necessary.

c. When system has no leaks at final test pressure, depressurize the system, disconnect the test source, and cap the system to prevent entrance of water.

d. Nitrogen Gas: Use cylinders of dry, high-purity nitrogen gas, nitrogen handling cylinder mounted pressure regulator with zero to 300 psig range, and necessary fittings and adapters to connect source to pipe being tested. Pressure regulator shall be self-relieving type, venting to atmosphere, and include throttling valve.

e. Dry Air: Provide oil-free air with relative humidity of zero. Fittings, adapters, and accessories, pressure regulator, and throttling valve shall be suitable for pressure testing with air and rated for 300 psig.

7. Service Gas (Chlorine Gas) Leak Testing:

a. After pressure testing and immediately after chlorine system has been dried, gradually introduce service gas to pipe; service gas is gas that will be conveyed through pipe when pipe is in use. After gas has completely filled pipe, increase service gas pressure to five psig and check all joints for leaks.

b. Implement precautions to safeguard personnel and minimize risk when performing service gas leak test.

c. Use liquid ammonia solution or chlorine gas detector to check for chlorine leaks. When using liquid ammonia solution, spray solution at pipe joints and connections. Do not squirt liquid on pipe or fittings. Chorine gas and ammonia solution will react to produce a dense, white cloud. Leaks in piping and equipment, if detected, shall not be repaired until all gas has been purged from system being tested. Upon completion of repairs, repeat cleaning, drying, nitrogen or air leak testing, and service gas leak testing.

d. Do not perform service gas leak testing on liquid chlorine piping.

I. Examination of Welds:

1. Personnel performing examination of welds shall be qualified to at least Level II in accordance with ASNT SNT-TC-1A.

2. Conform to ASME Boiler and Pressure Vessel Code Section V and applicable articles for examination of welds.

3. Visually examine all welds, Category D Fluid Service, in conformance with ASME B31.3.

4. Examine at least ten percent of welds using liquid penetrant examination.

5. If defect is detected, all welds shall be examined by liquid penetrant examination.

6. At conclusion of liquid penetrant examination, remove penetrant test materials by flushing, washing, or wiping clean with applicable solvents.

J. Bacteriological Testing:

1. Bacteriological testing for potable water lines, finished water lines, and other piping in accordance with the Buried Piping Schedule, is specified in Article 3.6 of this Section.

3.06 CLEANING AND DISINFECTION

A. Cleaning, General: Clean pipe systems as follows:

1. Thoroughly clean all piping, including flushing with water, dry air, or inert gas as required, in manner approved by ENGINEER, prior to placing in service. Flush chlorine solution and sodium hypochlorite piping with water.

2. Piping 24-inch diameter and larger shall be inspected from inside and debris, dirt and foreign matter removed.

3. For piping that requires disinfection and has not been kept clean during storage or installation, swab each section individually before installation with five percent sodium hypochlorite solution.

B. Cleaning of Gas and Air Piping:

1. Unless otherwise specified, non-chlorine gas and air system piping six-inch diameter and smaller shall be blown out, using air or testing medium specified. Piping larger than six-inch diameter shall be cleaned by having a swab or "pig" drawn through each pipe reach.

2. After connecting to equipment, blow out pipe using the equipment.

3. Upon completion of cleaning, piping shall be drained and dried with blown air. Propane systems shall be purged with nitrogen and nitrogen pad maintained at ten psi until pipe is placed in service. Purge digester gas systems with nitrogen and maintain nitrogen pad at three psi until line is placed in service.

C. Cleaning of Chlorine Gas and Liquid Chlorine Systems:

1. General: All portions of system shall be cleaned free of oil and grease.

2. Clean chlorine piping in accordance with procedures in Chlorine Institute Pamphlet No. 6.

3. Steel Pipe:

a. Pipe threads shall be washed clean and free from cutting oil.

b. Remove from inside of pipe and fittings all pipe dope, oil, and grease by drawing cloth wetted with solvent through each pipe segment, or other method acceptable to ENGINEER.

c. Valves shall be dismantled, thoroughly cleaned with solvents, and repacked, if necessary, prior to installation.

d. Cap or plug openings in pipe at end of each workday.

e. When using solvents such as carbon tetrachloride or trichloroethylene, exercise caution to minimize solvent exposure, and provide proper handling and disposal. Do not use solvents containing hydrocarbons or alcohols.

4. Plastic Pipe: Clean vacuum and liquid piping with a detergent and water and thoroughly rinse to remove all detergent, after which cleaning ball or swab shall be drawn through pipe.

D. Cleaning of Hydraulic and Fluid Power Oil Systems: Upon completion of field piping, but before connection to control components, hydraulic and fluid power oil systems shall be flushed and cleaned by circulating special flushing oil through system. Flushing oil and procedures shall comply with ASTM D4174. Clean system such that internal contamination of system, when tested using procedures specified in SAE J1227, Section 2.3, shall not exceed the Allowable Cleanliness Level (ACL). Unless otherwise specified, ACL value shall be established by manufacturer of major hydraulic system components in accordance with SAE J1227, Section 9.1.

E. Disinfection:

1. Disinfect all potable and finished water piping.

2. Suggested procedure for accomplishing complete and satisfactory disinfection is specified below. Other procedures may be considered for acceptance by ENGINEER.

a. Prior to disinfection, clean piping as specified and flush thoroughly.

b. Conform to procedures described in ANSI/AWWA C651. Use continuous feed method of disinfecting, unless alternative method is acceptable to ENGINEER.

3. Water for initial flushing, testing, and disinfection will be furnished by OWNER. CONTRACTOR shall provide all temporary piping, hose, valves, appurtenances, and services required. Cost of water required for redisinfection will be paid by CONTRACTOR to OWNER at water utility's standard rates.

4. Chlorine shall be provided by CONTRACTOR.

5. Bacteriologic tests will be performed by OWNER. Certified test laboratory report will be provided to CONTRACTOR, if requested.

6. Chlorine concentration in water entering the piping shall be between 50 and 100 ppm, such that minimum residual concentration of 25 mg/L remains after 24 hour retention period. Disinfect piping and all related components. Repeat as necessary to provide complete disinfection.

7. After required retention period, flush chlorinated water to closed drain line, unless otherwise acceptable to ENGINEER. Properly dispose of chlorinated water in accordance with Laws and Regulations. Do not discharge chlorinated water to storm sewers, ditches, or overland.

3.07 CATHODIC PROTECTION

A. General:

1. Provide cathodic protection for buried steel pipelines.

2. Provide insulated joint at each of the following:

   a. Connection to steel water tanks and each branch connecting to a water line.

   b. Connection between concrete pipe and steel pipe, and between ductile iron pipe and steel pipe.

   c. Connection through wall.

   d. Where indicated.

3. Provide electrical bond across all other gasketed steel pipe joints.

4. Provide test lead stations for monitoring electrical currents on pipeline at locations shown and indicated in the Contract Documents.

B. Details of Cathodic Protection:

1. Insulated Joints: Where shown or indicated in the Contract Documents, provide insulated flange type joints. After joint is made, provide exterior coating around joint as specified for piping being joined.

2. Electrical Bond Across Rubber Gasket Joints: Provide two electrical bonding cables across each rubber-gasketed bell and spigot joint. Before exterior coating is applied to bell and spigot joints, two small areas of metal shall be exposed on each side of joint, one on spigot ring and one on bell. Thoroughly clean each area and bond two cathodic protection cables to pipe, one on each side of joint. Bond each cable by thermite process. Coat completed connections and exposed metal as specified for exterior coating of pipe being joined.

3. Electrical Bond Across Mechanical Couplings: Provide two electrical bonding cables across each mechanical coupling. Before the exterior coating is applied to mechanical couplings, expose two small areas of metal on pipe surface on each side of coupling, on middle ring and on each follower ring of coupling. Thoroughly clean each area and bond two cathodic protection cables to pipe, one on each side of joint and to middle

ring and follower rings of mechanical coupling. Bond each cable by thermite process. Coat completed connections and exposed metal as specified for exterior coating of pipe being joined.

4. Electrical Bond Across Valves and Flanges: Provide two electrical bonding cables across valves and flanged connections other than insulated flange type joints. Provide electrical bond as specified for bond across rubber gasket joints.

5. Test Lead Stations: Provide test lead stations where shown and indicated in the Contract Documents. Terminate test lead on ground surface in standard connection box at a protected location acceptable to ENGINEER.

3.08 SCHEDULES

A. Schedules listed below, following the "End of Section" designation, are part of this Specification section.

1. Table 33 05 05-A, Buried Piping Schedule.

END OF SECTION

TABLE 33 05 05-A, BURIED PIPING SCHEDULE

Service	Location	Diameter (inch)	Material	Interior Lining	Exterior Coating	Pressure Class/ Thickness	Joint	Test	Alternate Materials
INF	STAGED REACTOR	12	DIP	CE	AC	PC 350	RMJ, RPOJ, FL	NR	HDPE, PVC
SAN	MISC.	10, 12	DIP	CE	AC	PC 350	POJ	NR	PVC
MS	STAGED REACTOR	14	DIP	CE	AC	PC 350	RMJ, RPOJ, POJ	NR	PVC
SD	CLARIFIERS	8	DIP	CE	AC	PC 350	RMJ	NR	
DR	CLARIFIERS	8	DIP	CE	AC	PC 350	RMJ, POJ	NR	PVC
MS	CLARIFIER SB	12	DIP	CE	AC	PC 350	POJ	AIR	PVC
EFF	FILTER	14	DIP	CE	AC	PC 350	RMJ, RPOJ	NR	PVC
DR	CCC	8	DIP	CL	AC	PC 350	RMJ	NR	PVC
EFF	CCC	16	DIP	CL	AC	PC 350	POJ	AIR	PVC
BW	FILTER	4	DIP	CL	AC	PC 350	RMJ, RPOJ	NR	
DR	FILTER	4, 6	DIP	CE	AC	PC 350	RMJ, RPOJ	NR	
OF	FILTER	10	DIP	CE	AC	PC 350	RMJ	NR	PVC
RAS	RAS PS	8	DIP	CE	AC	PC 350	FL, RMJ	HYD (50 PSI)	
RAS	RAS PS	10	DIP	CE	AC	PC 350	RMJ, RPOJ, POJ	HYD (50 PSI)	HDPE, PVC
WAS	STAGED REACTOR	4	DIP	CE	AC	PC 350	FL, RMJ, RPOJ, POJ	HYD (50 PSI)	HDPE, PVC
DR	DIGESTOR	6	DIP	CE	AC	PC 350	RMJ, RPOJ	NR	PVC

See part 3.05.F of this Section for televised inspection requirements.

The following abbreviations are used in the Buried Piping Schedule.

A. SERVICE ABBREVIATIONS

Service	Abbrev		Service	Abbrev.
Sanitary Sewer	SAN		Wastewater	WW
Storm Sewer	ST		Overflow	OF
Combined Sewer	CS		Centrate	CEN
Sanitary Force Main	SFM		Filtrate	FILT
Raw Water	RW		Scum	SCUM
Potable Water	PW		Primary Sludge	PS
City Water	CW		Return Activated Sludge	RAS
Non-Potable Water	NPW		Waste Activate Sludge	WAS
Plant Effluent Water	PEW		Thickened Sludge	TS
Spray Water	SPW		Mixed Sludge	MS
Backwash Water	BW		Digested Sludge	DS
Hot Water Supply	HWS		Sludge Draw	SD
Hot Water Return	HWR		Chlorine Solution	CLS
Influent	INF		Sodium Hydroxide	NAOH
Effluent	EFF		Sodium Hypochlorite	NAOCL
Drain	DR		Polymer Solution	POLYS
Process Air	PA		Alum	AL
Instrument Air	IA		Hydraulic Fluid	HF
Digester Gas	DIG		Fuel Oil	FO
Chlorine Gas	CLG		Lube Oil	LO

B. MATERIAL ABBREVIATIONS

Material	Abbrev		Material	Abbrev.
Ductile Iron Pipe	DIP		Polyvinyl Chloride	PVC
Cast Iron	CI		Chlorinated Polyvinyl Chloride	CPVC
Carbon Steel	CS		Polyethylene	PE
Stainless Steel	SS		High Density Polyethylene	HDPE
Copper	C		Fiberglass Reinforced Plastic	FRP
Corrugated Metal Pipe	CMP		Acrylonitrile Butadiene Styrene	ABS
Reinforced Concrete Pipe	RCP		Vitrified Clay	VC
Prestressed Concrete Cylinder Pipe	PCCP			
Non-Prestressed Concrete Cylinder Pipe	CCP			
Steel Cylinder Pipe	SCP			

C. LINING/COATING ABBREVIATIONS

Lining	Abbrev		Coating	Abbrev.
Cement Mortar Lined	CL		Asphaltic Coated	AC
Glass Lined	GL		Polyethylene Wrapped	PEW
Ceramic Epoxy	CE		Painted	P
Fusion Bonded Epoxy Lined	FBEL		Fusion Bonded Epoxy Coated	FBEC
Plastic Lined	PL		Insulated	I
			Galvanized	Galv

D. JOINT ABBREVIATIONS

Joint Type	Abbrev		Joint Type	Abbrev.
Bell and Spigot	BS		Butt Weld	BW
Restrained Bell and Spigot	RBS		Lap Weld	LW
Push-on Joint	POJ		Butt Fusion Weld	BFW
Restrained Push-on Joint	RPOJ		Solvent Weld	SW
Mechanical Joint	MJ		Sleeve-type Flexible Coupling	SLFC
Restrained Mech. Joint	RMJ		Split Flexible Coupling	SPFC
Soldered	Sd		Plasticized PVC Coupling	PPVC
Brazed	Bz		Grooved or Shouldered End Coupling	GSEC
Threaded	Thd		Flanged	FL
Compression Sleeve Coupling	CSC		Compression Flange Adapter	CFA

E. TEST ABBREVIATIONS

Test	Abbrev		Test	Abbrev.
Hydrostatic Test (test pressure in psig)	HYD ( )		Process Air Pipe Test (test pressure in psig)	PA ( )
Exfiltration	EX		Chlorine Pipe Test	CL
Low-pressure Air Sewer Test	AIR		Disinfection and Bacteriological Testing	DBT
Vacuum Test	VAC		Examination of Welds	EW
Vertical Deflection	VD		No Test Required	NR
Televised Inspection	TV			

SECTION 33 05 13

MANHOLES AND STRUCTURES

PART 1 GENERAL

1.01 DESCRIPTION

A. The work required under this section consists of all materials, accessories, equipment, tools, and labor required to construct and/or place precast concrete manholes, where shown on the drawings.

B. Manholes shall be constructed of specified materials to the sizes, shapes and dimensions, and at the locations shown on the plans or as otherwise directed by the Engineer. Generally, the height of manholes shall be such that the top of the manhole frame will be at the finished grade of the pavement or ground surface for manholes located in pavement, in road or street rights-of-ways or in maintained grounds. In areas other than above, the top of the manhole shall be 24 to 30 inches above the finish ground level.

1.02 RELATED SECTIONS

A. Section 03 41 00 – Precast Concrete Structures.

1.03 REFERENCES

A. ASTM A 48 - Standard Specification for Gray Iron Castings.

B. ASTM C 55 - Standard Specification for Concrete Brick.

C. ASTM C 62 - Standard Specification for Building Brick (Solid Masonry Units Made From Clay or Shale).

D. ASTM C 144 - Standard Specification for Aggregate for Masonry.

E. ASTM C 270 – Standard Specification for Mortar for Unit Masonry.

F. ASTM C 478 - Standard Specification for Precast Reinforced Concrete Manhole Sections.

G. ASTM C 923 - Standard Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes and Laterals.

H. IMIAWC (CW) - Recommended Practices & Guide Specifications for Cold Weather Masonry Construction; International Masonry Industry All-Weather Council.

I. ASTM C 1244 - Concrete Sewer Manholes by the Negative Air Pressure (Vacuum) Test.

1.04 SUBMITTALS

A. See Section 01330 for submittal procedures.

B. Shop Drawings: Indicate manhole locations, elevations, piping sizes and elevations of penetrations.

C. Product Data: Provide manhole covers, component construction, features, configuration, and dimensions.

1.05 QUALITY ASSURANCE

Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

1.06 ENVIRONMENTAL REQUIREMENTS

A. Maintain materials and surrounding air temperature to minimum 50 degrees F (10 degrees C) prior to, during, and 48 hours after completion of masonry work.

B. Cold Weather Requirements: Comply with recommendations of IMIAWC (CW).

PART 2 PRODUCTS

2.01 MATERIALS

A. Manhole Sections: Reinforced precast concrete in accordance with ASTM C 478, with resilient connectors complying with ASTM C 923.

B. Manhole Sections and Joints: Water tight joints for precast manhole sections, using rubber gaskets for sealing the joints shall be in accordance with ASTM C 443.

C. Manhole Boots: Shall be NPC Kor-N-Seal connectors or approved equal.

D. Integral Steps: Fiber reinforced plastic in accordance with ASTM D 3753.

E. Concrete: As specified in Section 03 31 00.

F. Concrete Reinforcement: As specified in Section 03 31 00.

G. Brick: Shall conform to applicable requirements of ASTM C62 Grade NW.

H. Mortar: Shall be a 3:1 sand-cement mix.

2.02 COMPONENTS

A. Ring and Cover: ASTM A 48, Class 30B Cast iron construction, machined flat bearing surface, removable lockable cover (Bolted Watertight Cover) or

removable non-lockable cover (non-bolted), closed cover design; sealing gasket; cover molded with identifying name provided by the owner. Use USF 367 for (Bolted Watertight Standard) Cover or approved equal. Or use U.S. Foundry (USF) 360-E Ring and Cover Series or approved equal for (non-bolted) covers. See plans for frame and cover requirements.

B. Manhole Steps: Polypropylene safety steps meet to ASTM A-615 and ASTM C-478, AASHTO M-199 and all OSHA specifications. The 1/2" grade 60 steel reinforcing bar meets ASTM A-615. Polypropylene rungs shall be 1 inch diameter or approved equal.

C. Manhole Boots: Rubber boots shall be designed and manufactured to meet or exceed the requirements of ASTM C-923 "Standard Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes and Laterals". The rubber seal shall be made from a resilient rubber compound, which conforms to ASTM C923. The pipe clamp shall be manufactured from 304 series non-magnetic stainless steel, which conforms to ASTM C923 and ASTM A167.

2.03 CONFIGURATION

A. Construction: Cylindrical base, vertical sections with eccentric cone top section with tongue and groove joints.

B. Shape: Cylindrical unless otherwise noted on the plans.

C. Clear Inside Dimensions: 48 inch diameter or as indicated on the plans.

D. Design Depth: As indicated on the plans.

E. Clear Cover Opening: Shall be 20-5/8” to 22-1/2”.

F. Pipe Entry: Provide openings as indicated on the plans.

G. Steps: Set every 15 inches as indicated on the plans.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify items provided by other sections of work are properly sized and located.

B. Verify that built-in items are in proper location, and ready for roughing into work.

C. Verify excavation for manholes is correct.

3.02 MANHOLES

A. All manhole sections shall be manufactured in accordance to ASTM C-478.

B. Place manhole sections plumb and level, trim to correct elevations.

C. Form and place manhole cylinder plumb and level, to correct dimensions and elevations.

D. All manholes base sections shall have preformed inverts cast per the plans.

E. The manhole base shall be set on a 8 inch (minimum thickness) mat of No. 57 stone or as shown on the construction drawings.

F. Set frames and covers to correct elevations and properly anchor to the masonry. Where manholes are constructed in paved areas, the top surface of the frame and cover shall be tilted to conform to the exact slope, crown and grade of the existing or proposed pavement.

G. Installation for the step can be cast in place or driven into pre-formed or drilled hole. The step will resist pullout forces of over 1500 lbs.

3.03 MASONRY WORK

A. Maintain masonry courses to uniform dimension. Form vertical and horizontal joints of uniform thickness.

B. Lay masonry units in running bond. Course one unit and one mortar joint to equal 8 inches.

C. Form concave mortar joints.

D. Lay masonry units in full bed of mortar, with full head joints, uniformly jointed with other work.

E. Install joint reinforcement 16 inches on center.

F. Place joint reinforcement in first and second horizontal joints above base pad and below cover frame opening.

3.04 TESTING

A. Leakage Testing: Testing shall be conducted for each precast structure or manhole in accordance with ASTM C 1244 - Concrete Sewer Manholes by the Negative Air Pressure (Vacuum) Test.:

B. Vacuum Testing: Manholes shall be tested after assembly and prior to backfilling. Stub outs, manhole boots and pipe plugs shall be secured to prevent movement while the vacuum is drawn. Installation and operation of vacuum equipment and indicating devices shall be in accordance with equipment specifications for which performance information has been provided by the manufacturer and approved by the Engineer. A measured vacuum of 10 inches of mercury (-4.91 psi) shall be established in the manhole. The time for the vacuum to drop to nine inches of mercury (-4.42 psi) shall be recorded. Acceptance standards for leakage shall be established from the elapsed time for negative pressure change from 10 inches to 9 inches of mercury. The maximum allowable leakage rate and instructions for a four foot diameter manhole shall be in accordance with the following:

Testing Instructions:

1. Testing is done after complete assembly of the manhole.

2. The manhole to pipe connection should be a flexible connector, such as Kor-N-Seal or equivalent.

3. All lift holes need to be plugged with a non-shrinking mortar, or equivalent.

4. The seal between the manhole sections shall be in accordance with ASTM-C 923.

5. The contractor must plug the pipe openings, taking care to securely brace the plugs and pipe.

6. With the vacuum tester in place:

7. Inflate the compression band to 40 psi to effect a seal between the vacuum base and the structure

8. Connect the vacuum pump to the outlet port with the value open.

9. Draw a vacuum to 10" of Hg. (-4.91 psi) and close the value.

10. The test is considered passing if the vacuum remains between 9" Hg. and 10" Hg. in a time greater than one minute. If the initial test fails, the contractor can locate the leak, and the appropriate repairs made.

4' dia. Manhole Depth Minimum	Elapsed Time for a Pressure Change of 1 inch Hg
10 ft. or less	60 seconds
>10 ft. but < 15 ft.	75 seconds
>15 ft. but < 25 ft.	90 Seconds

For manholes five feet in diameter, add an additional 15 seconds and for manholes six feet in diameter, add an additional 30 seconds to the time requirements for four-foot diameter manholes. If the manholes fails the test, necessary repairs shall be made and the vacuum test and repairs shall be repeated until the manhole passes the test. If a manhole joint sealer is completely pulled out during the vacuum test, the manhole shall be disassembled and the sealer replaced.

END OF SECTION

SECTION 33 09 30

SCADA SYSTEM

PART 1 GENERAL

1.01 SCOPE

Furnish all materials, labor, and equipment to properly install and place into operation a cloud-based SCADA system that shall be managed by the system provider and includes remote terminal units (RTUs) as described in this Section. The system shall be furnished by Mission Communications Mydro 850, HighTide Technologies HTT-3100, or approved equal.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. 26 00 00 – General Electrical Provisions
B. Electric Wire and Cable

1.03 SUBMITTALS

Complete product data and engineering data, including shop drawings, shall be submitted to the Engineer in accordance with the requirements of Section 01 33 00 of the Contract Documents.

A. Manufacturer's Component Data Sheets indicating pertinent data and identifying each component by item number and nomenclature as specified and shown on the drawings.
B. Component Drawings showing dimensions, mounting and external connection details.
C. Detail Loop Diagrams showing both piping and wiring requirements for each instrument loop in the system.
D. A system piping schematic and wiring schematics each on a single drawing with full description of operation. Component item number identification on the schematics shall be as shown on the drawings.
E. Shop drawings of all panels and cabinets showing dimensions, mounting details, location and description of all instrumentation devices and nameplates that are mounted on the panel or cabinet, and location of terminal blocks and bulkhead fittings for field connections.
F. Manufacturer's recommended list of spare parts and special test equipment to be furnished.

PART 2 PRODUCTS

2.01 GENERAL

A. Quality Assurance

1. All work and materials shall conform to all applicable local, state and federal regulations.
2. Instrumentation shall be furnished by a single system supplier. This single supplier shall provide all equipment and appurtenances regardless of manufacturer and shall be responsible for satisfactory operation of the entire system.
3. The manufacturer shall be a specialist having had at least five (5) years experience in the design and fabrication of similar equipment.
4. All products, materials, and workmanship shall be fully warranted for a period of one (1) year after acceptance by the Owner. The warranty shall cover all cost of inspection and repair, including parts, labor, transportation, and engineering. This includes all problems associated with lightning and other surge problems.

B. Systems Supplier

1. The system supplier shall provide: the detailed design; complete functional description of the instrumentation and control system to be furnished under these specifications; the required submittal data including O&M manuals; and all tests including calibration and operational demonstrations to be performed under these specifications.
2. The supplier shall provide the supervisory service of a trained field service technician during construction to assist the Contractor in the location of sleeves; methods of installing conduit and cable; mounting; piping and wiring of one of each type of device; methods of protecting all of the equipment; and instructing the operating personnel. In addition, services of a field service engineer on-site shall be provided for as many days as needed for adjusting all equipment, placing it in operation, and instructing plant personnel in its proper operation and maintenance.
3. The supplier shall coordinate all interface requirements between the SCADA and control suppliers and other suppliers and make sure that any signal isolation devices required for proper interface are supplied.
4. The supplier shall calibrate all instrumentation in the presence of the Owner in accordance with the range and accuracy of the approved submittals.

C. System Requirements: All electrical components of the system shall operate on 120-volt, single-phase, 60 Hertz, except as otherwise noted. Controls for remote electrically operated or motor driven equipment shall include all necessary auxiliary relays so that only wiring and connections to the equipment control circuit will be required. Contacts for control of remotely motor operated or electrically operated equipment shall be rated no less than 10 amperes, 120 volts unless otherwise specified herein.

1. Each remote motor operated, or electrically operated equipment shall have a separate 120-volt control circuit.

2. Fuses or switches required by the instrumentation manufacturer shall be provided with the equipment. All instruments requiring internal power supply shall have an internal ON-OFF switch.

3. Solid state devices incorporated into the instrument system shall have state-of-the-art lightning and surge arresters furnished as part of the devices. All A.C. input source points shall have proper protection, and both ends of each signal loop shall be properly isolated and protected as part of the monitoring and instrumentation equipment.

4. Protective devices shall be specifically selected for protection of solid state equipment. Manufacturer shall be Joslyn, Phoenix Contact, or equal.

5. In the development of the control system schematics and equipment tabulations, it may be necessary to furnish transducers and/or isolation devices that have not been detailed. The instrument and control system supplier shall include all such devices as may be required for proper protection and operation of the system. These devices shall be of all solid-state design with isolated input and output. All electronic components shall be mounted on laminated epoxy glass circuit boards, in an impact resistant case for protection against moisture and temperature changes. Units shall be designed to plug into a common motherboard with plug-in isolated 24VDC power supply. Referenced supplier is AGM.

2.02 PRODUCTS/EQUIPMENT

B. Manufacturers: Provide products of one of the following:
   1. Mission Communications
   2. HighTide Technologies

C. General
   1. The SCADA system shall monitor all components of the Sewerage System, as shown on the electrical drawings. The system shall be for remote monitoring, data collection, and alarms only.

D. Panels
   1. RTU-INFLUENT:
      RTU-Influent shall monitor the following:
      a. AI - Wet Well Level (4-20 mA)
      b. DI - Raw Sewage Pump 1 RUN
      c. DI – Raw Sewage Pump 1 FAULT
      d. DI - Raw Sewage Pump 2 RUN
      e. DI – Raw Sewage Pump 2 FAULT
      f. DI - Raw Sewage Pump 3 RUN
      g. DI – Raw Sewage Pump 3 FAULT
      h. DI – Wet Well High-Level ALARM
      i. Power Failure Alarm
   2. RTU-PASS:
      RTU-Pass shall monitor the following:
      a. AI – Basin 1 DO
      b. AI – Basin 2 DO

c. AI – Basin 3 DO
d. AI – RAS Flow Rate
e. DI – Basin 1 Mixer 1A RUN
f. DI – Basin 1 Mixer 1B RUN
g. DI – Basin 1 Aerator RUN
h. DI – Basin 2 Mixer 2A RUN
i. DI – Basin 2 Mixer 2B RUN
j. DI – Basin 2 Aerator RUN
k. DI – Basin 3 Mixer 3A RUN
l. DI – Basin 3 Mixer 3B RUN
m. DI – Basin 3 Aerator RUN
n. DI – Aqua Pass System Fault
o. Power Failure Alarm

3. RTU-RAS PS

RTU-RAS PS shall monitor the following:

a. AI – Wetwell Level
b. DI – PUMP 1 RUN
c. DI – PUM P1 FAULT
d. DI – PUMP 2 RUN
e. DI – PUMP 2 FAULT
f. DI – PUMP 3 RUN
g. DI – PUMP 3 FAULT
h. DI – High-High ALARM
i. Power Fail Alarm

4. RTU-EFFLUENT

RTU-EFFLUENT shall monitor the following:

a. AI – Effluent Flow Rate
b. Power Fail Alarm

E. Communications System: The system shall be based on using third generation or newer cellular data for SCADA and on sending that data to a web based hosted SCADA computer service that monitors the entire system. Owner shall have administrative access to adjust any alarm setpoints via the web service. The system shall have an emergency contact list, editable by Owner, that will automatically call, text, and/or email contacts during alarm conditions.

F. Antennas, Cable, Masts and Poles

1. The SCADA system supplier shall provide the antenna for the sites as required to achieve the overall communications requirements of the system. Antenna shall be rated for out door use and approved by the Engineer. It shall be of all aluminum construction and rated to withstand at least 100-MPH winds with 1/2-inch radial ice.
2. Adequate lengths of cable shall be provided for connection of the antenna to the transceiver at the site. The transmission line shall be terminated only in connectors rated for the required service. A lightning arrestor shall be placed between the transceiver and coaxial cable.
3. Attention shall be given to the correct installation of the antennas to give adequate protection from nearby lighting strikes by providing a low

resistance DC path to ground. Instruction for installing this antenna shall be given to the Contractor to insure reliable operation.

4. Furnish all mounting masts or poles as required to support the antennas at the elevation and orientation required. Mast and pole shall be suitable for outdoor environmental conditions, provide adequate support and protection for transmission lines and be provided complete with all necessary mounting accessories.

PART 3 EXECUTION

3.01 DELIVERY, STORAGE, AND HANDLING

A. Receive, unload, and store all products in a clean, dry and secure environment until ready to install. Protect all parts and equipment from weather or physical damage.

3.02 PREPARATION

A. Inspect all field conditions and preceding work to determine conformance to the drawings and project requirements prior to execution of the Work.

B. Provide all necessary products, materials, supplies, and equipment at the site prior to commencing the construction.

3.03 INSTALLATION

A. Be responsible for the methods of construction, using generally accepted and safe procedures and equipment, with experienced workers, and in full conformance with applicable laws and regulations.

B. Coordinate the work of the system suppliers service personnel during construction testing, calibration, and acceptance of the instruments.

C. Tag all components with the item number and nomenclature given in the specifications and component tabulation lists.

D. Install per manufacturer’s recommendations.

E. Installed equipment must be inspected by manufacturer’s service representative prior to equipment start-up

3.04 SPARE PARTS

A. System manufacturer shall supply the following spare parts as well as any additional parts recommended for one year's operation:

B. Parts shall be packaged in protective enclosure suitable for storage and shipped separately to minimize possibility of damage.

3.05 FIELD TESTING

A. Provide the services of a factory trained, certified manufacturer's representative for inspection, start-up, testing and operator training as required. A minimum of two 8 hour days (one day for start-up / second day for training).
B. Submit operation and maintenance manuals at least ten (10) days prior to inspection.
C. Schedule field start-up with at least seven (7) days notice to the Owner.
D. Perform field test of completed work operating under actual field conditions witnessed by the Owner.

PART 4 SCHEDULE

END OF SECTION

SECTION 33 11 13

DUCTILE IRON PIPE AND FITTINGS

PART 1 GENERAL

1.01 SCOPE

A. Provide all labor, materials, equipment and incidentals necessary to construct and disinfect, if required, all ductile iron pipe and appurtenances located inside and under buildings and structures, and test as shown on the Drawings and as specified herein.

B. Ductile iron pipe and appurtenances covered under this Section shall include all interior pipe and accessories to the outside face of structures and buildings, except where there is no joint at the outside face. Where there is no joint at the exterior face, this Section shall include all ductile iron pipe and accessories within two feet of the exterior face of the structure or building.

C. This Section includes piping and fittings in utility vaults and manholes.

1.02 SUBMITTALS

A. Complete shop drawings and product data on all piping and fittings shall be submitted to the Engineer in accordance with the requirements of Section 01 33 00 of these Specifications.

B. Shop drawings shall indicate piping layout in plan and/or elevations and shall include a complete schedule of all pipe, fittings, specials, hangers and supports. Special castings shall be detailed showing all pertinent dimensions. Special coatings shall be clearly identified.

C. The Contractor shall furnish the Inspector with lists of all pieces of pipe and fittings in each shipment received. These lists shall give the serial or mark number, weight, class, size and description of each item received.

D. The Contractor shall submit written evidence to the Engineer that the products furnished under this Section will conform with the material and mechanical requirements specified herein. Certified copies of independent laboratory test results or mill test results from the pipe supplier may be considered evidence of compliance provided such tests are performed in accordance with the appropriate testing standards by experienced, competent personnel. In case of doubt as to the accuracy or adequacy of mill tests, the Engineer may require that the Contractor furnish test reports from an independent testing laboratory on samples of pipe materials.

E. This contract is partially funded by the GEFA CWSRF and the equipment m manufacturer shall meet the requirements identified in the SRF Supplemental

General conditions.

PART 2 PRODUCTS

2.01 DUCTILE IRON PIPE (DIP)

Ductile iron pipe shall be manufactured in accordance with AWWA C115. All pipe, except specials, shall be furnished in nominal lengths of 18 to 20 feet. Sizes will be as shown on the Drawings. All pipe shall have a minimum pressure rating as indicated in the following table, and corresponding minimum wall thickness, unless otherwise specified or shown on the Drawings:

Pipe Sizes (inches)	Special Thickness Class
4 - 54 Flanged	53
4 - 16 Grooved	53
18 Grooved	54
24 - 30 Grooved	56

2.02 FITTINGS AND ACCESSORIES

A. Fittings, 48-inches and smaller, shall be ductile iron and shall conform to AWWA C110/ANSI A21.10 with a minimum rated working pressure of 250 psi. Fittings, 54 inches and larger, shall be ductile iron and shall conform to AWWA C153/ANSI A15.30 and shall have a minimum rated working pressure of 150 psi. AWWA C153 compact ductile fittings in sizes 4” though 36" are an acceptable substitute unless otherwise specified.

B. Flanged elbow fittings shall be ANSI pattern using short radius elbows except where noted differently on the Drawings. Special fittings, ductile iron wall pipes and sleeves shall conform to the dimensions and details as shown on the Drawings.

C. Thrust Collars: Thrust collars shall be welded on ductile iron body type capable of withstanding a thrust due to 250 psi internal pressure on a dead end from either direction on that pipe size. The welded on collars shall be continuously welded to the pipe by the pipe manufacturer.

D. Solid sleeves shall permit the connection of plain end ductile iron pipe. Solid sleeves shall meet the requirements of ANSI/AWWA C110 for long pattern and have a minimum pressure rating of 250 psi. Solid sleeves shall have mechanical or restrained joints as specified in this Section and as shown on the Drawings.

Solid sleeves shall be used only in locations shown on the Drawings or at the direction of the Engineer. Solid sleeves shall be manufactured by ACIPCO, U.S. Pipe or McWane (Clow).

E. Tapping Saddles: Tapping saddles shall be ductile iron body type with O ring gasket and alloy steel straps. Connection shall be flanged or mechanical joint as detailed on the Drawings. Tapping saddles shall be equal to ACIPCO A 10920 (mechanical joint) or ACIPCO A 30920 (flange joint).

F. Flange Adapter Coupling: The flange adapter coupling shall permit the connection of unthreaded, ungrooved, open ended ductile iron pipe to ANSI/ASME B16.1, Class 125 flanges. The flange adapter coupling shall meet the test requirements of ANSI/ASME B16.1 for Class 125 flanges. The adapter shall be a ductile iron casting incorporating gripping wedges and gasket. The gasket shall provide a compression seal between the adapter, the pipe and the adjacent flange. Flange adapter couplings are to be used only in locations specifically shown on the Drawings and shall be installed in accordance with the manufacturer's recommendations. The flange adapter coupling shall be EBAA Iron Megaflange-Flange Adapter Series 2100.

G. Grooved joint fittings shall be manufactured of ductile iron, conforming to ASTM A395 and A536 or cast iron, conforming to ASTM A48 with grooved ends in conformance with ANSI/AWWA C606. Grooved joint fittings shall conform to ANSI A21.10/AWWA C110.

F. This contract is partially funded by the GEFA CWSRF and the equipment manufacturer shall meet the requirements identified in the SRF Supplemental General conditions.

2.03 JOINTS

A. General

1. Unless shown or specified otherwise, joints for buried service shall be push on or restrained joint type for pipe and standard mechanical, push on or restrained joints for fittings. Joints for exposed service shall be flanged for pipe and fittings, unless shown otherwise. Grooved joint fittings are allowable subject to the specified requirements in this section. See Table 33 05 05-A, Buried Piping Schedule, for service-specific joint types.

2. Provide the necessary bolts for connections. All bolts and nuts shall be threaded in accordance with ANSI B1.1, Coarse Thread Series, Class 2A external and 2B internal fit. All bolts and nuts shall be made in the U.S.A.

3. In all cases, gaskets shall be made of material that will not be damaged by the fluid being transported nor by the environment in which the pipe is installed.

B. Mechanical Joints

1. Joints shall conform to AWWA C111/ANSI A21.11.

2. Bolts and nuts shall be Tee Head bolts and nuts of high strength low alloy steel in accordance with ASTM A 242 to the dimension shown in AWWA C111/ANSI A21.11.

3. Gaskets shall be in accordance with AWWA C111/ANSI A21.11 and shall be constructed of neoprene unless otherwise shown on the Drawings.

4. Mechanical joint glands shall be ductile iron.

5. Retainer Glands: Retainer glands shall be Megalug Series 1100, as manufactured by EBAA Iron.

C. Push-On Joints: Push-on joints and gaskets shall conform to AWWA C111/ANSI A21.11. Details of the joint design shall be in accordance with the manufacturer's standard practice such as ACIPCO "Fastite", McWane (Clow) "Bell-Tite", or U.S. Pipe "Tyton" joints.

D. Flanged Joints

1. Flanged joints shall conform to AWWA C115/ANSI A21.15. Flanges shall be ductile iron and shall be furnished by the pipe manufacturer.

2. Flanged joints shall be bolted with through stud or tap bolts of required size as directed. Bolt length and diameter shall conform to ANSI/AWWA C115 for Class 125 flanges shown in ANSI/ASME B16.1.

   a. Bolts for exposed service shall be zinc plated, cold pressed, steel machine bolts conforming to ASTM A 307, Grade B. Nuts for exposed service shall be zinc plated, heavy hex conforming to ASTM A 563. Zinc plating shall conform to ASTM B 633, Type II.

   b. Bolts for submerged service shall be stainless steel machine bolts conforming to ASTM A 193, Grade B8. Nuts shall be heavy hex, stainless steel conforming to ASTM A 194, Grade 8.

3. Gaskets shall be made of 1/8 inch thick, Neoprene. Gaskets may be ring type or full face type.

4. Flanged ductile iron pipe shall have flanges cast solidly or threaded to the pipe barrel. Pipe threads shall be of such length that with flanges screwed home, the end of the pipe shall project beyond the face line of the flange. Flange and pipe shall then be machined to give a flush finish to the pipe and the flange and surface shall be normal to the axis of the pipe. Ductile iron flanges shall be of such design that the flange neck completely covers the threaded portion of the pipe to protect same against corrosion. All pipe with threaded type flanges shall be assembled, faced, and drilled at the point of manufacture, unless otherwise approved by the Engineer.

5. Flange filler shall conform to AWWA C110/ANSI A21.10. Joint bolt length shall be increased by the thickness of the flange filler.

6. Where tap or stud bolts are required, flanges shall be drilled and tapped accordingly.

E. Restrained Joints

1. Restrained joints shall be ACIPCO “FLEX RING" or U.S. Pipe "TR FLEX" for piping larger than 36-inches.

2. For piping 36-inches and less, restraining gaskets shall be ACIPCO "Fast Grip" or U.S. Pipe "Field Lok Gasket".

3. Bolts, nuts, and joint accessories shall be in accordance with manufacturer's recommendation.

4. Gaskets shall be in accordance with manufacturer's recommendation.

F. Grooved Joints

1. Grooved joints may be used in lieu of flanged or threaded piping systems.

2. Grooved joint couplings shall consist of ductile iron housings, conforming to ASTM A395 and A536, complete with pressure responsive synthetic rubber gasket (grade to suit the intended service). This synthetic rubber is NSF 61 certified for contact with portable water. Victaulic Style 31 with Grade M Gasket.

2.04 WALL SLEEVES AND WALL PIPES

A. Where piping passes through concrete structures, furnish and install wall sleeves unless wall pipes or other provisions are specifically shown on the Drawings.

B. Wall Sleeves

1. For pipe sizes smaller than 3 inches, wall sleeves shall be steel oversize sleeves furnished with a full circle, integral or continuously welded waterstop collar. The sleeve seal shall be the mechanically expanded, synthetic rubber type. Provide all associated bolts, seals and seal fittings, pressure clamps or plates necessary to achieve a watertight installation. Sleeves shall extend the full thickness of the concrete. All hardware shall be 316 stainless steel. Sleeves and seal shall be Link Seal.

2. For larger pipe sizes, wall sleeves shall be statically cast ductile iron mechanical joint wall sleeves. Unless specified or shown otherwise for a specific situation, wall sleeves shall be mechanical joint bell plain end type with waterstop/thrust collar. Sleeves shall be constructed with studs and mechanical joint retainer gland on the air side of the concrete structure.

   Provide retainer gland where shown on the Drawings. Where the concrete structure is exposed to dirt on one side and is wet on the other side, construct with studs and glands on the dirt side. Wall sleeves shall be equal to ACIPCO A 10771.

C. Wall Pipes

1. Wall pipes shall be either statically cast ductile iron with integral waterstop/thrust collar or centrifugally cast ductile iron with a

continuously welded waterstop/thrust collar. The welded on collar shall be attached to the pipe by the manufacturer. The collar shall be capable of withstanding a thrust force caused by a 250 psi dead end load from either direction on that size pipe. Wall pipes shall be furnished uncoated on the outside and cement lined on the inside.

2. Where shown on the Drawings, provide wall pipes (flange by restrained joint) which shall bolt to a Type C wall thimble provided by the sluice gate manufacturer. Class 125 flanges shall be provided.

3. Wall pipes shall be cast and/or fabricated and lined in one manufacturer's facility and delivered to the job site ready for use.

4. Wall pipe flanges shall be located 9-inches from wall to face of flange unless otherwise noted on the Drawings.

2.05 COATINGS

The exterior of pipe and fittings for buried service shall be factory coated with an asphaltic coating conforming to AWWA C151/ANSI 21.51 for ductile iron pipe, AWWA C115/ANSI 21.15 for flanged pipe and AWWA C110/ANSI 21.10 for fittings. Pipe and fittings which shall be exposed or submerged shall be factory coated with a general purpose rust inhibitive primer compatible with the type of paint which will be field applied in accordance with the requirements of Section 09 90 00 of these Specifications.

2.06 PIPE LININGS

A. Cement Linings: Unless shown or specified otherwise, ductile iron pipe and fittings shall be cement lined in accordance with AWWA C104/ ANSI A21.4, standard thickness.

B. Interior Lining: Ductile iron piping and fittings shall be epoxy lined where shown on the drawings.

C. Ceramic Epoxy Lining:

1. Linings shall cover all exposed surfaces of pipe and fittings. The lining of the pipe barrel shall extend from spigot end through the socket to the edge of the gasket sealing area or recess for pipe using push on gaskets, and to the edge of the gasket seat for mechanical joints. The lining shall also cover the exterior of the spigot end from the end of the pipe to beyond the gasket sealing area. The lining in fittings shall cover the interior surfaces including the socket areas as defined above. All linings shall be hermetically sealed at the ends. The pipe shall be coated on the interior with 40 mils nominal dry film thickness in one or more coats.

2. Lining Material: The lining material shall be Protecto 401 Ceramic Epoxy or Tnemec Perma-Shield PL 431, formulated for corrosion control with the following minimum requirements:

a. The material shall be recoatable with itself for at least seven days with no additional surface preparation when exposed to direct summer sun and a temperature of 90 degrees F.

b. The material shall contain at least 20 percent by volume of ceramic quartz pigment.

c. A test and service history demonstrating the ability of the material to withstand the service expected.

d. Possess a minimum solids volume content of 88 percent, + one percent.

3. Surface Preparation: The interior of the pipe exposed to liquids and gases shall be blasted and cleaned to remove all loose laitance, scale, or other loose material. No lining shall take place over grease, oil, etc., that would be detrimental to the adhesion of the compound to the substrate.

4. Application: The lining shall be applied with strict adherence to the manufacturer's instructions by a manufacturer certified applicator.

5. Lining of pipe barrel and fittings shall be 40 mils nominal thickness; minimum lining thickness shall be 30 mils. Lining thickness for exterior of spigot and interior of socket shall be 8 to 10 mils.

6. All pipe and fitting linings shall be tested for pinholes in accordance with ASTM G 62, Method B and shall be holiday free.

7. All pipe linings shall be checked for thickness using a magnetic film thickness gauge.

8. Each pipe joint and fitting shall be marked with the date of application of the lining system and with the numerical sequence of application of that date."

D. See Table 33 05 05-A, Buried Piping Schedule, for service specific lining requirements.

2.07 EXPANSION JOINTS

A. The Expansion Joint shall have a rubber inner tube, a body constructed of multiple piles of fabric impregnated with synthetic rubber, and a protective outer cover of synthetic rubber to provide resistance to deterioration from weather and ozone. Special covers shall be applied when indicated on the drawings to resist weather, ozone, and corrosive fumes. Steel wire shall be imbedded in the body for additional strength.

B. The elastomer and fabric materials shall be determined by the temperature and chemical compatibility requirements, as indicated on the drawings.

1. Class 1 - to 108°F: PGR, Neoprene, Buna-N, or Hypalon, with Nylon or Polyester reinforcement.

2. Class II - to 250°F: Chlorobutyl, EPDM, or Teflon® -lined, with Polyester reinforcement.

3. Class III - to 400°F: Solid Viton®, with Kevlar® reinforcement.

C. Flanges shall be constructed integrally with the body to resist stresses. Flanges shall be full-pattern so that gaskets are not necessary. Flanges shall be drilled to ANSI B16.5 Class 150#. Flanges shall be accompanied with Galvanized 3/8" split steel retaining rings and enough control rods installed to achieve a working pressure of 200 psi.

D. The expansion joint shall be available with a single arch or multiple arches, in open or filled arch (s) construction, and with wide arch (es) as specified on the drawings. Joint dimensions, movement, and spring rates for all variations shall follow Fluid Sealing Association guidelines.

E. The elastomer construction of the joint acts to absorb vibration, preventing it from being transmitted to the piping, as well as compensation for lateral deflection. The integral arch allows for axial compression and elongation of the joint, to compensate for expansion and contraction of the piping.

F. All expansion joints shall be Redflex™ Type J-1 as manufactured by the Red alve Company, Inc. of Carnegie, PA 15105 or approved equal.

PART 3 EXECUTION

3.01 CUTTING

A. When new or existing pipe is required to be cut, the pipe shall be cut in such a manner as to leave a smooth end normal to the axis of the pipe.

B. All cutting of ductile iron pipe shall be performed with a cutting saw. All burrs shall be removed from the inside and outside edges of all cut pipe. All damaged linings and coatings shall be repaired.

C. Lining Repair: Repair linings and recoat spigot ends of cut pipe with a product equal to Protecto 401 in accordance with the manufacturer's recommendations and as specified below:

1. Remove all burrs and areas of loose lining materials by sanding or scraping to bare metal.

2. Remove oil and lubricants used during field cutting.

3. Lining shall be stripped back a minimum of 1 inch from the spigot end into well adhered lined areas.

4. Roughen 1 to 2 inches of good lining with a rough grade (40 grit) emery paper, rasp or small chisel, to allow an overlap between new and existing lining.

5. Apply lining repair material in the number of coats required to match the

thickness requirements as specified in Part 2 of this Section and in accordance with the manufacturer's recommendations.

3.02 JOINT ASSEMBLY

A. General: Ductile iron pipe shall be assembled in accordance with ANSI/AWWA C600.

B. Push On Joints: The inside of the bell and the outside of the pipe from the plain end to the guide stripe shall be wiped clean immediately before assembling the pipe joint. Then the rubber gasket shall be inserted into a groove or shaped recess in the bell. Both the bell and spigot ends to be joined shall be wiped again to ensure they are thoroughly clean. A liberal coating of special lubricant furnished by the pipe manufacturer shall be applied to the outside of the pipe. The plain end shall be centered in the bell and the spigot pushed home.

C. Mechanical Joints

1. The surfaces with which the rubber gasket comes in contact shall be brushed thoroughly with a wire brush just prior to assembly to remove all loose rust or foreign material which may be present and to provide clean surfaces which shall be brushed with a liberal amount of soapy water or other approved lubricant just prior to slipping the gasket over the spigot end and into the bell. Lubricant shall be brushed over the gasket prior to installation to remove loose dirt and lubricate the gasket as it is forced into its retaining space.

2. Joint bolts shall be tightened by the use of wrenches and to a tension recommended by the pipe manufacturer. When tightening bolts, the gland shall be brought up toward the pipe bell. If effective sealing is not attained at the maximum torque indicated above, the joint shall be disassembled and reassembled after thorough cleaning. Overstressing of bolts to compensate for poor installation shall not be permitted.

3. After installation, bolts and nuts in buried piping shall be given two heavy coats of a bituminous paint. Bolts and nuts for exposed or submerged service shall be coated in accordance with the requirements of Section 09 90 00 of these Specifications.

D. Flanged Joints

1. All flanges shall be true and perpendicular to the axis of the pipe. Flanges shall be cleaned of all burrs, deformations, or other imperfections before joining. Flanged joints shall be installed so as to ensure uniform gasket compression. All bolting shall be pulled up to the specified torque by crossover sequence. Where screwed flanges are used, the finished pipe edge shall not extend beyond the face of the flange, and the flange neck shall completely cover the threaded portion of the pipe.

2. Connections to equipment shall be made in such a way that no torque is placed on the equipment flanges. Connecting flanges must be in proper

position and alignment and no external force may be used to bring them together properly.

3. After installation, bolts and nuts for exposed or submerged service shall be coated in accordance with the requirements of Section 09 90 00 of these Specifications.

4. Flanged filler shall be used only where shown on the Drawings or approved by the Engineer to make up minor differences in pipe length, less than 3 inches. Joint bolts shall be increased in length by the thickness of the flange filler.

E. Grooved Joints: All grooved couplings, fittings and valves shall be the products of a single manufacturer. Grooving tools shall be of the same manufacturer as the grooved components. The gasket style and elastomeric material (grade) shall be verified as suitable for the intended service as specified. Gaskets shall be molded and produced by the grooved coupling manufacturer. Grooved ends shall be clean and free from indentations and projections in the area from pipe end to groove. Grooved coupling manufacturer's factory trained field representative shall provide on-site training for contractor's field personnel in the proper use of grooving tools, application of groove, and installation of grooved piping products. Factory trained representative shall periodically inspect the product installation. Contractor shall remove and replace any improperly installed products.

F. Joints of Dissimilar Metals: When a flanged joint consists of a ductile iron flange mated to a steel or alloy flange, the steel flanges shall be flat faced and furnished with full faced gaskets, insulating bushings.

3.03 DRILLING AND TAPPING

A. Wherever required ductile iron pipe and fittings shall be drilled and tapped to receive drainage or any other piping. All holes shall be drilled accurately at right angles to the axis of any pipe or fitting. Where plugs are drilled, holes shall be at right angles to the face of the plug.

B. Unless shown otherwise, small diameter pipes, less than 2 inches, shall be connected to ductile iron pipe using one of the following methods:

1. Direct tap.

2. Direct tap with service saddle.

3. Direct tap boss.

4. Tapped plug or flange on tapping saddle.

C. In no case shall the effective number of threads be less than 4.

3.04 CONSTRUCTING BENEATH AND BEYOND STRUCTURES

A. Construct beyond buildings and structures in accordance with Section 33 11 00 of these Specifications.

B. All ductile iron pipe installed under buildings or basins shall be encased and backfilled in accordance with Section 31 20 00 and 31 23 16 of these Specifications.

C. All ductile iron pipes entering buildings or basins shall be adequately supported between the structure and undisturbed earth to prevent damage resulting from settlement of backfill around the structure.

3.05 CONSTRUCTING WITHIN STRUCTURES

A. Proper and suitable tools and appliances for safe and convenient handling and laying of pipe and fittings shall be used. Care shall be taken to prevent the pipe coating from being damaged, particularly cement linings on the inside of the pipes and fittings. Any damage shall be remedied as directed by the Engineer.

B. All pipe and fittings shall be carefully examined by the Contractor for defects just before installing and no pipe or fitting shall be installed if it is defective. If any defective pipe or fitting is discovered after having been installed, it shall be removed and replaced in a satisfactory manner with a sound pipe or fitting by the Contractor at Contractor's own expense.

C. All pipes and fittings shall be thoroughly cleaned before they are installed and shall be kept clean until they are used in the completed work. Open ends of pipe shall be kept plugged with a bulkhead during construction.

D. All elbows, tees, brackets, crosses, and reducers in pressure piping systems shall be adequately restrained against thrust.

E. Wall pipe and wall sleeves shall be accurately located and securely fastened in place before concrete is poured. All wall pipe and sleeves shall have wall collars properly located to be in the center of the wall where the respective pipes are to be installed. Pipe passing through the sleeve shall extend no more than three feet beyond the structure without a piping joint.

F. Wall pipe and wall sleeves shall be constructed when the wall or slab is constructed. Blocking out or breaking of the wall for later installation shall not be permitted.

G. Cutting or weakening of structural members to facilitate pipe installation shall not be permitted. All piping shall be installed in place without springing or forcing.

H. Exposed ductile iron piping shall be supported as shown on the Drawings.

3.06 FIELD PAINTING

Field painting of exposed and submerged pipe shall be in accordance with the requirements of Section 09 90 00 of these Specifications.

3.07 INSPECTION AND TESTING

All testing shall be in accordance with the requirements of Section 33 05 05 of these Specifications.

3.08 INSULATION AND HEAT TRACING

Provide insulation and heat tracing for above grade piping where shown on the Plans in accordance with Section 22 05 33 of these Specifications.

3.09 DISINFECTION

Following installation and testing, potable water lines shall be disinfected in accordance with the requirements of Section 33 11 00 of these Specifications.

END OF SECTION

PART 1 GENERAL

1.01 SCOPE

A. Furnish all labor, tools, equipment and materials necessary for the construction of all gravity sewer lines as shown on the plans and/or in the specifications; including mains, fittings, connections, piers, collars, headwalls and all other appurtenances specified and/or required.

B. Site piping covered under this Section shall begin at the outside face of structures and buildings, except where there is no joint at the outside face, then site piping shall begin not more than two feet beyond the face of the structure or building.

1.02 RELATED WORK SPECIFIED ELSEWHERE

Section 31 23 16 - Trench Excavation and Backfill.

Section 33 05 23 – Pipe Jacking

Section 00 34 00 – Sanitary Sewer Force Main.

Section 33 05 13 – Manholes and Structures.

Section 33 31 05 – Sanitary Utility Equipment.

1.03. SUBMITTALS

1. Complete product data and engineering data, including shop drawings, shall be submitted to the Engineer in accordance with the requirements of Section 01 33 00 of the Contract Documents.
2. This contract is partially funded by the GEFA CWSRF and the equipment manufacturer shall meet the requirements identified in the SRF Supplemental General conditions.

1.04 TRANSPORTATION AND HANDLING

A. Unloading: Furnish equipment and facilities for unloading, handling, distributing and storing pipe, fittings, valves and accessories. Make equipment available at all times for use in unloading. Do not drop or dump materials. Any materials dropped or dumped will be subject to rejection without additional justification. Pipe handled on skids shall not be rolled or skidded against the pipe on the ground.

B. Handling: Handle pipe, fittings and accessories carefully to prevent shock or damage. Handle pipe by rolling on skids, forklift, or front end loader. Do not use material damaged in handling. Slings, hooks or pipe tongs shall be padded and used in such a manner as to prevent damage to the exterior coatings or internal lining of the pipe. Do not use chains in handling pipe, fittings and appurtenances.

1.05 STORAGE AND PROTECTION

A. Store all pipe which cannot be distributed along the route. Make arrangements for the use of suitable storage areas.

B. Stored materials shall be kept safe from damage. The interior of all pipe, fittings and other appurtenances shall be kept free from dirt or foreign matter at all times.

C. Pipe shall not be stacked higher than the limits recommended by the manufacturer. The bottom tier shall be kept off the ground on timbers, rails or concrete. Pipe in tiers shall be alternated: bell, plain end; bell, plain end. At least two rows of timbers shall be placed between tiers and chocks, affixed to each other in order to prevent movement. The timbers shall be large enough to prevent contact between the pipe in adjacent tiers.

D. Stored push-on joint gaskets shall be placed in a cool location out of direct sunlight. Gaskets shall not come in contact with petroleum products. Gaskets shall be used on a first-in, first-out basis.

PART 2 PRODUCTS

2.01 PIPE

A. Polyvinyl Chloride Pipe (PVC: SDR-26) is classified as "Flexible" pipe, the plastic having a cell classification of 12454 or 12364, as defined in ASTM D3034 for 4” through 15” and F679 for 18” through 36”. Furnished in 14 or 20-foot lengths. Minimum wall thickness shall be as follows:

4”	-	.162 inches	15”	-	.588 inches
6”	-	.241 inches	18”	-	.671 inches
8”	-	.323 inches	21”	-	.791 inches
10”	-	.404 inches	24”	-	.889 inches
12”	-	.481 inches	27”	-	1.002 inches

1. Each length of pipe shall be marked with the manufacturer’s name, trade name, nominal size, class, hydrostatic test pressure, manufacturer’s standard symbol signifying it was tested and date of manufacture.

2. Each rubber ring shall be marked with the manufacturer’s identification, size, year of manufacture and the classes of pipe with which it can be used.

B. Ductile Iron Pipe – DIP shall be pressure class 350 for 4" thru 12", class 250 for 14" th

ru 20", class 200 for 24" and Class 150 for 30" thru 64". Ductile Iron Pipe designed and manufactured in accordance with ANSI A21.51 centrifugally cast in metal or sand lined molds. Exterior surface shall be seal coated with 1 mil thick approved asphaltic coating in accordance with ANSI/AWWA C151/A21.51

C. Ultra-Rib Polyvinyl Chloride Pipe (PVC) Pipe from 8" thru 30" shall have a smooth interior with a solid cross-sectional rib exterior. The pipe shall have cell classification of 12454-B, 12454-C or 13364-B as defined in ASTM D1784. Ultra-Rib PVC Gravity Sewer Pipe shall meet the requirements of ASTM F794. Exterior ribs shall be perpendicular to the axis of the pipe to allow placement of sealing gasket without additional cutting or machining. The minimum "Pipe Stiffness" at 5% deflection shall be 60 psi for 8" thru 12" and 46 psi for 15" thru 30" when tested in accordance with ASTM D2412.

D. Reinforced Concrete Pipe (RCP) shall be manufactured in accordance with ASTM C 76, AASHTO M 170.

E. A-2000 Polyvinyl Chloride Pipe (PVC): Pipe from 4" thru 36" shall have a **smooth interior with corrugated exterior** the pipe shall have a cell classification of 12454-B or 12454-C, as defined in ASTM D1784 furnished in 13 or 20-foot lengths. A-2000 PVC Gravity Sewer Pipe shall meet the requirements of ASTM F949 and ASTM F794. Pipe shall be manufactured to a minimum "Pipe Stiffness" of 46 psi when tested in accordance with ASTM D2412.

1. Each length of pipe shall be marked with the manufacturer's name, trade name, nominal size, class, hydrostatic test pressure, manufacturer's standard symbol signifying it was tested and date of manufacture.

2. Each rubber ring shall be marked with the manufacturer's identification, size, year of manufacture and the classes of pipe with which it can be used.

F. A-2026 Polyvinyl Chloride Pipe (PVC): Pipe from 8" thru 12" shall have a **smooth interior with corrugated exterior** the pipe shall have a cell classification of 12454-B or 12454-C, as defined in ASTM D1784 furnished in 121/2 foot lengths. A-2026 PVC Gravity Sewer Pipe shall meet the requirements of ASTM F949. Pipe shall be manufactured to a minimum "Pipe Stiffness" of 115 psi when tested in accordance with ASTM D2412.

1. Each length of pipe shall be marked with the manufacturer's name, trade name, nominal size, class, hydrostatic test pressure, manufacturer's standard symbol signifying it was tested and date of manufacture.

2. Each rubber ring shall be marked with the manufacturer's identification, size, year of manufacture and the classes of pipe with which it can be used.

2.02 SERVICE PIPE AND FITTINGS

All service pipe and fittings shall be the same as approved for SDR 26 PVC and PC 350 DIP sewer pipe only. No other pipe material will be accepted unless approved by the Engineer.

2.03 JOINTS AND JOINING MATERIALS

A. PVC Pipe joints shall be rubber ring type slip joints as manufactured by Clow or approved equal. Ring/gasket shall be designed to prevent inflow or outflow. The rubber gaskets shall conform to ASTM D-3139 for Polyvinyl Chloride Slip Joint.

1. Joints for rubber push type gaskets and compression joint sealing meeting the requirements of ASTM D-3212 or F-477 shall also be acceptable.

2. All lubricants and gaskets used shall be suitable for sewage applications and be in accordance with the manufacturer's recommendations.

B. Ductile Iron Pipe joints shall be single rubber gasket push-on type, such as Fastite or Tyton, conforming to the requirements of ANSI A21.11; unless mechanical joints conforming to ANSI A 21.11 are specified in the bid schedule or on the plans.

1. All lubricants and gaskets used shall be suitable for sewage applications and be in accordance with the manufacturer's recommendations.

C. Ultra-Rib PVC Gravity Sewer Pipe joints shall be installed using the same methods currently used for PVC pipe.

D. Reinforced Concrete Pipe joints shall conform to ASTM C 361, ASTM C443 (AASHTO M198). "O"-ring type rubber gasketed concrete joints shall be installed in accordance with the manufacturer's recommendations. All lubricants and gaskets used shall be suitable for sewage applications and be in accordance with the manufacturer's recommendations.

E. A-2000 PVC Gravity Sewer Pipe joints shall be installed using the same methods currently used for PVC pipe.

F. A2026 PVC Gravity Sewer Pipe joints shall be installed using the same methods currently used for PVC pipe.

2.04 PIPE FITTINGS AND SPECIALS

A. Dip Fittings And Specials

Mechanical joint fittings shall conform to either AWWA C110 or AWWA C153 (Compact Fittings). Minimum pressure rating for fittings shall be 350 psi. All other fittings shall conform to AWWA C110. Unless otherwise noted on the plans, fittings for underground installation shall be mechanical joint conforming to AWWA C111, and fittings for above ground installation shall be flanged conforming to ANSI B16.1 Class 125. Minimum pressure rating for fittings shall be 250 psi. Fittings and specials shall be completed with rings, bolts, gaskets, etc., for joints.

B. Polyvinylchloride Pipe

Fittings used on 4" thru 10" PVC Pipe transitions shall be mechanical or restrained joints as manufactured by American Pipe, U.S. Pipe, Clow, Contech Construction Products Inc. or EBAA Iron Inc.

2.05 TRANSITION COUPLINGS

Transition Couplings – Couplings shall be ductile iron conforming to ASTM A-536. Coupling shall be as manufactured by Ford, Dresser, JCM or approved equal.

PART 3 EXECUTION

3.01 EXISTING UNDERGROUND UTILITIES AND OBSTRUCTIONS

A. The plans indicate utilities and obstructions that are known to exist according to the best information available to the Owner.

B. Existing Utility Location: The following steps shall be exercised to avoid interruption of existing utility service.

1. Expose the facility, for a distance of at least 100 feet in advance of pipeline construction, to verify its true location and grade. Repair, or have repaired, any damage to utilities resulting from locating or exposing their true location.

2. Avoid utility damage and interruption by protection with means or methods recommended by the utility owner.

C. Conflict with Existing Utilities

1. Horizontal Conflict: Horizontal conflict shall be defined as when the actual horizontal separation between a utility, main, or service and the proposed piping does not permit safe installation of the piping by the use of sheeting, shoring, tying-back, supporting, or temporarily suspending service of the parallel or crossing facility. The Contractor may change the proposed alignment of the piping to avoid horizontal conflicts if the new alignment complies with regulatory agency requirements and after a written request to and subsequent approval by the Engineer. Where such relocation of the piping is denied by the Engineer, the Contractor shall arrange to have the utility, main, or service relocated.

2. Vertical Conflict: Vertical conflict shall be defined as when the actual vertical separation between a utility, main, or service and the proposed piping does not permit the crossing without immediate or potential future damage to the utility, main, service, or the piping. The Contractor may change the proposed grade of the piping to avoid vertical conflicts if the changed grade maintains adequate cover and complies with regulatory agencies requirements after written request to and subsequent approval by the Engineer.

D. Electronic Locator: Have available at all times an electronic pipe locator and a magnetic locator, in good working order, to aid in locating existing pipe lines or other obstructions.

E. Water and Sewer Separation

1. Gravity sewer lines should maintain a minimum 10 foot edge-to-edge separation from potable water mains. If the main cannot be installed providing

the 10 foot separation, the separation may be reduced, provided the bottom of the water main is a minimum of 18-inches above the top of the sewer. Should neither of these two separation criteria be possible, the potable water main shall be encased in concrete with a minimum depth of 6-inches.

2. Where sewer mains cross the water, the pipe joint adjacent to the pipe crossing the water shall be cut to provide maximum separation of the pipe joints from the water.

3. No water main shall pass through, or come in contact with, any part of a sanitary sewer manhole.

3.02 INSTALLATION IN TRENCH

A. Installation for PVC pipe shall conform to ASTM D 2321 Latest Designation. Minimum cover for gravity sewer lines shall be 48 inches for PVC piping and 36 inches for all other materials. PVC shall be installed on a Class B bedding as specified in Section 31 23 16.

B. Installation for DIP shall conform to the Ductile Iron Pipe Handbook published by DIPRA latest revision. Installation in Georgia State Highway rights-of-way and streets and roads under the jurisdiction of the Georgia State Highway Department shall meet the requirements of the Georgia State Highway Department's Standard Specifications and Policy and Procedure for Accommodation of Utilities. Provide stakes, planks, nails, etc., and such field men and assistance for establishing benches and reference as the Engineer may request. DIP shall be installed on a Class C bedding as specified in Section 31 23 16.

C. Ultra-Rib PVC Gravity Sewer Pipe shall be installed using the same methods currently used for PVC pipe. PVC shall be installed on a Class B bedding as specified in Section 31 23 16.

D. Reinforced Concrete Pipe shall be installed in accordance with applicable provisions of the American Concrete Pipe Association (ACPA). RCP shall be installed on a Class C bedding as specified in Section 31 23 16.

E. A-2000 PVC Gravity Sewer Pipe shall be installed using the same methods currently used for PVC pipe. PVC shall be installed on a Class B bedding as specified in Section 31 23 16.

F. A2026 PVC Gravity Sewer Pipe shall be installed using the same methods currently used for PVC pipe. PVC shall be installed on a Class B bedding as specified in Section 31 23 16.

3.03 UNPAVED AREAS

In areas not used for streets and in unpaved streets, maximum trench width shall be the pipe diameter plus 24 inches. Protect all trees, shrubs and structures. Protect all fences and replace those damaged/removed with like kind. Keep work and equipment within easement limits. Repair and replace any damage.

3.04 PAVED AREAS

A. Paved streets shall have a maximum trench width of pipe diameter plus 24 inches. Shore and brace trench walls as necessary to prevent damage to existing paving. Do not cut existing sidewalk, or curb and gutter without approval by the Engineer. Use rubber tired equipment only on streets. Repair and replace all damage. Saw cut all pavements an additional 6 inches on each side of the trench prior to replacement.

B. All materials and construction methods shall conform to the Georgia State Highway Department's Standard Specifications and Policy and Procedure for Accommodation of Utilities.

3.05 LAYING SEWER PIPE

A. Lay to line and grade established by the plans using a laser. Begin construction downstream and lay with bells upstream. Pipe to be clean and dry prior to placement. Maintain pipe in dry condition until joints are thoroughly set. Joints shall be close and even butting all around. Maintain true surface of invert throughout entire length of sewer. Secure and close pipe at end of each work period.

B. Any pipe, which has its alignment, grade or joints disturbed after installation shall be taken up and relaid.

C. Maintain 10' minimum edge-to-edge horizontal separation between sewers and water mains as shown on the plans. Where sewer and water lines cross, maintain 18" minimum edge-to-edge vertical separation. Crossings shall be arranged to obtain maximum separation between water and sewer joints. When minimum clearances cannot be met, encasement shall be accomplished as shown in the details or as directed by the Engineer.

3.06 JOINING SEWER PIPE AND SERVICE CONNECTIONS

A. Join pipe in strict accordance with pipe manufacturer's recommendations. All lubricants and gaskets used shall be suitable for sewage applications and be in accordance with the manufacturer’s recommendations. All pipe with defective joints will be removed from the job site. When joining any plastic pipe to manhole use only manhole adaptors that have been approved by the Engineer or coring method with manhole adaptors for existing manholes.

B. Wyes and/or service connections to be installed where shown on the plans or as directed by the Engineer. All service pipe fittings shall be the same as approved for SDR 26 PVC and PC 350 DIP sewer pipe only. No other pipe material will be accepted unless approved by the Engineer. Service connections shall be carried from the sewer to the street right-of-way, easement line or as directed by the Engineer. Install service pipe under existing sidewalk, paved driveways, paved streets and roads where shown on plans by boring, tunneling, or jacking. All service lines not immediately connected to a service stub shall be closed with an air-tight, removable

plastic plug and marked with a 2 x 2 or larger wood stake driven two feet in the ground or by other means approved by the Engineer. Contractor to record actual installed location of all wyes and/or services and submit same to Engineer.

3.07 CLEANOUTS

Cleanouts shall be installed at any bends, and at intervals no greater than 90 feet along straight runs in all sewer services. Cleanouts shall be located as shown on the plans or as directed in the field by the Engineer or the Owner's Representative.

3.08 PIPELINE DETECTION MARKING

A. All sewer mains shall be protected by a plastic marking tape placed a minimum of 24 inches above the top of pipe for its full length. The tape shall be similar to Reef Industries' Terra Tape Standard. It will have sufficient thickness; tensile strength; elongation and resistance to alkalis, acids and other destructive agents to remain a permanent marker of the line buried below. A message shall be printed on the tape at least every 30 inches "**CAUTION SEWER LINE BURIED BELOW**".

B. All non-metallic sewer mains shall be protected by a metalized foil tape buried a minimum of 24 inches above the top of the pipe or at a maximum depth of 6'-0" for its full length. The foil shall be protected by plastic film laminated on each side. The lamination shall be strong enough to prevent the separation of foil and plastic film. The tape should be similar to Reef Industries' Terra Type Detectable. It shall be inductively locatable and conductively traceable using a standard pipe and cable-locating device. A message shall be printed on the tape every 30 inches "**CAUTION SEWER LINE BURIED BELOW**".

3.09 TESTING

A. Payment may be withheld for work failing to meet the required tests. All lines and manholes must be laid accurately to line and grade and meet the required tests.

B. LAMP TEST: All gravity sewer lines shall be tested between manholes with lanterns or reflected light. Shall show at least 90% of the full circle of the pipe from manhole to manhole without obstruction.

C. INFILTRATION AND LOW PRESSURE AIR TEST: Infiltration of groundwater into sewer lines shall not exceed 25 gallons per inch of pipe diameter, per mile of sewer within a 24 hour day. All visible or audible leaks must be dug up and repaired unless it is found to be in a joint and can be repaired by chemical grouting. The contractor shall test the integrity of the installed sewer line by the use of low-pressure air. This test shall be performed upon such lines after connection laterals, if any, have been plugged adequately and braced to withstand the test pressure, and the trenches have been backfilled for sufficient time as to generate a reasonable portion of the ultimate trench load upon the pipe. The minimum time between completion of the backfill operation and commencing this testing shall be determined by the engineer.

1. The contractor shall have the responsibility to ensure that all air plugs are installed and braced to prevent blowouts. Pressurizing equipment shall include a regulator or relief valve to avoid over pressurizing and damaging an otherwise acceptable line. No one shall be allowed in the manholes during testing.

2. Secure the plugs in all pipe outlets, including stoppers in laterals, to resist the test pressure. Clean out all debris in the pipe. At the option of the contractor, the interior pipe surface may be wet by flushing the line, in order to produce more consistent test results.

3. Procedure; The sewer line to be tested shall be tested between manholes. The line shall be sealed at each end. The seal at one end shall have an orifice through which to pass air into the pipe. An air supply shall be connected to the orifice at one end of the line. The air supply line will contain an on-off gas valve and a pressure gauge having a range of from 0 to 5 psi. The gauge shall have minimum divisions of 0.10 psi and shall have an accuracy of = 0.04 psi. The pipe line under test shall be pressurized to 4 psig. The line will be allowed to stabilize between 4 psig and 3.5 psig for a period of no less than 5 minutes. If necessary, air should be added to the line to maintain the pressure above 3.5 psig. After the stabilization period, the gas valve shall be closed. When the line pressure drops to 3.5 psig, commence timing with a stop watch. The stop watch should be allowed to run until such time as the line pressure drops to 2.5 psig. Then the watch should be stopped and the time lapse compared with the allowable time lapse as specified below in this specification for the pipe size and leakage allowance specified by the Engineer. If the time lapse is greater than that specified, the section undergoing test shall have passed, and the test may be discontinued at that time. If the time is less than that specified, the line has not passed the test and the Contractor will be required to prepare the line for retest. If the pipe line to be tested is beneath the ground water level, the test pressure shall be increased 0.433 psi for each foot the ground water level is above the invert of the pipe.

Air Leakage Chart (min:s): ASTM F-1417

Minimum time required for a 1.0 psig pressure drop from 3.5 psig to 2.5 psig. See Practice UNI-B-6-90

Size (in.)	Min. Time min:s	Time for Length, s	Size (in.)	Min. Time min:s	Time for Length, s
4	3:46	0.380*L	15	14:10	5.342*L
6	5:40	0.854*L	18	17:00	7.692*L
8	7:34	1.520*L	21	19:50	10.740*L
10	9:26	2.374*L	24	22:40	13.674*L

12	11:20	3.418*L

Example: 400 l.f. of 8-inch pipe; Time = 1.520*400 = 608.0s = 10m:08s

4. Retest of Test Section: Any section of line in which a loss of more than 1.0 psig is encountered during the period of test may be retested at the option of the contractor. Failure of a test section of a line shall require location and grouting or other repair or replacement of the source of excessive air loss. The engineer shall approve the method to be used prior to any repair or replacement. The cost of repair or replacement as well as acceptance retesting shall be borne by the contractor.

D. Compaction tests shall be required for line under pavement and structures. Initial testing shall be performed by a certified testing laboratory, and the cost borne by the Owner. The frequency shall be one test every one hundred (100) feet on each lift along a trench or as directed by the Engineer. Material failing to meet the required test shall be removed, replaced and retested at the Contractor's expense.

E. Deflection (Mandrel) Testing

PVC sewer lines suspect of excessive deflection will, when directed by the Engineer and at his option, be subjected to a mandrel test for deflection. Additionally, the mandrel test shall be performed on all PVC lines in accordance with ASTM D3034, F679, F949 or 2122.

Not before 30 days after pipe is laid and backfill placed, the Contractor shall, in the presence of the Engineer, test designated pipe for deflection. A mandrel, sized to permit up to 5.0% deflection, shall be used. Minimum diameters of mandrels used for their corresponding pipe size are as follows:

8" line=7.6" or 10" line=9.5" or 12" line=11.4"

The sequence for testing is as follows:

1. Completely flush the line making sure the pipe is clean of any mud or debris that would hinder the passage of the mandrel.
2. During the final flushing of the line, attach a floating block or ball to the end of the mandrel pull rope and float the rope through the line.
3. After the rope is threaded through the line, connect the pull rope to the mandrel and place the mandrel in the entrance of the pipe.
4. Connect a retrieval rope to the back of the mandrel to pull it back if necessary.
5. Remove all the slack in the pull rope and place a tape marker on the rope at the ends of the pipe where the mandrel will exit, determining the location of the mandrel in the line.
6. Draw mandrel through the sewer line.
7. If a section with excessive deflection is found, locate it; dig down and uncover the pipe; inspect the pipe, if any damaged pipe is found, replace it; if pipe is not damaged, replace and thoroughly tamp the haunching and initial

backfill; replace remainder of backfill.

F. Television Testing

The sewer line to be TV inspected. The sewer line shall be flushed with clean water prior to TV inspection. The video shall be clear and of good quality. Contractor shall submit the video to Owner and Engineer for review.

3.10 CLEANUP

Remove all surplus materials, tools, excess dirt, rubbish, and debris from the site as installation progresses. Clean as directed by the Engineer. Obtain letter of approval from the State Highway Department covering work installed in areas of State Highway jurisdiction. Contractor to maintain surface of ditches, unpaved streets, road shoulders, sod, grass, and other disturbed surfaces for a period of thirty (30) days thereafter.

END OF SECTION

SECTION 33 31 14

TEMPORARY BYPASS PUMPING SYSTEM

PART 1 GENERAL

1.01 SCOPE

A. Under this item the Contractor is required to furnish all materials, labor, equipment, power, maintenance, etc. to implement a temporary pumping system for the purpose of diverting the existing flow around the work area for the duration of the project.

B. The design, installation and operation of the temporary pumping system shall be the Contractor's responsibility. The Contractor shall employ the services of a vendor who can demonstrate to the engineer that he specializes in the design and operation of temporary bypass pumping systems. The vendor shall provide at least five (5) references of projects of a similar size and complexity as this project performed by his firm within the past three years. The bypass system shall meet the requirements of all codes and regulatory agencies having jurisdiction.

1.02 SUBMITTALS

The Contractor shall submit to the Engineer detailed plans and descriptions outlining all provisions and precautions to be taken by the Contractor regarding the handling of existing wastewater flows. This plan must be specific and complete, including such items as schedules, locations, elevations, capacities of equipment, materials and all other incidental items necessary and/or required to insure proper protection of the facilities, including protection of the access and bypass pumping locations from damage due to the discharge flows, and compliance with the requirements and permit conditions specified in these Contract Documents. No construction shall begin until all provisions and requirements have been reviewed by the Engineer.

A. Staging areas for pumps;

B. Sewer plugging method and types of plugs;

C. Number, size, material, location and method of installation of suction piping;

D. Number, size, material, method of installation and location of installation of discharge piping;

E. Bypass pump sizes, capacity, number of each size to be on site and power requirements;

F. Calculations of static lift, friction losses, and flow velocity (pump curves showing pump operating range shall be submitted);

G. Standby power generator size, location;

H. Downstream discharge plan;

I. Method of protecting discharge manholes or structures from erosion and damage;

J. Thrust and restraint block sizes and locations;

K. Sections showing suction and discharge pipe depth, embedment, select fill and special backfill;

L. Method of noise control for each pump and/or generator;

M. Any temporary pipe supports and anchoring required;

N. Design plans and computation for access to bypass pumping locations indicated on the drawings;

O. Calculations for selection of bypass pumping pipe size;

P. Schedule for installation of and maintenance of bypass pumping lines;

Q. Plan indicating selection location of bypass pumping line locations.

1.03 DESIGN REQUIREMENTS

A. Bypass pumping systems shall have sufficient capacity to pump a peak flow of 695 GPM @ 20' TDH. The Contractor shall provide all pipeline plugs, pumps of adequate size to handle peak flow, and temporary discharge piping to ensure that the total flow of the main can be safely diverted around the section to be repaired. Bypass pumping system will be required to be operated 24 hours per day.

B. The Contractor shall have adequate standby equipment available and ready for immediate operation and use in the event of an emergency or breakdown. One standby pump for each size pump utilized shall be installed at the mainline flow bypassing locations, ready for use in the event of primary pump failure.

1.04 PERFORMANCE REQUIREMENTS

A It is essential to the operation of the existing sewerage system that there be no interruption in the flow of sewage throughout the duration of the project. To this end, the Contractor shall provide, maintain and operate all temporary facilities such as dams, plugs, pumping equipment (both primary and back-up units are required), conduits, all necessary power, and all other labor and equipment necessary to intercept the sewage flow before it reaches the point where it would interfere with his work, carry it past his work and return it to the existing sewer downstream of his work.

B. The Contractor shall maintain sewer flow around the work area in a manner that will not cause surcharging of sewers, damage to sewers and that will protect public and private property from damage and flooding.

C. The Contractor shall protect water resources, wetlands and other natural resources.

PART 2 PRODUCTS

2.01 EQUIPMENT

A. All pumps used shall be fully automatic self-priming units that do not require the use of foot-valves or vacuum pumps in the priming system. The pumps may be electric or diesel powered. All pumps used must be constructed to allow dry running for long periods of time to accommodate the cyclical nature of effluent flows.

B. The Contractor shall provide the necessary automatic stop/start controls with floats and autodailer for each pump.

C. The Contractor shall include one stand-by pump of each size to be maintained on site. Back-up pumps shall be on-line, isolated from the primary system by a valve.

D. Discharge Piping - In order to prevent the accidental spillage of flows all discharge systems shall be temporarily constructed of rigid pipe with positive, restrained joints (HDPE). Under no circumstances will aluminum "irrigation" type piping or glued PVC pipe be allowed. Discharge hose will only be allowed in short sections and by specific permission from the engineer.

PART 3 EXECUTION

3.01 PREPARATION

A. Contractor is responsible for locating any existing utilities in the area the Contractor selects to locate the bypass pipelines. The Contractor shall locate his bypass pipelines to minimize any disturbance to existing utilities and shall obtain approval of the pipeline locations from the City and the Engineer. All costs associated with relocating utilities and obtaining all approvals shall be paid by the Contractor.

B. During all bypass pumping operation, the Contractor shall protect the Pumping Station and main and all local sewer lines from damage inflicted by any equipment. The Contractor shall be responsible for all physical damage to the Pumping Station and main and all local sewer lines caused by human or mechanical failure.

3.02 INSTALLATION AND REMOVAL

A. The Contractor shall remove manhole sections or make connections to the existing sewer and construct temporary bypass pumping structures only at the access location indicated on the Drawings and as may be required to provide adequate suction conduit.

B. Plugging or blocking of sewage flows shall incorporate a primary and secondary plugging device. When plugging or blocking is no longer needed for performance and acceptance of work, it is to be removed in a manner that permits the sewage flow to slowly return to normal without surge, to prevent surcharging or causing other major disturbances downstream.

C. When working inside manhole or force main, the Contractor shall exercise caution and comply with OSHA requirements when working in the presence of sewer gases, combustible or oxygen-deficient atmospheres, and confined spaces.

D. The installation of the bypass pipelines is prohibited in all saltmarsh/wetland areas. The pipeline must be located off streets and sidewalks and on shoulders of the roads. When the bypass pipeline crosses local streets and private driveways, the contractor must place the bypass pipelines in trenches and cover with temporary pavement. Upon completion of the bypass pumping operations, and after the receipt of written permission from the Engineer, the Contractor shall remove all the piping, restore all property to pre-construction condition and restore all pavement. The Contractor is responsible for obtaining any approvals for placement of the temporary pipeline within public ways from the City.

END OF SECTION

SECTION 33 34 00

SANITARY SEWERAGE FORCE MAIN

PART 1 GENERAL

1.01 SCOPE

A. Furnish all labor, equipment, materials for the construction of all sanitary sewer force main(s) shown on the drawings, including pipe, bends, connections, air release/and or vacuum valves, and all other appurtenances specified and/or required.

B. Site piping covered under this Section shall begin at the outside face of structures and buildings, except where there is no joint at the outside face, then site piping shall begin not more than two feet beyond the face of the structure or building. Piping covered under this section shall also include piping within miscellaneous vaults such as valve vaults.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Section 31 23 16 - Trench Excavation and Backfill

B. Section 33 05 23 – Pipe Jacking

C. Section 33 31 00 – Sanitary Sewerage Piping

D. Section 33 05 13 – Manholes and Structures

E. Section 33 31 05 – Sanitary Utility Equipment

1.03 SUBMITTALS

1. Complete product data and engineering data, including shop drawings, shall be submitted to the Engineer in accordance with the requirements of Section 01 33 00 of the Contract Documents.

2. This contract is partially funded by the GEFA CWSRF and the equipment manufacturer shall meet the requirements identified in the SRF Supplemental General conditions.

1.04 TRANSPORTATION AND HANDLING

A. Unloading: Furnish equipment and facilities for unloading, handling, distributing and storing pipe, fittings and accessories. Make equipment available at all times for use in unloading. Do not drop or dump materials. Any materials dropped or dumped will be subject to rejection without additional justification. Pipe handled on skids shall not be rolled or skidded against the pipe on the ground.

B. Handling: Handle pipe, fittings, valves and accessories carefully to prevent shock or damage. Handle pipe by rolling on skids, forklift, or front end loader. Do not use material damaged in handling. Slings, hooks or pipe tongs shall be padded and used in such a manner as to prevent damage to the exterior coatings or internal lining of the pipe. Do not use chains in handling pipe, fittings and appurtenances.

1.05 STORAGE AND PROTECTION

A. Store all pipe which cannot be distributed along the route. Make arrangements for the use of suitable storage areas.

B. Stored materials shall be kept safe from damage. The interior of all pipe, fittings and other appurtenances shall be kept free from dirt or foreign matter at all times. Valves shall be drained and stored in a manner that will protect them from damage by freezing.

C. Pipe shall not be stacked higher than the limits recommended by the manufacturer. The bottom tier shall be kept off the ground on timbers, rails or concrete. Pipe in tiers shall be alternated: bell, plain end; bell, plain end. At least two rows of timbers shall be placed between tiers and chocks, affixed to each other in order to prevent movement. The timbers shall be large enough to prevent contact between the pipe in adjacent tiers.

D. Stored mechanical and push-on joint gaskets shall be placed in a cool location out of direct sunlight. Gaskets shall not come in contact with petroleum products. Gaskets shall be used on a first-in, first-out basis.

E. Mechanical-joint bolts shall be handled and stored in such a manner that will ensure proper use with respect to types and sizes.

PART 2 PRODUCTS

2.01 FORCE MAIN PIPE

A. Molecular Oriented Polyvinyl Chloride, (C909 PVCO),

Oriented Poly(Vinyl Chloride), PVCO Class 150 Pipe 6”, 8” and 10” shall meet or exceed all requirements of ASTM D2241. Pipe shall have a minimum Hydrostatic Design Basis (HDB) of 7100 psi. The PVCO pipe shall be joined using elastomeric seals (gaskets). The joint shall meet the requirements of Specification D3139 and the elastomeric seal shall meet the requirements of Specification F477. PVCO pipe shall not be joined by solvent cementing. Pipe shall have a ductile iron outside diameter and have a pressure rating of 150 psi. PVCO pipe shall have a safety factor of 2.5 to 1 along with a surge allowance. It shall carry FM Class #1612 approval and be listed by U.L.

Pipe shall be blue in color and shall be Ultra-Blue (PVCO) Class 150 psi (unless otherwise shown on the plans) CI O.D., by JM Eagle. JM Eagle shall provide the standard one year warranty from the date of completion and approval by the Owner. This warranty includes the cost of repair or replacement from problems resulting

from pipe failure due to defect in materials or manufacture. Size and class shall be as called for in the Bid Form or plans.

B. Ductile Iron Pipe:

Ductile Iron Pipe – DIP shall be pressure class 350 for 4" thru 12", and class 250 for 14" thru 20". The pipe shall be coated on the interior with 40 mils nominal dry film thickness of PROTECTO 401 Ceramic Epoxy within 8 hours of surface preparation as manufactured by U.S. Pipe or "SewperCoat" with Calcium Aluminate as manufactured by Lafarge or approved equal. Ductile Iron Pipe designed and manufactured in accordance with ANSI A21.51 centrifugally cast in metal or sand lined molds. Exterior surface shall be seal coated with 1 mil thick approved asphaltic coating in accordance with ANSI/AWWA C151/A21.51.

C. High Density Polyethylene Pipe (C906): **Sanitary Sewer Force Mains**:

High density polyethylene **Sanitary Sewer Force Main** pipe in sizes 4" and above shall be joined by means of zero leak-rate heat-fusion, and approved mechanical joints, meeting the specifications and requirements of American Water Works Association Standard C906 and ASTM F714.

The polyethylene pipe and fittings shall be made from virgin resins exhibiting a cell classification of PE 345464C for black and a cell classification of PE 345464E for stripes per ASTM D3350; and shall be Listed in the name of the pipe and fitting Manufacturer in PPI (Plastics Pipe Institute) TR-4, *Recommended Hydrostatic Strengths and Design Stresses for Thermoplastic Pipe and Fittings Compounds*, with a standard grade HDB rating of 1600 psi at 73°F.

The wall thickness shall follow the Dimension Ration (DR) system prescribed in AWWA C906. Laying lengths are 40 ft standard. The pipe is to be joined by heat fusion, flanges or other mechanical joint systems proven for HDPE pipes. HDPE shall be the DR as shown on plans or Bid Form. The DIPS longitudinal color stripe pattern shall have three equally spaced pairs of **GREEN** color stripes extruded into the pipe OD for **Sanitary Sewer Force mains**. The pipe shall be DRISCOPLEX 4300 or approved equal.

D. High Density Polyethylene Pipe: **Raw, Treated or Reclaimed Water:**

High density polyethylene **Raw, Treated or Reclaimed Water** pipe in sizes 4" and above shall be joined by means of zero leak-rate heat-fusion, and approved mechanical joints, meeting the specifications and requirements of American Water Works Association Standard C906 and ASTM F714.

The polyethylene pipe and fittings shall be made from virgin resins exhibiting a cell classification of PE 345464C for black and a cell classification of PE 345464E for stripes per ASTM D3350; and shall be Listed in the name of the pipe and fitting Manufacturer in PPI (Plastics Pipe Institute) TR-4, *Recommended Hydrostatic Strengths and Design Stresses for Thermoplastic Pipe and Fittings Compounds*, with a standard grade HDB rating of 1600 psi at 73°F.

The wall thickness shall follow the Dimension Ration (DR) system prescribed in AWWA C906. Laying lengths are 40 ft standard. The pipe is to be joined by heat

fusion, flanges or other mechanical joint systems proven for HDPE pipes. HDPE shall be the DR as shown on plans or Bid Form. The DIPS longitudinal color stripe pattern shall have three equally spaced pairs of **PURPLE** color stripes extruded into the pipe OD for **Raw, Treated or Reclaimed Water** mains. The pipe shall be DRISCOPLEX 4500 or approved equal.

E. This contract is partially funded by the GEFA CWSRF and the equipment manufacturer shall meet the requirements identified in the SRF Supplemental General conditions.

2.02 JOINTS AND GASKETS

A. Push-On Joints:

1. DIP Push-on joints shall conform to AWWA C111/ANSI A21.11 (latest revision) - Rubber Gasket Joints for Cast Iron Pressure Pipe and Fittings. Details of the joint design shall be in accordance with the manufacturer's standard practice such as "Fastite", "Bell-Tite," "Tyton," or equal joints. Gasket material shall be standard styrene butadiene copolymer (SBR).

   Whenever the pipe is cut in the field, the cut end shall be conditioned so it can be used in making up a joint by filing or grinding the cut end to remove burrs or sharp edges that might damage the gasket.

2. PVC Push-on joints shall be an elastomeric gasketed joint. Insertion and lubrication of the elastomeric gasket in the annular groove must be as recommended by the manufacturer.

B. Restrained Joints:

Restrained joints for DIP shall be obtained by the installation of “Field Lok”, “TR Flex”, “Fast-Grip”, “Flex-Ring”, MEGALUG by EBAA Iron, Inc.or approved equal. These restraint glands shall have a working pressure of at least 250 psi with a minimum safety factor of 2:1.

Tyton Joint Pipe with “Field Lok Gaskets”, Fastite Pipe with “Fast-Grip Gaskets” or DIP or PVC Pipe with EBAA Iron, Inc. pipe restraints or approved equal.

All underground creek crossings and jack and bores with steel casing shall use “Field Lok” or “Fast-Grip” restrained joints.

C. Flexible Joints:

Flexible joints shall be American Pipe "Flex Lok", Clow "Ball and Socket", U. S. Pipe "Usiflex", EBAA Iron Inc. FLEX-900 or approved equal. Piping shall have a minimum working pressure rating of 250 PSI and a minimum allowable joint deflection of 15^{o}.

D. Mechanical Joints:

Mechanical joints for DIP and PVC shall consist of a bolt joint of the stuffing box type as detailed in AWWA C110/ANSI A21.10 (latest revision) and described in

AWWA C111/ANSI A21.11 (latest revision) - Rubber Gasket Joints shall be SBR rubber and conform to AWWA C111/ANSI A21.11 (latest revision).

E. Flanged Joints:

Flanged joints shall conform to AWWA C110/ANSI A21.10 (latest revision). Gaskets shall be SBR rubber per ANSI/AWWA C111/A21.11. This rubber compound is NSF 61 certified for contact with potable water or other approved quality shall be used in all flanged joints. The bolts and nuts shall conform in dimensions to the American Standard heavy series.

"KWIK" or Uni-Flange adaptors for plain and pipe shall be used only when authorized by the Engineer. Set screws shall be self-torquing or be properly torqued during installation with a torque wrench.

F. Fusion Joints:

1. Sections of polyethylene pipe should be joined into continuous lengths on the jobsite above ground. The joining method shall be the butt fusion method and shall be performed in strict accordance with the pipe manufacturer's recommendations. The butt fusion equipment used in the joining procedures should be capable of meeting all conditions recommended by the pipe manufacturer, including, but not limited to, temperature requirements of 400 degrees Fahrenheit, alignment, and an interfacial fusion pressure of 75 PSI. The butt fusion joining will produce a joint weld strength equal to or greater than the tensile strength of the pipe itself. All welds will be made using a Data Logger to record temperature, fusion pressure, with a graphic representation of the fusion cycle shall be part of the Quality Control records.

2. Sidewall fusions for connections to outlet piping shall be performed in accordance with HDPE pipe and fitting manufacturer’s specifications. The heating irons used for sidewall fusion shall have an inside diameter equal to the outside diameter of the HDPE pipe being fused. The size of the heating iron shall be ¼ inch larger than the size of the outlet branch being fused.

3. Mechanical joining will be used where the butt fusion method can not be used. Mechanical joining will be accomplished by either using a HDPE flange adapter with a Ductile Iron back-up ring or HDPE Mechanical Joint adapter with a Ductile Iron back-up ring.

4. Socket fusion, hot gas fusion, threading, solvents, and epoxies will not be used to join HDPE pipe.

G. Transition Couplings – Couplings shall be ductile iron conforming to ASTM A-536. Coupling shall be as manufactured by Ford, Dresser, and JCM or approved equal.

2.03 PIPE FITTINGS, SPECIALS AND MISC.

A. Polyvinyl Chloride Pipe:

Fittings used on 4" thru 10” PVC Pipe transitions shall be mechanical or restrained joints as manufactured by American Pipe, U.S. Pipe, Clow or EBAA Iron Inc.

B. Dip Fittings And Specials:

Mechanical joint fittings shall conform to either AWWA C110 or AWWA C153 (Compact Fittings). Minimum pressure rating for fittings shall be 350 psi. All other fittings shall conform to AWWA C110. The pipe shall be coated on the interior with 40 mils nominal dry film thickness of PROTECTO 401 Ceramic Epoxy within 8 hours of surface preparation as manufactured by U.S. Pipe or "SewperCoat" with Calcium Aluminate as manufactured by Lafarge or approved equal. Unless otherwise noted on the plans, fittings for underground installation shall be mechanical joint conforming to AWWA C111, and fittings for above ground installation shall be flanged conforming to ANSI B16.1 Class 125. Minimum pressure rating for fittings shall be 250 psi. Fittings and specials shall be completed with rings, bolts, gaskets, etc., for joints.

C. Polyethylene Pipe (HDPE):

1. Butt Fusion Fittings - Fittings shall be PE3408 HDPE, Cell Classification of 345464C as determined by ASTM D3350. Butt Fusion Fittings shall have a manufacturing standard of ASTM D3261. Molded & fabricated fittings shall have a pressure rating equal to the pipe unless otherwise specified in the plans. Fabricated fittings are to be manufactured using Data Loggers. Temperature, fusion pressure and a graphic representation of the fusion cycle shall be part of the quality control records. All fittings shall be suitable for use as pressure conduits, and per AWWA C906, have nominal burst values of three and one-half times the Working Pressure Rating (WPR) of the fitting.

2. Electrofusion Fittings - Fittings shall be PE3408 HDPE, Cell Classification of 345464C as determined by ASTM D3350. Electrofusion Fittings shall have a manufacturing standard of ASTM F1055. Fittings shall have a pressure rating equal to the pipe unless otherwise specified on the plans. All electrofusion fittings shall be suitable for use as pressure conduits, and per AWWA C906, have nominal burst values of three and one-half times the Working Pressure Rating (WPR) of the fitting.

3. Flanged and Mechanical Joint Adapters - Flanged and Mechanical Joint Adapters shall be PE 3408 HDPE, Cell Classification of 345464C as determined by ASTM D3350. Flanged and Mechanical Joint Adapters shall have a manufacturing standard of ASTM D3261. Fittings shall have a pressure rating equal to the pipe unless otherwise specified on the plans.

PART 3 EXECUTION

3.01 EXISTING UNDERGROUND UTILITIES AND OBSTRUCTIONS

A. The plans indicate utilities and obstructions that are known to exist according to the best information available to the Owner.

B. Existing Utility Location: The following steps shall be exercised to avoid interruption of existing utility service.

1. Expose the facility, for a distance of at least 100 feet in advance of pipeline construction, to verify its true location and grade. Repair, or have repaired, any damage to utilities resulting from locating or exposing their true location.

2. Avoid utility damage and interruption by protection with means or methods recommended by the utility owner.

C. Conflict with Existing Utilities

1. Horizontal Conflict: Horizontal conflict shall be defined as when the actual horizontal separation between a utility, main, or service and the proposed piping does not permit safe installation of the piping by the use of sheeting, shoring, tying-back, supporting, or temporarily suspending service of the parallel or crossing facility. The Contractor may change the proposed alignment of the piping to avoid horizontal conflicts if the new alignment complies with regulatory agency requirements and after a written request to and subsequent approval by the Engineer. Where such relocation of the piping is denied by the Engineer, the Contractor shall arrange to have the utility, main, or service relocated.

2. Vertical Conflict: Vertical conflict shall be defined as when the actual vertical separation between a utility, main, or service and the proposed piping does not permit the crossing without immediate or potential future damage to the utility, main, service, or the piping. The Contractor may change the proposed grade of the piping to avoid vertical conflicts if the changed grade maintains adequate cover and complies with regulatory agencies requirements after written request to and subsequent approval by the Engineer.

D. Electronic Locator: Have available at all times an electronic pipe locator and a magnetic locator, in good working order, to aid in locating existing pipe lines or other obstructions.

E. Sewer and Water Separation

1. Sewer force mains should maintain a minimum 10 foot edge-to-edge separation from potable water lines. If the main cannot be installed providing the 10 foot separation, the separation may be reduced, provided the bottom of the water main is a minimum of 18-inches above the top of the sewer. Should neither of these two separation criteria be possible, the potable water main shall be installed below the sewer with a minimum vertical separation of 18-inches and the water main shall be encased in concrete with a minimum depth of 6-inches.

2. Where water mains cross the sewer, the pipe joint adjacent to the pipe crossing the sewer shall be cut to provide maximum separation of the pipe joints from the sewer.

3.02 INSTALLATION IN TRENCH

A. Proper and suitable tools and appliances for safe and convenient handling and installing of pipe and fittings shall be used. Great care shall be taken to prevent pipe coatings from being damaged, particularly calcium aluminate cement linings on the inside of D.I.P. pipes and fittings. Any damage shall be remedied as directed. All pipe and fittings shall be carefully examined by the Contractor for defects just before installing and no pipe or fitting shall be installed which is defective.

B. If any defective pipe or fitting is discovered after having been installed, it shall be removed and replaced in a satisfactory manner with a sound pipe or fitting by the Contractor at his own expense. All pipes and fittings shall be cleaned before they are installed and shall be kept clean until they are used in the completed work. Open ends of pipe shall be kept plugged with a bulkhead during construction.

C. Force mains shall be installed on a 4" Class II or III select natural material bedding as specified in Section 31 23 16 Trench Excavation and Backfill with O.D./2 haunching. The compaction for bedding and haunching shall be 90% of Standard Proctor Density as determined by (ASTM D698). Pipe shall not be installed within 6 inches of rock. In trench rock conditions, a minimum of 6 inches of sand or approved suitable soil shall be placed on rock prior to pipe installation. Trenches shall be kept free of water.

D. Where bends and tees occur in pressure mains, the Contractor will pour a block of concrete at the bend or tee as detailed on the Plans. The block shall consist of 3000 psi concrete, and shall be of size and shape as shown on the plans or as directed by the Engineer. The Contractor may use forms or either walls to mold the "thrust block;" however, if earth walls are used they shall be cut true to shape with all excess earth removed and the work shall be done in such a manner that no loose earth will become mixed with the fresh concrete. The Engineer shall inspect all thrust blocks prior to them being covered.

E. All ductile iron pipe laid underground shall be mechanical joint pipe and fittings or "push-on" type joint unless otherwise shown on the plans or directed by the Engineer.

F. All force mains laid underground shall have a minimum of 42 inches of cover above the top of the pipe in non GA DOT R/W and a minimum of 48 inches of cover above the top of the pipe in GA DOT R/W unless otherwise shown on the plans, or unless otherwise directed by the Engineer.

G. All force mains laid under existing water mains, sewers, storm drains, culverts, structures, etc., shall have a minimum clearance of 18 inches between the outside wall of the force main pipe and the outside surface of the existing pipe or structure.

3.03 PIPE JOINTING

A. Mechanical And Restrained Joints:

Clean spigot and bell of foreign material and apply soapy water containing chlorine solution before slipping gasket and gland over spigot end of pipe. Small side of gasket and lip of gland must face the socket. Paint gasket with soapy solution and

place spigot end of pipe securely home in socket. Push gasket evenly into position in socket, slide gland into position and tighten bolts with fingers.

Tighten bolts to uniform tightness with ratchet wrench by tightening bottom bolt and then top bolt. Thereafter, all bolts shall be tightened in sequence of 180 degrees apart until all bolts are within the range of torque recommended by the manufacturer.

B. Push-On Joints:

Jointing shall be made with rubber gaskets and lubricant furnished by the manufacturer in strict accordance with the manufacturer's recommendations. Prepare field cut pipe by filing 1/8 inch 30 degree bevel on pipe end to avoid injuring gasket.

C. Threaded Flange Joint:

Insert recommended manufacturer’s gasket and tighten bolts to uniform tightness with ratchet wrench by tightening bottom bolt and then top bolt. Thereafter, all bolts shall be tightened in sequence of 180 degrees apart until all bolts are within the range of torque recommended by the manufacturer.

D. Polyvinyl Chloride Pipe:

Do not thread PVC pipe. When threads are necessary, adaptors will be used. Use strap wrenches to couple threaded PVC pipe fittings and use lubricant recommended by pipe manufacturer.

Avoid excessive torque and do not score pipe. Use couplings furnished with pipe for fittings and install in strict accordance with the manufacturer's recommendations.

E. Polyethylene Pipe (HDPE):

Sections of polyethylene pipe should be joined into continuous lengths on the jobsite above ground. The joining method shall be the butt fusion method and shall be performed in strict accordance with the pipe manufacturer's recommendations. The butt fusion equipment used in the joining procedures should be capable of meeting all conditions recommended by the pipe manufacturer, including, but not limited to, temperature requirements of 400 degrees Fahrenheit, alignment, and an interfacial fusion pressure of 75 PSI. The butt fusion joining will produce a joint weld strength equal to or greater than the tensile strength of the pipe itself. All welds will be made using a Data Logger to record temperature, fusion pressure, with a graphic representation of the fusion cycle shall be part of the Quality Control records.

3.04 PIPELINE DETECTION MARKING

A. All metallic force mains shall be protected by a 6” wide plastic marking tape placed a minimum of 12 inches above the top of pipe for its full length. The tape shall be equal to Reef Industries Terra Tape Extra Stretch™. It will have sufficient thickness; tensile strength; elongation and resistance to alkalis, acids and other destructive agents to remain a permanent marker of the line buried below. A message shall be printed on the tape at least every 30 inches “**CAUTION SEWER LINE BURIED**

BELOW", "**CAUTION RAW WATER LINE BURIED BELOW"** or **"CAUTION TREATED/RECLAIM WATER LINE BURIED BELOW"**.

B. All non-metallic force mains shall be protected by a 6" wide metalized foil tape buried a minimum of 12 inches above the top of the pipe for its full length. The foil shall be protected by plastic film laminated on each side. The lamination shall be strong enough to prevent the separation of foil and plastic film. The tape should be equal to Reef Industries Terra Tape Sentry Line® Reinforced Detectable. It shall be inductively locatable and conductively traceable using a standard pipe and cable-locating device. A message shall be printed on the tape every 30 inches "**CAUTION SEWER LINE BURIED BELOW**", "**CAUTION RAW WATER LINE BURIED BELOW"** or **"CAUTION TREATED/RECLAIM WATER LINE BURIED BELOW"**..

3.05 PRESSURE TESTING

A. Hydrostatic testing shall be performed on lines after pipe has been laid and backfilled between joints, all newly laid pipe, or any valved section thereof. The pipe shall be subjected to a hydrostatic gauge pressure of at least (150%) of the rated working pressure of the pipe for two hours and not less than (125%) at the high point per AWWA C600 (DIP) and AWWA C605 (PVC). Working pressure is defined as maximum anticipated sustained operating pressure. In no case shall the test pressure be allowed to exceed the design pressure for pipe, appurtenances, or thrust restraints.

1. The Contractor shall have the responsibility to ensure that all outlets are closed by valves or plugged and braced to prevent blowouts. Pressurizing equipment shall be constantly monitored or include a regulator or relief valve to avoid over pressurizing and damaging an otherwise acceptable line. No one shall be allowed in manholes, wet wells, valve pits, etc. during testing.

2. To prepare the line for testing, the contractor shall backfill all pipe and provide all reaction blocking before hydrostatic testing. The Engineer may direct the Contractor to leave certain joints and connections uncovered until testing has been completed. All pipe outlets shall be secured to resist the test pressure. Clean out all debris in the pipe.

   The section of pipe under test shall be slowly filled with water and all air shall be expelled from the pipe. If blow-offs are not available at high places, taps at points of highest elevation shall be made before the test and plugged during and after test.

3. Procedure; the specified test pressure, based on the elevation of the lowest point of the line or lowest point of the section under test and corrected to the elevation of the test gauge, shall be applied by means of a gasoline driven test pump connected to the pipe in a manner satisfactory to the Engineer. The Contractor shall meter the amount of water used during the test. The duration of the test shall be at least two consecutive hours.

   The Contractor shall locate and repair any and all leaks that may develop. All exposed pipe, fittings, valves, hydrants, and joints will be carefully examined

during the test. Any cracked or defective pipe, fittings or valves discovered as a result of this test shall be removed and replaced with sound material, and the test shall be repeated until satisfactory to the Engineer.

B. Allowable leakage. The contractor shall furnish the gauges and measuring device for the leakage test, pump, pipe, connections, and all other necessary apparatus, unless otherwise specified, and shall furnish the necessary assistance to conduct the test. The duration of each leakage test shall be 2 hours, unless otherwise specified. During the test, the pipeline shall be subjected to the pressure stated above. Leakage shall be defined as the quantity of water that must be supplied into the pipe section being tested to maintain a pressure within 5 psi of the specified leakage-test pressure after the pipe has been filled with water and the air in the pipeline has been expelled. No installation will be accepted if the leakage is greater than that determined by the formula per AWWA C600 (DIP) and AWWA C605:

1) For DIP use:

$$L = \frac{SD\sqrt{P}}{133{,}200}$$

Where:

L = allowable leakage, in gallons per hour

S = length of pipe tested, in feet

D = nominal diameter of the pipe, in inches

P = average test pressure during the leakage test, in pounds per square inch (gauge)

This formula is based on an allowable leakage of 11.65 gpd/mi/in. of nominal diameter at a pressure of 150 psi.

2) For PVC use:

$$L = \frac{ND\sqrt{P}}{7{,}400}$$

Where:

L = allowable leakage, in gallons per hour

N = number of joints in the length of pipeline tested

D = nominal diameter of the pipe, in inches

P = average test pressure during the leakage test, in pounds per square inch (gauge)

This formula is based on an allowable leakage of 10.50 gpd/mi/in. of nominal diameter at a pressure of 150 psi.

3) Hydrostatic Leak Testing for HDPE:

This hydrostatic leak test procedure consists of filling, an initial expansion phase, a test phase, and depressurizing in accordance with **Chevron Phillips Chemical Co. Publication – Technical Note 802 – Leak Testing.**

a) Filling: Fill the restrained test section completely with a test liquid acceptable to the Owner.

WARNING – Ensure that there is no air trapped in the test section. Failure with entrapped air can result in explosive release and result in death or serious bodily injury. Use equipment vents at high points to remove air.

b) Initial Expansion Phase:

Gradually pressurize the test section to test pressure, and maintain test pressure for three (3) hours. During the initial expansion phase, polyethylene pipe will expand slightly. Additional test liquid will be required to maintain pressure. It is not necessary to monitor the amount of water added during the initial expansion phase.

c) Test Phase:

This alternative is applicable when the test pressure is 150% of the system design pressure.

Immediately following the initial expansion phase, monitor the amount of make-up water required to maintain test

pressure for one (1), or two (2), or three (3) hours. If the amount of make-up water needed to maintain test pressure does not exceed the amount in Table 2, no leakage is indicated.

Table 2 Test Phase – Make-Up Water Allowance:

Make-Up Water Allowance for Test Phase – (U.S. Gal/100 ft of pipe)			
Nominal Pipe size (in.)	1-Hour Test	2-Hour Test	3-Hour Test
4	0.13	0.25	0.40
6	0.3	0.6	0.9
8	0.5	1.0	1.5
10	0.8	1.3	2.1
12	1.1	2.3	3.4
14	1.4	2.8	4.2
16	1.7	3.3	5.0
18	2.0	4.3	6.5
20	2.8	5.5	8.0
22	3.5	7.0	10.5
24	4.5	8.9	13.3

d) Depressurizing:

At the conclusion of the test, carefully depressurize the test section by the controlled release of test liquid. The test liquid may need to be drained and its disposal may be subject to regulations.

3.06 PIGGING TEST

A. After completion of hydrostatic testing and prior to final acceptance, test force mains longer than 200 feet by pigging to ensure piping is free of obstructions.

B. Pigs: Provide proving pigs manufactured of an open-cell polyurethane foam body, without any coating or abrasives which would scratch or otherwise damage interior pipe wall surface or lining. Pigs shall be able to pass through reductions of up to 65 percent of the nominal cross-sectional area of the pipe. Pigs shall be able to pass through standard fittings such as 45° and 90° elbows, crosses, tees, wyes, gate valves, or plug valves, as applicable to the force main being tested.

C. Test Execution: Pigging test shall be conducted in the presence of the Engineer. Provide at least 48 hours notice of scheduled pigging of the force main prior to commencing the test.

3.07 CLEANUP

Remove all surplus materials, tools, excess dirt, rubbish, and debris from the site as installation progresses. Clean as directed by the Engineer. Obtain letter of approval from the State Highway Department covering work installed in areas of State Highway jurisdiction. Contractor to maintain surface of ditches, unpaved streets, road shoulders, sod, grass, and other disturbed surfaces for a period of thirty (30) days thereafter.

END OF SECTION

A. SECTION 33 32 11

SUBMERSIBLE WASTEWATER PUMP STATION

PART 1 GENERAL

1.01 SCOPE

A. Furnish all materials, labor, and equipment to properly install all pumps and related accessories at the locations shown on the plans or as directed by the Engineer for the proper completion of the work included under this contract whether shown expressly on the plans or implied by other requirements.

B. Construct one new pump station with automatic triplex submersible pumps. Station shall be complete with pumps, controls, hatches, precast structures, concrete, piping, valves, guide rails and all appurtenances required. The Contractor shall furnish all materials, labor, tools, and incidentals for a complete and functioning pump station.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. 26 00 00 – General Electrical Provisions
B. 26 05 19 – Electric Wire and Cable
C. 26 05 26 – Grounding
D. 26 05 34 – Conduit
E. 40 05 51 – Valves
F. 40 23 00 – Wastewater Process Piping
G. 40 71 00 – Flow Measurement Instrumentation

1.03 SUBMITTALS

Complete product data and engineering data, including shop drawings, shall be submitted to the Engineer in accordance with the requirements of Section 01 33 00 of the Contract Documents.

PART 2 PRODUCTS

2.01 GENERAL

A. The pump manufacturer shall provide a 5 year or 10,000 hour warranty against defects in material and workmanship. In the event of a defect, the manufacturer shall pay in whole or in part the costs for replacement or repair. The warranty value may be prorated based on age and usage hours of the pump.

B. Quality Control

1. The pump manufacturer shall perform the following inspections and test on each pump before shipment from factory:
    a. Impeller, motor rating and electrical connections shall first be checked for compliance to the customer's purchase order.
    b. A motor and cable insulation test for moisture content or insulation defects shall be made.
    c. Prior to submergence, the pump shall be run dry to establish correct rotation and mechanical integrity.
    d. The pump shall be run submerged, a minimum of six ft. under water.
    e. After operational test No. 4, the insulation test (No. 2) is to be performed again.
2. A written report stating the foregoing steps have been done shall be supplied with each pump at the time of shipment.

C. This contract is partially funded by the GEFA CWSRF and the equipment manufacturer shall meet the requirements identified in the SRF Supplemental General conditions.

2.02 PUMPS

A. Manufacturer

1. The submersible pumps shall meet the duty point of 1048 gpm @ 39 ft total dynamic head, with a static head of 32.5 ft. The following pump models meet the duty point requirements. Equivalent pumps will be accepted with prior approval.
    a. Hayward Gordon CHOPX5B-S with 9.125” impeller, 230 V, 3 phase, 60 Hz, 25 HP.
    b. Vaughn SE6U with 10.9” impeller, 230 V, 3 phase, 60 Hz, 20 HP.

B. General

1. Pumps shall be of a centrifugal chopper design, capable of handling wastewater sludge, having a solids content up to 2% and fibrous materials without fouling or clogging.
2. The integral pump/motor units shall be designed to operate at a continuous full load duty completely submerged in liquid without the need for external cooling.
3. The pump motors shall be designed to withstand 200 psi differential water pressure at all seal locations. Heat transfer shall be accomplished by convection through the stator wall to the surrounding media.

C. Construction

1. Casing: The pump casing will be constructed of ASTM A48 Cast Iron (Optional: High Chrome Iron 450 BHN minimum, 316SS, or CD4MCU). Flanged suction and discharge connections shall conform to the requirements of ANSI B16.1, Class 125. The casing backplate shall have a spiral cutting groove on the surface that is in close clearance to the rear flange of the impeller.

2. Impeller: The pump impeller shall be an open type with sharpened vane edges incorporated into the rear of the impeller which provides cutting action against the backplate spiral groove, preventing fouling behind the impeller. Primary chopping/conditioning of materials shall be accomplished by the action of the sharpened leading edges of the impeller blades moving across the cutter bar at the intake openings. Impeller shall be constructed of cast alloy steel case hardened to minimum Rockwell C60 (Optional: High Chrome Iron 450 BHN minimum, 316SS, or CD4MCU) and shall be dynamically balanced.
3. Cutter Bar: The casing will be fitted with a replaceable suction plate with cutter bars constructed of cast alloy steel case hardened to minimum Rockwell C60 (Optional: High Chrome Iron 450 BHN minimum, 316SS or CD4MCU). The surface of the suction plate facing the impeller shall have multiple radial cutting slots to prevent binding of material between it and the impeller vanes.
4. Upper Cutter: The area behind the impeller shall be protected from fouling by the cutting and expulsion action of sharpened vane edges in the rear of the impeller sweeping across the spiral grooves in the casing backplate.
5. Shaft: The motor/pump shaft shall be one-piece and shall be constructed of AISI type 416, 420, or 431 Stainless Steel.
6. Bearings: All bearings shall be rated for a minimum L10 life of 100,000 hours at 25% of the flow at the best efficiency point (BEP). Bearings shall be permanently lubricated with a premium moisture resistant grease containing rust inhibitors and shall be suitable for operation over a temperature range of –25 0C to +120 0C.
7. Shaft Seals: Two independent, tandem mounted, mechanical face type seals shall be provided to isolate and protect the air-filled motor from the pumped media. The inner and outer seal shall be separated by an oil filled chamber. The oil chamber shall act as a barrier to trap moisture and provide sufficient time for a planned shutdown. The lower seal faces shall be Tungsten Carbide vs. Tungsten Carbide. The upper mechanical seal shall be constructed of a carbon rotating face and a ceramic stationary face. All other seal components shall be 316SS. Mechanical seals shall be readily and commercially available from third party sources other than the pump and motor manufacturer.
8. Moisture Protection System: A dual (2) probe sensing system shall be provided to detect the presence of moisture within the motor. The moisture sensing probe leads shall terminate at a separately supplied conductance relay located in the control panel which shall provide an alarm in the event of moisture intrusion. The sensing relay shall either be provided or approved by the pump/motor manufacturer.
9. Cable Entry System: The power and control cable entry system shall be designed to provide a positive, leak-free seal to prevent liquid from entering the air filled motor housing. The design shall incorporate provisions which prevent moisture from wicking through the cable assemble even in the event that the cable jacket has been punctured. All cable shall be type SEOW-A

and U.L. listed for the intended submersible service. The power and control cable entry into the lead connection chamber shall be encapsulated for positive moisture sealing. A Buna-N cable grommet shall be provided in addition to the epoxy sealed leads. Compression type grommet fittings employed as the primary sealing system shall neither be considered equal or acceptable. Separate power and control cables shall be provided to prevent false sensor warnings.

10. Motor: Submersible motors shall successfully operate under power supply variations per NEMA MG1-14.30. Motors shall be NEMA Design B with torque and starting current in accordance with NEMA MG-12. The submersible motors shall be of an air-filled, high efficiency design with copper windings and shall be rated for continuous full load operation. The motor construction shall be of explosion proof, TENV-TEXP design and capable of being certified for use in Class 1, Groups C & D hazardous locations by either Factory Mutual (F.M.) or Underwriters Laboratories (U.L). Motors to be capable of running for 15 minutes in air (unsubmerged).
    a. Motors shall be capable of withstanding up to 15 starts per hours and shall have a minimum 1.15 service factor. Motors suitable for VFD (inverter) operation shall have a turndown ratio of 10:1 at a service factor of 1.0.
    b. The insulation system shall be Class F minimum, utilizing materials certified per IEEE 117, and shall be rated at a temperature of 155o C. Two (2) normally closed, automatic reset, thermostats shall be connected in series and embedded in adjoining phases of the stator windings.

2.03 CONTROL PANEL

A. General
1. The pump supplier shall furnish a 240V, 3phase control panel enclosure with variable frequency drives for each pump, circuit breaker, reset and disconnect for all phases. The panel shall include a triplex pump controller complete with a pump alternator for pump alternation at each cycle and at 24 hour intervals. The panel shall be complete with all necessary controls, including but not necessarily limited to the items listed below.
2. All equipment shall be guaranteed for a period of three (3) years from date of shipment. The guarantee is effective against all defects in workmanship and/or defective components. The warranty is limited to replacement or repair of the defective equipment.
3. The manufacturer shall be a UL listed shop for industrial control systems and shall serialization evidence of such on the control panel enclosure.

B. Enclosure
1. The enclosure shall be a 14 gauge, NEMA 4X rated enclosure manufactured from 304 stainless steel. The enclosure shall be a free standing type with a minimum depth of 12”, sized to adequately house all the components. The door gasket shall be rubber composition with a retainer to assure a positive

weatherproof seal. The door shall open a minimum of 180 degrees.

2. A polished, aluminum dead front shall be mounted on a continuous aircraft type hinge. It shall contain cutouts for mounted equipment, and provide protection of personnel from live, internal wiring. Cutouts for breaker handles shall be provided to allow operation of breakers without entering the compartment. All control switches, indicator pilot lights, elapsed time meters, duplex receptacle, and other operational devices shall be mounted on the external surface of the dead front. The dead front shall open a minimum of 150 degrees to allow access to equipment for maintenance. A 3/4" break shall be formed around the perimeter of the dead front to provide rigidity.
3. The back plate shall be manufactured of 12 gauge steel and be finished with a primer coat and two (2) coats of baked on, white enamel. All hardware mounted to the subpanel shall be attached with machine thread, tapped holes. Sheet metal screws are not acceptable. All devices shall be permanently identified.
4. A final, "as built" drawing encapsulated in mylar shall be attached to the inside of the front door. A list of all legends shall be included.
5. All component parts in the control panel shall be permanently marked and identified as they are indicated on the drawing. Marking shall be on the back plate adjacent to the component. All control conductors shall be identified with wire markers at each end, as close as practical to the end of the conductor.

C. Control Function

1. The control function shall provide for the operation of the pumps under normal conditions, and shall alternate the pumps on each pump down cycle, or at 24 hour intervals to equalize the run time. In the event the incoming flow exceeds the capacity of the lead pump, subsequent pumps shall automatically startup to handle the increased flow. As the flow decreases the pump shall cut off at the elevations as shown on the plans.
2. The control system shall provide for the automatic and manual control and alternation of the pumps to maintain an operator established liquid level in the wetwell. Wetwell levels shall be sensed through a measurement device adjusted to the specified levels and used for lead / lag control and alarms. If wetwell levels rise with one pump at full capacity, subsequent pumps shall be called to service at the elevations shown on the drawings. All pumps shall be called off if wetwell levels reach the "off" level. If the wetwell level reaches the high water float, an audible alarm shall be activated. Provide a 10 second delay between pump starts; under no circumstance shall the pumps start simultaneously.

D. Electrical

1. The panel power distribution shall include necessary components and be completely wired stranded copper conductors rated at 90 degrees C. All conductor terminations shall be as recommended by the device manufacturer.
2. All circuit breakers shall be heavy duty thermal magnetic or motor circuit

protectors similar and equal to Square D Type FAL. Each motor breaker shall be adequately sized to meet the pump motor operating characteristics with minimum interrupting capacity of 35,000 A R.M.S. symmetrical at 240 volts. The control circuit shall be controlled by heavy duty breakers.

3. Circuit breakers shall be indicating type, providing “on-off-trip” positions of the operating handle. When the breaker is tripped automatically, the handle shall assume a middle position indicating “trip.”
4. Thermal magnetic breakers shall be quick-make and quick-break on manual and automatic operation and have inverse time characteristics secured through the use of bimetallic tripping elements supplemented by a magnetic trip.
5. Breakers shall be designed so that an overload on one pole automatically trips and opens all legs. Field installed handle ties shall not be acceptable.
6. The alarm light shall be a weatherproof, shatterproof, red light fixture with a 40 watt bulb to indicate alarm conditions. The alarm light shall be turned on by the alarm relay.
7. Each complete suppression unit shall be UL listed as a secondary surge arrestor and bear CSA certification and meet ANSI/IEEE C62-11-1987; suitable for indoor and outdoor applications; suitable for use in service entrance location; meet requirements of NEC Article 280; rated at 650V phase-to-ground maximum.
8. Control transformers shall be provided to produce the 120 VAC and/or 24 VAC for control circuits. Transformers shall be fused on the primary and secondary circuits. The secondary circuits shall be grounded. The 240V-120V control transformer shall be a minimum of 5kVA.
9. Provide 120V, 20A, 1P circuit breakers for Owner’s use. Breakers shall be viewable from inner door, labeled, and be designed for circuits shown in the drawings, including, but not limited to, RTU, Receptacle, and Spare.
10. Provide elapsed time meters for each pump.
11. A line voltage rated, adjustable phase monitor shall be installed to sense low voltage, loss of power, reverse phase, and loss of phase. Control circuit shall de-energize upon sensing any of the faults and shall automatically restore service upon return to normal power.
12. Provide spare dry contacts for "Pump #1 Fail", "Pump #2 Fail", “Pump #3 Fail”, "High Level Alarm", "Pump #1 Run", “Pump #2 Run”, “Pump #3 Run” for Owner's use.
13. All panels shall be tested to the power requirements as shown on the plans to assure proper operation of all components. Each control function shall be activated to check for proper indication.
14. VFDs shall be Danfoss Aqua Drive FC202 or ABB ACQ580.
15. Provide intrinsically safe relays for all devices located in the wet well.
16. Provide auxiliary set of contacts for Owner’s SCADA system. Monitoring points shall include: Pump 1 / 2 / 3 Run, Pumps 1 / 2 / 3 Fail, Level, High Water Alarm, Low Water Alarm, and 120V Control Power Available.

E. Alarms

1. Furnish and install a high water alarm horn and light at the pump station

panel that will sound and flash when the water level in the wet well reaches the elevation noted in the plans. Upon reaching an alarm condition the horn will cease sounding, and the light will continue to flash to show that there has been such a condition, until the reset is actuated in the control panel. The unit shall be factory constructed on a suitable mounting panel. The unit shall consist of a loud audible horn with manual adjustment for pitch; a flashing red, including a 40 watt bulb, red vapor proof globe and guard; and a Raintite Control Center with horn silencer and reset and test switches.

2.04 ACCESSORIES

A. The pumps shall be supplied with the following accessories
   (3) - Discharge Connections.
   (3) - Safety Chain Hook Assemblies.
   (3) – Stainless Steel Upper Guide Brackets (UGB).
   (3) - Stainless Steel Intermediate Guide Brackets (If required, see plans).
   (3) – Stainless Steel Chain Lifting System.
   (1) - Stainless Steel Triplex Cable Holder Assembly.
   (1) - Triplex Control Panel as Specified.
   (1) - Stainless Steel Kellum Grips for power cables.
   (4) – Hardware kits for mounting UGB & Cable holder
   (1) – Stainless Steel Pressure Transducer with cable for sensing water level.
   (2) – Float Switches for emergency level alarms.
   (1) – Mix Flush Valve (If required, see plans).

B. Discharge Connection and Rail System
   1. The pump shall be provided with a guide system to allow easy removal without entering the wet well. The main base fixture shall be bolted to the floor and shall include a 90 degree Cast Iron elbow and mounts for two stainless steel rails of standard schedule 40 pipe. The base fixture shall be designed to receive the connecting pump slide bracket without the need for bolts, nuts, or clamps. The pump discharge will connect to a Cast Iron slide bracket that seals against the base fixture by the weight of the pump.

C. Level Sensors
   1. Furnish and install a KPSI series 750 submersible level transmitter in the wetwell for control of pumps.
   2. Furnish and install float-type level sensors at the elevations shown on the drawings for emergency high level alarm and emergency low level cut-off.

PART 3 EXECUTION

3.01 INSTALLATION

A. The Contractor shall install the pump station as shown on the drawings in strict accordance with the manufacturer's installation instructions to provide a complete installation.

B. Wiring and conduits for electrical power, control and instrumentation will be provided by the Electrical Contractor under 26 00 00, Electrical.

3.02 SPARE PARTS

A. Pump supplier shall furnish the following spare parts

(1) Set upper and lower seals
(1) Set upper and lower bearings
(1) Set wear rings
(1) Impeller
(1) Set of spare float switches
(3) Spare fuses for each fuse size

3.03 FIELD SERVICE

B. Following installation, all pumps shall be checked by a manufacturer's representative for proper rotation, pumping capacity, amperage draw, lack of vibration, and other checks as may be deemed necessary to assure proper operation.

C. All submersible pumps shall be pulled out of and reinstalled in the wetwell in the presence of a representative owner to assure proper clearances for easy removal of pumps for maintenance.

END OF SECTION

SECTION 40 05 51

VALVES

PART 1 GENERAL

1.01 SCOPE

Furnish all materials, labor, and equipment to properly install all valves and related accessories at the locations shown on the plans or as directed by the Engineer for the proper completion of the work included under this contract whether shown expressly on the plans or implied by other requirements.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Section 33 31 00 - Sanitary Sewerage Piping

B. Section 33 34 00 - Sanitary Sewerage Force Main

1.03 SUBMITTALS

Complete product data and engineering data, including shop drawings, shall be submitted to the Engineer in accordance with the requirements of Section 01 33 00 of the Contract Documents.

PART 2 PRODUCTS

2.01 GENERAL

A. All valves shall have the name of the manufacturer, pressure, and size of the valve cast upon the body or bonnet in raised letters.

B. Valves and operating mechanisms shall be of the proper size and dimensions to fit the pipe connections thereto and shall be installed in the position and within the space shown on the plans.

C. All castings, whether bronze, iron or steel, shall be sound and smooth, without swells, lumps, blisters, sand holes or other imperfections and shall be made in accordance with best foundry practice. All materials, unless specifically noted otherwise, shall be of the grade and qualities as established by the specifications of the ASTM listed as follows:

Iron Castings	A126, Grade B
Steel Castings	A216
Stem, Bolts, & Nuts	B21, Grade A, Half Hard

Stem Nut & Yoke Nut	B132, Grade B
Stuffing Box Gland	B62, with some modifications
Bushings	B62, Permissible as approved

D. Manufacturer shall have minimum of five years of experience producing substantially similar materials and equipment to that required and be able to provide evidence of at least five installations in satisfactory operation for at least five years.

E. Provide valves to turn clockwise to close, unless otherwise specified.

F. Provide valves with permanent markings for direction to open.

G. Manually operated valves, with or without extension stems, shall require not more than 40-pound pull on manual operator to open or close valve against specified criteria. Gear actuator and valve components shall be able to withstand minimum pull of 200 pounds on manual operator and input torque of 300-foot pounds to actuator nut. Manual operators include handwheel, chainwheel, crank, lever, and T-handle wrench.

H. This contract is partially funded by the GEFA CWSRF and the equipment manufacturer shall meet the requirements identified in the SRF Supplemental General conditions.

2.02 CHECK VALVES

A. Manufacturers: Provide products of one of the following:
1. APCO
2. GA Industries
3. Crispin
4. Val-Matic

B. General:
1. Rubber flapper check valves shall prevent backflow and be watertight. Valves shall be designed for the operating head indicated and shall not slam shut on pump shutdown. Rubber flapper check valves shall be installed for use in basic flow reversal situations, and may be mounted either horizontally or vertically. The valves shall be ANSI Class 150 with a standard ASTM A536 65-45-12 ductile iron body and a steel-reinforced Buna-N-Rubber Flapper with “O-Ring” face, and primer coating inside and out. It shall operate below the maximum 250 PSIG.
2. A manual indicator shall be provided on the valve exterior for positive confirmation of flapper open/closed positioning.
3. Valve ends shall be flanged, meeting the requirements of ANSI B16.1, Class 125.

2.03 FLAP VALVES

A. Manufacturers: Provide products of one of the following, or approved equal:
1. Troy (6” or smaller)
2. Clow (6” or smaller)

3. Rodney Hunt (8” or larger)
4. Waterman (8” or larger)
5. Hydro Gate (8” or larger)

B. General:
1. Provide flap valves for transfer piping as shown on the plans.
2. Flap valve shall have a cast iron body and cover, with flanged connection meeting the requirements of ANSI B16.1, Class 125.
3. Flap valves 6 inches and smaller shall have a bronze seat and brass hinge pins. Valve body and flap shall be cast iron in accordance with ASTM A 126, Class B.

C. Interior Coating
1. Valves shall be coated inside. Steel, cast-iron, and ductile iron surfaces, except machined surfaces, shall be epoxy-coated in accordance with AWWA C550.

2.04 PLUG VALVES

A. Manufacturers: Provide products of one of the following, or approved equal:
1. DeZurik
2. Pratt
3. Clow
4. Val-matic
5. GA Industries

B. General
1. Valves shall be 90-degree turn, non-lubricated, eccentric type with resilient faced plugs. Design of the valve shall provide that contact between the seat and the plug shall only occur in the final degrees of plug movement. Valves shall be suitable for minimal throttling service and service where valve operation is infrequent.
2. Valves shall be capable of providing drip-tight shut-off up to the full pressure rating with pressure in flow direction. Pressure ratings shall be established by hydrostatic tests conducted in accordance with ANSI B16.1. Valves shall be rated at a minimum of 150 psi.
3. Valves shall have a port area equal to at least 80 percent of the full pipe area for valves 24-inches and less. Valves 30-inches and greater shall have a port area equal to at least 70 percent of the full pipe area.

C. Construction
1. Bodies shall be cast-iron, conforming to ASTM A 126, Class B
2. Valve ends shall be a mechanical joint type with restraining glands, except where flanged ends are shown on the Drawings. Mechanical joint valves shall have bell ends conforming to applicable requirements of AWWA C111/ANSI A21.11. Flanged joints shall meet the requirements of ANSI B16.1, Class 125. Flanged valves with flange-to-MJ adapters shall not be acceptable in lieu of MJ valves. At the contractor’s option, grooved

mechanical fittings meeting the requirements of AWWA C606 may be used in lieu of flanged connections in all interior or exposed ductile iron piping.

3. Valve seats shall be a raised, welded-in overlay of not less than 90 percent pure nickel, machined to mate with the resilient faced plug. Overlay shall be minimum of 1/8-inch thick.
4. The plug shall be of semi-steel, conforming to ASTM A 126, Class B. The plug facing shall be a synthetic rubber compound of approximately 70 durometer hardness bonded to the plug. Facing material shall be abrasion resistant and suitable for service in sewage and sludge applications.
5. Valves shall be furnished with replaceable, sleeve-type bearings in the upper and lower journals. Bearings shall comply with applicable requirements of AWWA C507. Bearing materials shall have a proven record of service of not less than five years.
6. The valve body shall be fitted with a bolted bonnet incorporating a stuffing box and pull-down packing gland. Packing shall be the split chevron type. Design of exposed valves shall allow visible inspection of the shaft seal, adjustment of the packing, and replacement of the packing, all without disturbing the bonnet or valve operator. The shaft seal shall comply with the requirements of AWWA C504.

D. Actuators

1. Valves for exposed service, 3 through 8-inches in diameter, shall be lever operated.
2. Valves 3” to 8” shall be equipped with a 2” square nut for direct quarter turn operation, unless otherwise specified in the Drawings. Valves 10” and larger shall be provided with a sealed manual operated worm gear actuator designed for either buried or exposed service to match installation conditions. Geared actuators shall be totally enclosed, oil or grease lubricated with shaft seals to prevent entry of dirt and water into the actuator. All shaft bearings shall be permanently lubricated bronze bushings. Actuators shall clearly indicate valve position and an adjustable stop shall be provided to set closing torque. Construction of actuator housing shall be semi-steel. Gear actuators shall comply with requirements of AWWA C504.
3. Valves for buried service shall be equipped with a valve box and stem extension required to bring the operation nut within 6-inches of finished grade. Valve boxes and extension stems shall be as specified in this Section.
4. Motorized actuators shall be provided where shown on the Drawings.
5. Valves and operators for submerged or buried service shall have seals on all shafts and gaskets on valve operator covers to prevent the entry of water. Operator mounting brackets for submerged service shall be totally enclosed and shall have gasket seals.
6. Valves for non-buried service, six feet or more above the operating floor shall be furnished with a chainwheel operator and chain for operation from floor level.
7. Valves shall be equipped with pedestal type operators where shown on the Drawings and as specified in this Section.
8. Where shown on the Drawings, provide an extended bonnet and mount the

gear actuator on top of the extended bonnet.

9. Provide T-handle operating wrench with direct nut valves as specified in this Section.

E. Interior Coating

1. Valves shall be coated inside. Steel, cast-iron, and ductile iron surfaces, except machined surfaces, shall be epoxy-coated in accordance with AWWA C550.

2.05 BUTTERFLY VALVES

A. Manufacturers: Provide products of one of the following, or approved equal:

1. Mueller Company
2. M&H Valve Company
3. Henry Pratt Company
4. Watts Water Technologies
5. GA Industries
6. Val-Matic

B. General

1. Butterfly valves shall be resilient seated, short body design and shall conform to AWWA C-504 latest edition. Valves shall be Class 250 (250 psi bi-directional shut-off rating, 500 psi body hydrostatic shell test, and maximum line velocity of 16 feet per second).
2. The valve body shall have integral flanged connections conforming to ANSI B16.1, Class 125, or mechanical joint connections conforming to AWWA C111/ANSI A21.11, as shown in the Construction Plans.

C. Construction

1. The valve body shall be made from ductile iron conforming to ASTM A536 Grade 65-45-12. Sizes 24-inch and smaller shall have a permanent, transfer molded and vulcanized EPDM-P rubber seat. Sizes 30-inch and larger shall have an EPDM-P rubber seat that is that is mechanically retained in the body without epoxy and field adjustable or replaceable using common hand tools.
2. The valve disc shall be made from ductile iron conforming to ASTM A536 Grade 65-45-12 with a 316 stainless steel seat edge.
3. Size 24-inch and smaller valve shafts shall be one-piece, larger sizes shall have upper and lower stub shafts. Shafts shall be made from Type 304 stainless steel in Class 150B valves and ASTM A564 Type 17-4PH stainless steel in Class 250B valves. The valve disc shall be attached to the shaft by multiple, mechanically secured stainless steel pins.
4. The valve shall have upper and lower self-lubricating shaft bearings. Sizes 24" and larger shall be provided with an adjustable thrust bearing. The shaft shall be sealed with self-adjusting Buna-N or EPDM packing. The actuator shall not be used to retain the packing and shaft packing leakage shall be prevented from entering the actuator.

D. Actuators

1. Butterfly valves for exposed service shall be supplied with a manual worm

gear actuator with a vertically positioned handwheel and visual position indicator.

2. Include additional extension stem sections and stainless steel coupling hardware as necessary to construct the full assembly to the elevations indicated in the Construction Plans.
3. When shown on the Plans, exposed service valves sizes 3" to 8" may be operated with a 10-position lever.
4. Butterfly valves for buried service shall be supplied with worm gear actuators filled with grease and sealed against water entry with a 2" operating nut.

E. Interior Coating

1. Valves shall be coated exterior and interior. Steel, cast-iron, and ductile iron surfaces, except machined surfaces, shall be epoxy-coated in accordance with AWWA C550.

2.06 TELESCOPING VALVES

A. Manufacturers: Provide products of one of the following, or approved equal:
1. RW Gate Company
2. Troy
3. Waterman

B. General
1. Provide telescoping valves for use in the Sludge Collection Box and Aerobic Digestor.
2. Telescoping valves shall be the rising stem type and provided complete as shown in the Construction Plans to include slip tubes and valve seals, bail assembly, extension stem, wall mount bracket and pedestal assembly, and rack and pinion manual operator. Use only Type 316 stainless steel hardware to install the valves as shown. Provide scum baffles with telescoping valves where shown on the Construction Plans.

C. Construction
1. The slip tube of the valves shall be made of Schedule 40 Type 316 stainless steel and shall have the necessary length to provide vertical travel indicated in the Construction Plans. A minimum of 6 inches of slip tube shall engage the receiving pipe when the slip tube is fully raised. The slip tube shall be square on top unless otherwise specified for a V-notch.
2. Provide seal assemblies for telescoping valves that mount to riser pipes and that include EPDM or Buna-N gaskets, seal flanges, and retainer plates. Provide seal assemblies with bolt holes drilled for ANSI 125# class flanges.
3. Provide telescoping valves with lifting bails, extension stems, couplers, and attachment hardware made of Type 316 stainless steel. Include additional extension stem sections and stainless steel coupling hardware as necessary to construct the full assembly to the elevations indicated in the Construction Plans.

4. Support the extension stems of telescoping valves using adjustable stem guides made of cast or fabricated stainless steel and assembled using stainless steel hardware. For each valve, provide one (1) stem guide centered on the extension stem. The stem guide bushings shall be of UHMWPE or bronze.
5. Provide a cast or fabricated stainless steel adjustable wall mount bracket for each telescoping valve to which an operator pedestal assembly will attach. The pedestal assembly for each telescoping shall be made of cast or fabricated stainless steel and include a manual, vertically positioned handwheel operator coupled to a rack and pinion gear box or rising stem gearbox that will permit fine adjustment of the slip tube discharge elevation. If a rising stem is utilized, the stem shall have a minimum diameter of 1-1/2 inches and shall have triple lead threads for rapid travel.
6. For each telescoping valve, include a clear plastic stem cover connected to the top of the pedestal assembly to enclose the rising stem of the valve. Stem cover shall be butyrate or equal with resistance to ultraviolet light, weather tightness, and scale to indicate valve position.

2.07 AIR RELEASE AND VACUUM VALVES (SEWAGE)

A. Manufacturers: Provide products of one of the following, or approved equal:
   1. GA Industries
   2. APCO Valve Corporation
   3. Crispin
   4. Val-Matic

B. General

   1. Air Release Valves: The air release valve shall automatically release air accumulations from the pipeline due to the action of the float and lever mechanism. When the air valve body fills with air, the float falls. Through the leverage mechanism, this causes the resilient seat to open the orifice and allow the air to escape to the atmosphere. When all the air has been exhausted from the valve body, the float will be buoyed up through the leverage mechanism, this will cause the resilient seat to close the orifice, preventing water from being exhausted from the valve.
      a. The valve body and cover shall be constructed of cast iron conforming to ASTM A 126, Class B. The float shall be constructed of stainless steel and attached to a stainless steel lever mechanism. A resilient, Buna-N seat shall be attached to the lever mechanism for drop-tight closure. The valve shall be equipped with the necessary attachments, including valves, quick disconnect couplings and hose, to permit back flushing after installation without diverting the valve.

   2. Air/Vacuum Valve: The air/vacuum valve shall discharge large amounts of air as the pipeline fills and allow air to enter the pipeline as it drains or in the event of vacuum conditions.
      a. The valve body and cover shall be constructed of cast iron conforming to ASTM A 126, Class B. The valve shall operate by

means of a non-collapsible stainless steel float which seals an orifice. As air enters the valve the float shall drop from the orifice and allow the air to escape. As water rises in the valve, the float will again seal the orifice. The valve will be of such design that the float cannot blow shut at any air velocity. All working parts shall be of stainless steel. The valve shall be equipped with the necessary attachments, including valves, quick disconnect couplings and hose, to permit back flushing after installation without diverting the valve.

3. Combination Air Valves: Combination air valves shall combine the features of an air release valve and an air/vacuum valve and shall be of one of the following types:
   a. Combination air valves 3 inches and larger shall consist of an air/vacuum valve described in 2. above, with an air release valve described in 1. above tapped into its body. The valve shall be of two-piece body design with an isolation gate valve separating the two valves.
   b. Combination air valves less than 3 inches shall be single body, double orifice, allowing large volumes of air to escape out the larger diameter air and vacuum orifice when filling a pipeline and closes watertight when the liquid enters the valve. During large orifice closure, the smaller diameter air release orifice will open to allow small pockets of air to escape automatically and independently of the large orifice. The large air/vacuum orifice shall also allow large volumes of air to enter through the orifice during pipeline drainage to break the vacuum. The valve body and cover shall be constructed of cast iron conforming to ASTM A 126, Class B. The Buna-N seats must be fastened to the valve, without distortion, for drop-tight shut-off. The float and other internal metal components shall be stainless steel. The valve shall be equipped with the necessary attachments, including valves, quick disconnect couplings and hose, to permit back flushing after installation without diverting the valve.

2.08 VALVE BOXES AND COVERS

A. All valves below ground level shall be furnished with a valve box and cover. Each shall be of the roadway extension type, or proper length and base size with suitable detachable cover, bituminous coated inside and out. Boxes shall be 5 1/4 inch inside diameter, "Standard Telescopic Valve Box" as manufactured by American Cast Iron Pipe Co. or approved equal.

B. Valve boxes shall be provided with precast concrete collar installed flush with the ground surface.

2.09 METER BOXES

A. 1 inch and Smaller: Shall be a Ford Meter Long Yokebox or approved equal.

B. 1-1/2 & 2 inch: Shall be as manufactured by Brooks Products or approved equal.

C. 3 inch and Larger: Shall be as shown on the plans and approved by the Engineer.

2.10 SERVICE PIPE COUPLINGS

Dresser Style 65, Ford or approved equal.

2.11 SERVICE SADDLES

Service Saddles shall have a Brass Body with 304 Stainless Steel Double Straps, 304 Stainless Steel Teflon coated Hex Nuts & 304 SS Washers as manufactured by A.Y. McDonald Mfr. Co., Smith-Blair, Rockwell, Ford, Dresser or Mueller for each specific piping material.

2.12 VALVE VAULTS

Precast Manufacturing shall be in conformance with ASTM C913.

Furnish and install for each valve vault an aluminum access assembly as shown on plans, complete with hinged and hasp-equipped cover. Frame shall be securely mounted. The door shall have a safety locking handle in the open position. Designed to withstand vehicular traffic in off-street locations. Single or Double leaf covers are constructed of ¼" diamond pattern plate and reinforced for AASHTO H-20 wheel loading.

2.13 T-HANDLE OPERATING WRENCH

The contractor shall furnish two wrenches, 30 inches long, standard waterworks type with socket for square operating nuts of plug or other valves. All below grade valves shall be adapted with an extension stem and fittings so that they can be operated with a 30-inch long wrench.

2.14 ANCHORAGES AND MOUNTING HARDWARE

A. Obtain bolts, nuts, and washers for connection of valve and appurtenances to concrete structure or other structural members from valve Supplier.

B. Bolts, nuts, and washers shall be of ample size and strength for purpose intended. Anchorages in concrete shall be at least 5/8-inch diameter.

C. Provide stem guide anchorages of required strength to prevent twisting and sagging of guides under load.

D. Materials:

1. Provide bolts and washers of Type 316 stainless steel and nitrided nuts. Bolts shall have rolled threads. Bolts and nuts shall be electropolished to remove burrs.

PART 3 EXECUTION

3.01 GENERAL

A. All items specified under this Section shall be installed in conjunction with piping that is specified under the appropriate Section. Locations are to be as shown on the plans or as otherwise specified.

B. Install valves and appurtenances in accordance with supplier's instructions and applicable AWWA standards.

C. Install valves plumb and level, with valve boxes plumb and centered, and soil tamped to a lateral distance of four feet on all sides of valve or to undisturbed trench face if less than four feet.

D. Valves, brackets, and fittings where not constructed of brass, aluminum, bronze, or finished steel, shall be factory finished in accordance with approved manufacturer's standards. Machined surfaces shall be given a suitable coating of grease or other protective material. After installation, exposed items shall be field painted as specified elsewhere.

3.02 FIELD TESTING

A. All valves shall be tested at point of manufacture. After the valves are installed, the contractor shall test them under the working pressure, and any valves found to leak shall be satisfactorily repaired or replaced.

B. Conduct functional field test on each valve in the presence of Engineer to demonstrate that each valve operates correctly.

C. Demonstrate satisfactory opening and closing of valves at specified criteria requiring not more than 40 pounds effort on manual actuators.

D. Test each valve by applying 200 pounds effort on manual operators. There shall be no damage to gear actuator or valve.

PART 4 SCHEDULE OF VALVES

IDENTIFIER	DESCRIPTION	OPERATOR	SPECIFICATION
INF-PV-1	12" PLUG VALVE (MJ/MJ)	WORM GEAR W/ OPERATING NUT & POSITION INDICATOR, N.O.	40 05 51 2.04
INF-PV-2	12" PLUG VALVE (MJ/MJ)	WORM GEAR W/ OPERATING NUT & POSITION INDICATOR, N.O.	40 05 51 2.04
INF-CV-1	12" CHECK VALVE (FL/FL)	AUTOMATIC W/ VISUSAL POSITION INDICATOR	40 05 51 2.02
TR-FV-1	4" FLAP VALVE (FL)	AUTOMATIC	40 05 51 2.03
TR-FV-2	4" FLAP VALVE (FL)	AUTOMATIC	40 05 51 2.03
TR-FV-3	4" FLAP VALVE (FL)	AUTOMATIC	40 05 51 2.03
SL-PV-1	8" PLUG VALVE (MJ/MJ)	WORM GEAR W/ OPERATING NUT & POSITION INDICATOR, N.O.	40 05 51 2.04
SL-PV-2	8" PLUG VALVE (MJ/MJ)	WORM GEAR W/ OPERATING NUT & POSITION INDICATOR, N.C.	40 05 51 2.04
SL-PV-3	8" PLUG VALVE (MJ/MJ)	WORM GEAR W/ OPERATING NUT & POSITION INDICATOR, N.O.	40 05 51 2.04
SL-PV-4	8" PLUG VALVE (MJ/MJ)	WORM GEAR W/ OPERATING NUT & POSITION INDICATOR, N.C.	40 05 51 2.04
SL-PV-5	8" PLUG VALVE (MJ/MJ)	DIRECT NUT, N.C.	40 05 51 2.04
SL-PV-6	8" PLUG VALVE (MJ/MJ)	DIRECT NUT, N.C.	40 05 51 2.04
SL-PV-7	8" PLUG VALVE (MJ/MJ)	DIRECT NUT, N.C.	41 05 51 2.04
SL-TV-1	8" TELESCOPING VALVE (FL)	RACK & PINION W/ HAND WHEEL	40 05 51 2.06
SL-TV-2	8" TELESCOPING VALVE (FL)	RACK & PINION W/ HAND WHEEL	40 05 51 2.06
SL-TV-3	8" TELESCOPING VALVE (FL)	RACK & PINION W/ HAND WHEEL	40 05 51 2.06
FIL-BFV-1	16" BUTTERFLY VALVE (FL)	WORM GEAR W/ HAND WHEEL AND EXTENSION ASSEMBLY, N.O.	40 05 51 2.05
FIL-BFV-2	16" BUTTERFLY VALVE (FL)	WORM GEAR W/ HAND WHEEL AND EXTENSION ASSEMBLY, N.O.	40 05 51 2.05
TD-PV-1	6" PLUG VALVE (MJ/MJ)	DIRECT NUT, N.C.	40 05 51 2.04
TD-PV-2	6" PLUG VALVE (MJ/MJ)	DIRECT NUT, N.C.	40 05 51 2.04
TD-PV-3	8" PLUG VALVE (MJ/MJ)	DIRECT NUT, N.C.	40 05 51 2.04
TD-PV-4	8" PLUG VALVE (MJ/MJ)	DIRECT NUT, N.C.	40 05 51 2.04
RAS-PV-1	8" PLUG VALVE (FL/FL)	WORM GEAR AND HAND WHEEL, N.O.	40 05 51 2.04
RAS-PV-2	8" PLUG VALVE (FL/FL)	WORM GEAR AND HAND WHEEL, N.O.	40 05 51 2.04
RAS-PV-3	8" PLUG VALVE (FL/FL)	WORM GEAR AND HAND WHEEL, N.O.	40 05 51 2.04
RAS-PV-4	8" PLUG VALVE (MJ/MJ)	DIRECT NUT, N.O.	40 05 51 2.04
RAS-PV-5	8" PLUG VALVE (MJ/MJ)	DIRECT NUT, N.C.	40 05 51 2.04
RAS-PV-6	8" PLUG VALVE (MJ/MJ)	DIRECT NUT, N.O.	40 05 51 2.04
RAS-PV-7	8" PLUG VALVE (MJ/MJ)	DIRECT NUT, N.C.	40 05 51 2.04
RAS-PV-8	10" PLUG VALVE (MJ/MJ)	WORM GEAR W/ OPERATING NUT & POSITION INDICATOR, N.O.	40 05 51 2.04
RAS-CV-1	8" CHECK VALVE (FL/FL)	AUTOMATIC W/ VISUSAL POSITION INDICATOR	40 05 51 2.02
RAS-CV-2	8" CHECK VALVE (FL/FL)	AUTOMATIC W/ VISUSAL POSITION INDICATOR	40 05 51 2.02
RAS-CV-3	8" CHECK VALVE (FL/FL)	AUTOMATIC W/ VISUSAL POSITION INDICATOR	40 05 51 2.02
RAS-CV-4	8" CHECK VALVE (FL/FL)	AUTOMATIC W/ VISUSAL POSITION INDICATOR	40 05 51 2.02
RAS-ARV-1	2" AIR RELEASE VALVE (SADDLE)	AUTOMATIC	40 05 51 2.07
WAS-PV-1	6" PLUG VALVE (MJ/MJ)	DIRECT NUT, N.C.	40 05 51 2.04
WAS-PV-2	4" PLUG VALVE (MJ/MJ)	DIRECT NUT, N.O.	40 05 51 2.04
WAS-PV-3	6" PLUG VALVE (MJ/MJ)	DIRECT NUT, N.C.	40 05 51 2.04
WAS-PV-4	4" PLUG VALVE (MJ/MJ)	DIRECT NUT, N.O.	40 05 51 2.04
WAS-CAV-1	2" COMBINATION AIR VALVE (SADDLE)	AUTOMATIC	40 05 51 2.07
WAS-ARV-2	2" AIR RELEASE VALVE (SADDLE)	AUTOMATIC	40 05 51 2.07
WAS-TV-1	6" TELESCOPING VALVE (FL)	RACK & PINION W/ HAND WHEEL	40 05 51 2.06
WAS-TV-2	6" TELESCOPING VALVE (FL)	RACK & PINION W/ HAND WHEEL	40 05 51 2.06

END OF SECTION

SECTION 40 05 59

HYDRAULIC GATES

PART 1 GENERAL

1.01 SCOPE

A. Furnish all materials, labor, and equipment to properly install all hydraulic gates and related accessories at the locations shown on the plans or as directed by the Engineer for the proper completion of the work included under this contract whether shown expressly on the plans or implied by other requirements.

B. This section includes slide gates, stop gates, downward opening weir gates, operators, anchorage systems, and all associated appurtenances.

C. Extent of the equipment is shown on the Gate Schedule at the end of this Section.

1.02 SUBMITTALS

D. Complete product data and engineering data, including shop drawings, shall be submitted to the Engineer in accordance with the requirements of Section 01 33 00 of the Contract Documents.

E. Include with shop drawing submittal, the following items:

1. Fabrication, assembly and installation diagrams.
2. Setting drawings, templates, and directions for the installation of anchor bolts and other anchorages.
3. Wiring diagrams for electric motor operators..

PART 2 PRODUCTS

2.01 GENERAL

A. The equipment provided under this section shall be fabricated, assembled, erected, and placed in proper operating condition in full conformity with the drawings, specifications, engineering data, instructions and recommendations of the equipment manufacturer unless exceptions are noted by the Engineer.

B. Gates and operators shall be supplied with all the necessary parts and accessories indicated on the drawings, specified, or otherwise required for a complete, properly operating installation and shall be the latest standard product of a manufacturer regularly engaged in the production of fabricated gates.

C. The manufacturer shall have experience in the production of substantially similar

equipment for a minimum of five (5) years, and shall show evidence of satisfactory operation in at least 100 installations. The manufacturer's shop welds, welding procedures and welders shall be qualified and certified in accordance with the requirement of the latest edition of ASME, Section IX.

D. The fully assembled gates shall be shop inspected, tested for operation and leakage and adjusted before shipping. There shall be no assembling or adjusting on job sites other than for the lifting mechanism.

E. Bolts, studs, cap screws, and adjusting screws shall be of ample section to withstand the force created by operation of the gate under a full head of water.

F. All components shall be specifically constructed for the specified service conditions and shall be integrated into the overall assembly by the gates equipment manufacturer.

G. This contract is partially funded by the GEFA CWSRF and the equipment manufacturer shall meet the requirements identified in the SRF Supplemental General conditions.

2.02 PERFORMANCE

A. Gates shall be substantially watertight under the design head conditions. For slide and weir gates, leakage shall not exceed 0.05 gallon per minute per foot of periphery under the design seating head and 0.05 gallon per minute per foot of periphery for an unseating head of 30 feet.

B. For stop gates, leakage shall not exceed 0.1 gallons per minute per foot of periphery at the design seating and unseating heads.

C. The gates shall be designed to withstand at the water head specified in the gate schedule.

2.03 SLIDE GATES

A. Manufacturers: Provide products of one of the following, or approved equal:
   1. Rodney Hunt
   2. RW Gate Company
   3. Waterman
   4. Whipps, Inc.

B. General
   1. Provide slide gates from a single manufacturer as specified herein and shown in the drawings, meeting the standards of AWWA C562.
   2. Slide gates shall open to not less than 6-inches above the maximum water level in the channel in which they are installed.
   3. The frame shall be of the flange back design and allow mounting directly on a concrete wall in front of a pipe. The seating face of the frame shall be machined at an angle to the plane of the mounting flange.
   4. Identify each slide gate with a brass or stainless steel nameplate stamped with the approved designation as shown in the Aluminum Slide Gate

Schedule. Nameplate shall be permanently fastened to the gate at the factory.

C. Construction

1. Unless otherwise noted, all structural components of the frame and slide shall be fabricated of aluminum, ASTM B 209, Alloy 6061, or ASTM B 308/B 308M, Alloy 6061 having a minimum thickness of 1/4-inch and shall have adequate strength to prevent distortion during normal handling, during installation and while in service.
2. All bolts, studs, cap screws and adjusting screws shall be of Type 316 stainless steel. Anchor bolts shall have a minimum diameter of ½-inch and shall be of the epoxy adhesive type.
3. Frame
   a. Fabricate the slide of aluminum plate reinforced with structural shapes attached by welding in order to limit deflection under full head to not more than 1/360 of the span.
   b. Extend reinforcing ribs into the guides overlapping the seating surface of the guide.
   c. Weld stem mounting guides to the slide.
   d. Furnish tops of the extended guides with a yoke for mounting of the lifting device.
   e. Construct the yoke of structural shapes of sufficient strength to take the full thrust created by operating the gate under the maximum specified head.
   f. Attach the yoke to the framework by bolting or welding to permit removal of the gate slide and stem.
4. Stem
   a. Operating stem shall be of Type 316 stainless steel of minimum sizes shown or specified.
   b. Design stem to transmit in compression at least 2-1/2 times the rated output of the operating mechanism with an 80-pound effort on the crank or handwheel. Determine the critical buckling load using the Euler column formula, using C = 2. Where electric motor driven lifts are used, the stem design force shall not be less than 1.25 times the output thrust of the unit in the stalled motor condition.
   c. Stems shall have a slenderness ratio (L/R) less than 200.
   d. Threaded portion of the stem shall have machined cut threads of the Acme type. Join stems of more than one section by stainless steel couplings threaded and keyed, or bored and pinned to the stems. All threaded and keyed couplings of the same size shall be interchangeable. Provide rising stems with an adjustable stop collar on the stem.
   e. Connect the stem to the slide by means of a bolted connection.
   f. Stem guides shall be cast-iron, bronze bushed, mounted on cast-iron brackets.
   g. Guides shall be adjustable in two directions and shall be spaced so that stems have a maximum unsupported length of 84-inches.

5. Seals
    a. Seal system shall consist of self-adjusting UHMWPE seals with a rubber compression cord, unless otherwise recommended by manufacturer.
    b. The seals shall be arranged to ensure that there is no metal-to-metal contact between the slide and frame.
    c. The compression cord shall be contained between the frame and the UHMWPE seal and shall not be in contact with the slide.
    d. The invert seal on upward opening gates shall use a compressible rubber seal located on the bottom of the slide or in the invert of the frame.
    e. The invert seal shall be of a flush bottom arrangement.
    f. The invert seal shall be mechanically fastened with stainless steel bolts.
    g. All seals shall be field removable and field replaceable without the need to remove the gate frame from the wall.
    h. The seal system shall have been shop tested with a 30,000-cycle operating test in an abrasive environment to confirm the ability of the seals to withstand the abrasive condition with negligible deterioration and to confirm that the leakage restriction requirement is still achieved.

D. Operator
1. Manual operators shall turn right (clockwise) to close, unless otherwise specified. Operators shall indicate the direction of operation.
2. Manual operators shall be the bevel gear type and shall be yoke mounted, with the input shaft between 36-inches and 48-inches above the operating floor
3. All bearings and gears shall be totally enclosed in a weather tight housing.
4. Each manual operator shall be designed to operate the gate under the maximum specified seating and unseating heads by using a maximum effort of 40 lb on the crank or handwheel, and shall be able to withstand, without damage, an effort of 80 lb.
5. Ball or roller bearings shall support the lift nut and input shaft.
6. Provide lubricating fittings for all gears and bearings
7. The crank shall be removable and fitted with a corrosion-resistant rotating handle. The maximum crank radius shall be 15 inches and the maximum handwheel diameter shall be 24 inches.
8. Operating nut, thrust nut, and lift nut shall be of bronze casting, ASTM B 584, Alloy 865.
9. Gates with rising stems shall be provided with a clear plastic stem cover.
    a. The stem cover shall be butyrate and shall have a cap and condensation vents.
    b. Clear mylar indicating tape shall be provided for field application after the gate has been installed and positioned.
10. Stop collars shall be provided to limit the downward travel on gates with manual operating mechanisms.

a. Stop collars shall be bronze and shall be internally threaded and provided with stainless steel set screws.

E. Finish
1. All aluminum shall be mill finish.
2. Aluminum in contact with concrete shall be field coated with a heavy coat of bitumastic paint field applied by the Contractor.
3. All heat tint and slag from the stainless steel welding process shall be passivated in accordance with ASTM A380.
4. All ferrous components shall be suitably prepared and then shop coated with primer. Finish coating shall be applied by the Contractor. The ductile iron operator housing shall be finish coated by the Contractor with a suitable paint that complies with Section 09 91 00, Painting.
5. All gears, bearing surfaces, machined surfaces and other surfaces which are to remain unpainted shall receive a heavy application of grease or other rust-resistant coating. This coating shall be maintained during storage and until the equipment is placed into operation.

2.04 STOP GATES

A. Manufacturers: Provide products of one of the following, or approved equal:
1. Rodney Hunt
2. RW Gate Company
3. Waterman
4. Whipps, Inc.

B. General
1. Provide hand-pull stop gates from a single manufacturer as specified herein and shown in the drawings.
2. Provide the number of stop gate frames and slides as indicated in the gate schedule. Unless otherwise noted, provide stop gates as a set, with the slide and frame.
3. All gates shall be shop inspected for proper operation prior to shipment.
4. Welds shall be performed by welders with ASME Section IX or AWS D1.2 certification.

C. Construction
1. The gate and frame shall be constructed of aluminum alloy 6061-T6, ASTM B308/308M.
2. Anchor bolts and assembly bolts shall be Type 316 stainless steel. Anchor bolts shall have a minimum diameter of ½-inch and be of the epoxy adhesive type.
3. Frame
a. The frame shall be constructed of extruded aluminum and shall be reinforced to withstand the specified operating conditions.
b. Frames shall have a minimum material thickness of 3/8-inch.
c. Frames shall have a minimum weight of 4 lbs/ft.
d. The frame shall be of the flange back design and allow mounting directly on a concrete wall.

4. Slide
    a. The slide shall consist of an aluminum plate that is reinforced with stiffeners to withstand the specified head conditions. The slide shall engage the frame a minimum of 1-inch on each side.
    b. The slide plate and stiffeners shall have a minimum material thickness of 1/4-inch.
    c. The slide shall be reinforced with plates or channel shaped members to restrict deflection to 1/16-inch or less at the design head.
    d. The stiffeners shall be welded to the slide.
    e. Dual lifting handles shall be provided on slides with opening widths in excess of24 inches.
    f. Lifting handles shall be formed from round bar or shall be lifting slots in the top of the stop plate as shown on the Contract Drawings.
5. Seals
    a. The seal system shall consist of UHMWPE side seals and an EPDM invert seal.
    b. The UHMWPE seals shall be arranged to ensure that there is no metal-to-metal contact between the slide and frame.
    c. The invert seal shall use a compressible EPDM or neoprene seal located on the bottom of the slide or in the invert of the frame.
    d. The invert seal shall be of a flush bottom arrangement.
    e. All seals shall be secured with stainless steel assembly bolts. All seals shall be field removable and field replaceable without the need to remove the gate frame from the wall.

D. Finish
1. All aluminum shall be mill finish.
2. Aluminum in contact with concrete shall be field coated with a heavy coat of bitumastic paint field applied by the Contractor.

2.05 DOWNWARD OPENING WEIR GATES

A. Manufacturers: Provide products of one of the following, or approved equal:
1. Rodney Hunt
2. RW Gate Company
3. Waterman
4. Whipps, Inc.

B. General
1. Provide downward opening weir gates from a single manufacturer as specified herein and shown in the drawings, meeting the standards of AWWA C651.
2. All gates shall be shop inspected for proper operation prior to shipment.
3. Downward opening gates shall be capable of being lowered to an elevation below the invert of the channel or opening.
4. All welds shall be full and continuous performed by welders with AWS D1.6 or ASME Section IX certification.
5. Equipment shall be designed and manufactured in the United States.

C. Construction

1. All structural components of the frame and slide shall be fabricated of stainless steel having a minimum thickness of 1/4-inch and shall have adequate strength to prevent distortion during normal handling, during installation and while in service.
2. Anchor bolts and assembly bolts shall be Type 316 stainless steel. Anchor bolts shall have a minimum diameter of ½-inch and be of the epoxy adhesive type.
3. Frame
    a. The frame shall be of the flange back design and allow mounting directly on a concrete wall. The seating face of the frame shall be machined at an angle to the plane of the mounting flange.
    b. Wall mounted guides shall have a minimum weight of 10 lbs per foot.
    c. Gussets shall be provided as necessary to support the guide members and accommodate unseating heads as per design requirement.
    d. On self-contained gates, a yoke shall be provided across the top of the frame. The yoke shall be formed by two C-channel shaped structural members affixed to the top of the side frame members to provide a one-piece rigid assembly. The design of the yoke shall allow the removal of the slide.
    e. A rigid stainless steel invert member shall be provided across the bottom of the opening.
4. Slide
    a. The slide and reinforcing stiffeners shall be constructed of stainless steel plate.
    b. The slide shall not deflect more than 1/720 of the span or 1/16 inch, whichever is smaller, under the maximum design head.
    c. The portion of the slide that engages the frame shall have a minimum thickness of 1/2-inch.
5. Seals
    a. Seal system shall consist of self-adjusting UHMWPE seals with a rubber compression cord, unless otherwise recommended by manufacturer. The rubber compression cord shall be constructed of EPDM or neoprene.
    b. The seals shall be arranged to ensure that there is no metal-to-metal contact between the slide and frame.
    c. The seat/seals shall extend to accommodate the 1-1/2 x the height of the slide when the slide is in the fully closed or fully opened position.
    d. All gates shall be provided with a resilient flush bottom seal to seal the bottom on downward opening gates.
    e. All seals must be bolted or otherwise mechanically fastened to the frame or slide.
    f. The compression cord shall be contained between the frame and the UHMWPE seal and shall not be in contact with the slide.

6. Stem
    a. A threaded operating stem shall be utilized to connect the operating mechanism to the slide.
    b. On rising stem gates, the threaded portion shall engage the operating nut in the manual operator.
    c. The threaded portion of the stem shall have a minimum outside diameter of 1-1/2 inches. Stem extension pipes are not acceptable.
    d. The stem shall be threaded to allow full travel of the slide unless the travel distance is otherwise shown on the Contract Drawings.
    e. Maximum L/R ratio for the unsupported part of the stem shall not exceed 200.
    f. In compression, the stem shall be designed for a critical buckling load caused by an 80 lb effort on the crank or handwheel with a safety factor of 2, using the Euler column formula.
    g. The stem shall be designed to withstand the tension load caused by the application of a 80 lb effort on the crank or handwheel without exceeding 1/5 of the ultimate tensile strength of the stem material.
    h. The threaded portion of the stem shall have threads of Stub Acme type.

D. Operator
1. Manual operators shall turn right (clockwise) to close, unless otherwise specified. Operators shall indicate the direction of operation.
2. Unless otherwise shown on the Drawings, gates shall be operated by a manual crank-operated gearbox. The operator shall be mounted on the yoke of self contained gates with the input shaft between 36-inches and 48-inches above the operating floor.
3. The gate manufacturer shall select the proper gear ratio to ensure that the gate can be operated with no more than a 40 lb effort when the gate is in the closed position and experiencing the maximum operating head.
4. Gates with rising stems shall be provided with a clear plastic stem cover.
    a. The stem cover shall be butyrate and shall have a cap and condensation vents.
    b. Clear mylar indicating tape shall be provided for field application after the gate has been installed and positioned.
5. Stop collars shall be provided to limit the downward travel on gates with manual operating mechanisms.

E. Finish
1. Mill finish on stainless steel. Welds shall be passivated in accordance with ASTM A380. If bead blasting is utilized, the entire slide and entire frame shall be blasted to help ensure a uniform finish.
2. All iron and steel components, such as the manual gearbox housing, shall be properly prepared and shop coated with a primer. A finish coat shall be applied by the Contractor with a suitable paint that complies with Section 09 91 00, Painting.
3. All gears, bearing surfaces, machined surfaces and other surfaces which are to remain unpainted shall receive a heavy application of grease or other rust-

resistant coating. This coating shall be maintained during storage and until the equipment is placed into operation.

PART 3 EXECUTION

3.01 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to the Site to ensure uninterrupted progress of the Work. Deliver anchor bolts and anchorage devices which are to be embedded in cast-in-place concrete in ample time to prevent delay of that Work.

B. All boxes, crates and packages shall be inspected by Contractor upon delivery to the Site. Contractor shall notify Engineer, in writing, if any loss or damage exists to equipment or components. Replace loss and repair damage to new condition in accordance with manufacturer's instructions.

C. Store materials to permit easy access for inspection and identification. Keep all material off the ground, using pallets, platforms, or other supports. Protect steel members and packaged materials from corrosion and deterioration.

3.02 INSTALLATION

A. Gates and appurtenances shall be handled and installed in accordance with the manufacturer’s recommendations.

B. The gate assemblies shall be installed in a true vertical plane, square and plumb.

C. Non-shrink grout or a resilient gasket shall be applied, by the Contractor, between the gate frame and the wall to ensure that there is no leakage around the gate.

D. Review installation procedures under this and other Sections and coordinate the installation of items that must be installed with, or before the gates work.

3.03 FIELD TESTING

A. Following the completion of each gate installation, the gates shall be operated through at least two complete open/close cycles in the presence of the Engineer or Owner. If an electric or hydraulic operator is used, limit switches shall be adjusted following the manufacturer’s instructions.

B. Each gate shall cycle without binding, scraping, or distorting.

C. Gates should be checked for leakage by the Contractor. Refer to the "Performance" section for approval criteria.

PART 4 SCHEDULE OF GATES

4.01 ABBREVIATIONS

1. WG Downward opening weir gate
2. SG Slide gate
3. SPG Stop gate
4. SB Splitter box
5. CCC Chlorine contact chamber

IDENTIFIER	LOCATION	OPERATOR / MOUNT	DIMENSIONS (WXH)	INV ELEVATION	OPERATING FLOOR ELEVATION
WG-1	INFLUENT SB	CRANK / YOKE	24" X 18"	169.5	173.5
WG-2	INFLUENT SB	CRANK / YOKE	24" X 18"	169.5	173.5
WG-3	INFLUENT SB	CRANK / YOKE	24" X 18"	169.5	173.5
WG-4*	CLARIFIER #1	CRANK / YOKE	12" X 12"	159.0	162.5
WG-5*	CLARIFIER #2	CRANK / YOKE	12" X 12"	159.0	162.5
SG-1	CLARIFIER SB	CRANK / YOKE	24" X 18"	160.85	166.0
SG-2	CLARIFIER SB	CRANK / YOKE	24" X 18"	160.85	166.0
SG-3	CLARIFIER SB	CRANK / YOKE	24" X 18"	160.85	166.0
SPG-1	CCC	HANDHOLE	24" x 76"	138.0	142.0
SPG-2**	CCC	HANDHOLE	24" x 76"	138.0	142.0
SPG-3	CCC	HANDHOLE	24" x 76"	138.0	142.0
SPG-4**	CCC	HANDHOLE	24" x 76"	138.0	142.0

Dimensions shown above are for the gate slide only and do not account for necessary overhang or frame dimensions.

*Contractor to verify exact dimension prior to ordering.

**Provide stop gate frame only.

END OF SECTION

SECTION 40 71 00

FLOW MEASUREMENT INSTRUMENTATION

PART 1 GENERAL

1.01 SCOPE

A. Furnish all materials, labor, and equipment to properly install all flow measurement devices and related accessories at the locations shown on the plans or as directed by the Engineer for the proper completion of the work included under this contract whether shown expressly on the plans or implied by other requirements.

B. This section includes electromagnetic flow meters, Parshall flumes, and all associated appurtenances.

1.02 RELATED WORK SPECIFIED ELSEWHERE

C. 33 11 13 – Ductile Iron Pipe and Fittings

1.03 SUBMITTALS

Complete product data and engineering data, including shop drawings, shall be submitted to the Engineer in accordance with the requirements of Section 01 33 00 of the Contract Documents.

PART 2 PRODUCTS

2.01 GENERAL

A. The manufacturer shall be experienced in the design and manufacture of the specific flow meters and accessories for a minimum of five (5) years.

B. The manufacturer shall provide a minimum two (2) year warranty on materials and construction of the flow meters.

C. This contract is partially funded by the GEFA CWSRF and the equipment manufacturer shall meet the requirements identified in the SRF Supplemental General conditions.

2.02 ELECTROMAGNETIC FLOW METER (MAG METER)

A. Manufacturers: Provide products of one of the following, or approved equal:

1. McCrometer

2. Krohne

B. General
1. The electromagnetic flow meter shall consist of a flow sensor based on Faraday's Law of Electromagnetic Induction and microprocessor-based signal convertor.
2. The sensor and signal convertor shall have a flow range of at least 0.2 feet per second to 32 feet per second.
3. The flow meter shall provide accurate flow readings to within +/- 0.5% of actual flow.
4. The flow meter shall have bi-directional flow capabilities with flow direction indication.
5. Provide Mag Meters of the sizes indicated on the drawings.

C. Sensor
1. The sensor flow tube shall be NEMA 6P or IP68 rated and shall be constructed of 304 stainless steel.
2. The liner shall be a factory applied epoxy coating typically used by the manufacturer and shall carry a lifetime guarantee.
3. Measurement and grounding electrodes shall be 316 stainless steel.
4. Connecting flanges shall be meet the requirements of ANSI B16.1, Class 125. For smaller meters 2" and 3" in diameter, a wafer style connection may be used.
5. Two (2) stainless steel grounding rings shall be supplied with each flow meter.
6. Install the flow meter as shown in the drawings. At minimum, the straight-run distances below should be provided up and downstream of the flow meter to promote laminar flow conditions:
   a. Sizes 4" – 48", provide 1 pipe diameter upstream and 0 pipe diameters downstream
   b. Sizes 2" and 3", provide 3 pipe diameters upstream and 1 pipe diameters downstream.
7. The sensor shall be capable of continual submergence at up to 6 ft.

D. Convertor
1. Signal convertor may be located in a stand-alone enclosure, or in a primary control panel cabinet. See drawings for mounting location.
   a. Stand-alone enclosure shall be NEMA 4X, IP67 rated.
   b. For convertor installation in a primary control cabinet, provide ample signal cable to enable a wired connection without splices.
   c. Power and signal cable between the converter and sensor shall be isolated and placed in separate cables.
2. The converter display shall have an alphanumeric graphical backlit LCD display with touch programming to indicate flow rate, totalized values, settings, and faults.
3. Power supply shall be AC.
4. The convertor shall provide two (2) 4-20 mA outputs and two digital outputs.

2.03 PARSHALL FLUME

A. Manufacturers: Provide products of one of the following, or approved equal:
   1. Plasti-Fab Composite Solutions
   2. Tracom, Inc.
   3. Siemens (ultrasonic level transducer)
   4. ABB (ultrasonic level transducer)
   5. Automation Products Group, Inc. (ultrasonic level transducer)

B. General
   1. The Parshall Flume assembly shall be an insert type to be cast in concrete or grout and provided with an ultrasonic level sensor for online flow metering and data logging.
   2. Provide Parshall Flumes in the sizes indicated on the drawings.

C. Flume
   1. Flume shall be dimensioned and shaped according to Dr. Ralph L. Parshall's design and shall conform to the physical dimensions listed in Figure 19 of the U.S. Department of Interior, Water Measurement Manual, latest edition. Dimensional tolerances for 1",2", and 3" Parshall flumes shall be plus or minus 1/16" (1.6mm) maximum in the throat, and plus or minus 1/8" (3mm) maximum elsewhere. Dimensional tolerances for all other sizes shall be plus or minus 1/8" (3mm) maximum in the throat, and plus or minus 1/4" (6mm) maximum elsewhere.
   2. The flume body shall be constructed of engineered composite fiberglass reinforced plastic (FRP), moled in one piece to create a seamless corrosion barrier impervious to moisture. The material shall meet the following minimum properties:
      a. Tensile strength 15,000 psi (1034 ksc)
      b. Flexural Modulus 1,000,000 psi (70307 ksc)
      c. Flexural Strength 20,000 psi (1406 ksc)
      d. Compressive Strength 22,000 psi (1547 ksc)
      e. Impact Strength 9.0 ft-lbs/in. (1.24 kgf.m/25mm)
      f. Water absorption 0.13% (in 24 hours)
   3. All hardware shall be 316 stainless steel.
   4. Flume inside surface shall be smooth, isophthalic gelcoat of 10 - 20 mil (0.25 - 0.51mm) thickness for UV resistance.
   5. The surface shall be free of exposed reinforcing fibers.
   6. The minimum glass content shall be 30% exclusive of gelcoat surfaces.
   7. The flume shall be reinforced with box section stiffeners down the sides and across the bottom. The stiffeners shall be joined at the knee to form a rigid dimensionally stable flume.
   8. Reinforcing shall be designed to provide structural support throughout the length and width of the flume floor.
   9. 60" and Larger Parshall Flume body hall have 2" x 3" steel tube laminated to the bottom of the flume to provide additional stiffening for the floor. The steel tubing on the inlet and outlet end of the flume shall extend 3" beyond the side of the flume to assist the contractor in placement, leveling and tie-down of the flume during installation.

10. Flume shall be structurally designed to maintain dimensional integrity with a full head of water while being free standing.
11. Flume shall have a molded-in head gage with dual graduation in inches and gpm.
12. Stiffeners across the top shall be permanent FRP pultruded angle/channel or temporary wood spreaders as required for the job, and shall provide sufficient strength and structural support to resist the stresses that occur during shipping and proper installation of the flume.

D. Ultrasonic Level Transducer and Controller
1. The Flume shall be provided with an adjustable stainless steel ultrasonic mounting bracket, ultrasonic level transducer, and controller.
2. Ultrasonic Level Transducer
   a. The ultrasonic level transducer shall provide reliable, continuous non-contact level monitoring of the effluent flowing through the Flume.
   b. The transducer shall be IP68 rated and fully submersible.
   c. The transducer shall have a measuring range of at least 1 to 26 feet.
   d. The transducer shall be the Siemens Echomax XRS-5, or approved equal.
3. Controller
   a. The controller shall be manufactured by the manufacturer of the ultrasonic level transducer and shall be compatible with the transducer.
   b. The controller shall be contained in an enclosure rated for exposed service, meeting IP67 or NEMA 4X
   c. The controller shall be suitable for continuous open channel flow measurement with data logging capabilities.
   d. Communication outputs shall be compatible with 4-20 mA analog instrumentation.
   e. The controller shall be the Siemens Sitrans LUT430, or approved equal.

PART 3 EXECUTION

3.01 INSTALLATION

A. Follow manufacturer's installation recommendations.
B. For Parshall Flume installation, the top spreaders shall be left on the flume until after installation is complete. They may be removed after the grout has cured if desired.
1. The flume shall be installed level end-to-end and side-to-side, and must remain level throughout installation. Flume assembly should be set into a pre-poured block-out / channel.

2. The contractor shall provide sufficient shoring and bracing of the floor and sidewalls to prevent lifting, floating, buckling or bulging of the sides and bottom during installation. The side locking clips are not intended to be used as anchorage points. Their function is to key the flume into the grout or concrete.
3. Concrete shall be poured in successive lifts of not more than 6" - 8"(152-203mm) per lift. Extra care shall be exercised during the first pour to insure that grout flows smoothly under the floor, and an even fill is achieved. The first lift shall be allowed to set so that excessive hydraulic forces are not transferred to the bottom of the flume by later lifts.

3.02 FIELD TESTING

A. Tests and Calibration

1. Calibrate each instrument to its published accuracy. Submit calibration sheets including the instrument tag number or name, the date, name of individual performing calibration, procedures and equipment used, and results obtained.

END OF SECTION

SECTION 41 22 00

CRANES AND HOISTS

PART 1 GENERAL

1.01 SCOPE

Furnish all materials, labor, equipment, and incidentals to properly install all hoist systems at the locations shown on the plans or as directed by the Engineer for the proper completion of the work included under this contract whether shown expressly on the plans or implied by other requirements.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. 00 00 00 - XX

1.03 SUBMITTALS

Complete product data and engineering data, including shop drawings, shall be submitted to the Engineer in accordance with the requirements of Section 01 33 00 of the Contract Documents.

PART 2 PRODUCTS

2.01 GENERAL

A. Manufacturer shall have a minimum of five years of experience producing substantially similar equipment and able to provide documentation of at least five installations in satisfactory operation in the United States.

B. Equipment shall be manufactured in the United States.

C. All equipment included in this Section shall be obtained from a single supplier, regardless of the manufacturer of individual components.

D. Materials and equipment shall come with a one (1) year manufacturer's warranty against defective equipment and materials. The warranty period shall begin at Substantial Completion.

E. This contract is partially funded by the GEFA CWSRF and the equipment manufacturer shall meet the requirements identified in the SRF Supplemental General conditions.

2.02 DAVIT CRANES

A. Davit cranes shall provide the required lift height and capacity as specified herein, and shall include the appropriate mounting hardware as specified for each installation.

B. Manufacturers: Provide products of one of the following, or approved equal:
   1. Thern
   2. EME

C. Construction
   1. The frame shall be constructed of structural steel pipe and tubing with factory welds. Field welding on the Davit Crane will not be allowed.
   2. Design of the Davit Crane shall permit 360° rotation under load and adjustable boom angles.
   3. Provide a winch as indicated in the Schedule. Winches shall be capable of handling the design load with a controlled ascent and decent. Winches shall have ample capacity for the specified length of wire rope. Winches shall be designed for exposed service.
      a. Manual winches shall be or the spur gear or worm gear type. Worm gear winches shall have the capability of being operated with a hand drill.
      b. Wire rope shall be ¼" 304 stainless steel at an appropriate length for lifting equipment.
      c. Wire rope shall be supplied with a factory installed swivel hook and latch complete with swaged-ball fitting to work with a quick disconnect anchor on the winch.
   4. Portable Davit Cranes shall not exceed a weight of 125 lbs and shall have quick disconnect components for quick disassembly and reassembly.

D. Coatings/Finishings
   1. Surface preparation and shop painting is required for ferrous metals, equipment, and accessories. Do not paint stainless steel and machined surfaces.
   2. Apply manufacturer's standard factory finish in accordance with 09 90 00 Painting and Coating or equivalent industry standards.
   3. Gears, bearing surfaces, and other machined surfaces shall receive a heavy application of rust-inhibiting coating that shall be maintained during storage and until equipment is placed into operation.

E. Davit Crane Schedule

Install Location	Mounting Type	Capacity @ Distance From Base	Winch Type	Model #
Staged Reactor	Portable w/ (2) flush mount bases	250 lbs @ 5'	Manual – Spur gear	Thern 5PT5-M1 5BF5 WS25-36NS
RAS Pump Station	Stationary	500 lbs @ 9'	Manual - Worm gear w/ drill drivable	Thern 5FT25-M2

			capability	

PART 3 EXECUTION

3.01 DELIVERY, STORAGE, AND HANDLING

A. Packing, Shipping, Handling, and Unloading

1. Deliver materials and equipment to site to ensure uninterrupted progress of the Work. Deliver anchorage materials to be embedded in concrete in ample time to prevent delaying the Work.
2. Inspect all boxes, crates, and packages upon delivery to Site and notify Engineer in writing of loss or damage to materials or equipment. Promptly remedy loss and damage to new condition in accordance with manufacturer's instructions.

B. Storage and Protection

1. Keep materials and equipment off ground using pallets, platforms, or other supports. Protect steel, packaged materials, motors, and electronics from corrosion and deterioration.

3.02 INSTALLATION

A. Examine conditions under which materials and equipment are to be installed and notify Engineer in writing of conditions detrimental to proper and timely completion of the Work. Do not proceed with the Work until unsatisfactory conditions have been corrected.

B. Install materials and equipment in conformance with applicable standards, manufacturer's instructions and recommendations, and the Contract Documents.

3.03 FIELD TESTING

A. After installing equipment, perform tests for hoisting pumps and other equipment at install location in presence of Owner or Engineer. Should testing indicate malfunction, make repairs and adjustments as required. Repeat testing and adjusting until, in Engineer's opinion, installation is complete and equipment is functioning properly and accurately, and is Substantially Complete.

END OF SECTION

SECTION 43 40 00

LIQUID STORAGE TANKS

PART 1 GENERAL

1.01 SCOPE

Furnish all materials, labor, and equipment to properly install a chemical storage tank and related accessories at the locations shown on the plans or as directed by the Engineer for the proper completion of the work included under this contract whether shown expressly on the plans or implied by other requirements.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. 46 33 00 – Liquid Chemical Feed Equipment

1.03 SUBMITTALS

Complete product data and engineering data, including shop drawings, shall be submitted to the Engineer in accordance with the requirements of Section 01 33 00 of the Contract Documents.

PART 2 PRODUCTS

2.01 DOUBLE WALL STORAGE TANK

A. Manufacturers: Provide products of one of the following, or approved equal:
   1. Poly Processing

B. General
   1. Provide a double-walled chemical storage tank with suitable for the following requirements:
      a. Storage volume 3,900 gallons
      b. Stored chemical Magnesium Hydroxide – $Mg(OH)_2$
   2. Manufacturer shall provide a five (5) year warranty to cover parts and labor for defects in material and workmanship.

C. Construction
   1. The tank shall be furnished with appropriate connection fittings as recommended by the manufacturer or shown on the drawings.
   2. The tank shall be furnished with a reverse float level gauge for identifying liquid level inside the tank.
   3. The tank shall include a manway for access to the inside of the tank as well

as other inlets and outlets shown on the drawings.

4. Tank shall be furnished with tie-down assemblies for securing the tank to mounting surface.
5. Construct tank and all appurtenant features using materials that are highly resistant to the chemical including cross-linked, high density polyethylene, frp, polyvinyl chloride (pvc), viton elastomerics, and titanium hardware. Other materials of construction for certain tank components will be acceptable as long as they are highly resistant to the chemical. For all wetted components of the tank, only use materials that comply with ANSI/NSF 61. In addition, the tank shall be suitable for exterior installation and shall not degrade exposure to sunlight.

PART 3 EXECUTION

3.01 DELIVERY, STORAGE, AND HANDLING

A. Store tank in a manner to prevent damage from construction activities. Store in the intended mounting position to prevent warping of deformation of materials.

3.02 INSTALLATION

A. Install the tank as shown in the drawings. Secure in place per manufacturer recommendations to prevent accidental movement.

B. When possible, all penetrations and connections shall be made and tested in the factory. Field connections shall be made according to manufacturer recommendations.

3.03 FIELD TESTING

A. Following installation, the tank and all associated connections shall be inspected for leaks by filling the tank with potable water. Any leaks shall be repaired prior to filling with the designated chemical.

B. Ensure that all level gauges function properly and adjust or calibrate as needed.

END OF SECTION

SECTION 43 41 63

PRECAST CONCRETE TANKS

PART 1 GENERAL

1.01 SCOPE

Furnish all materials, labor, and equipment to properly install precast post-tensioned concrete tanks and related accessories at the locations shown on the plans or as directed by the Engineer for the proper completion of the work included under this contract whether shown expressly on the plans or implied by other requirements. Work for this Section includes the **Staged Reactor** rectangular structure and **Aerobic Digestor** circular structure.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. 31 20 00 – Earth Moving
B. 03 31 00 – Cast-in-Place Concrete
C. 05 52 00 – Aluminum Railings
D. 05 53 00 – Aluminum Bar Gratings

1.03 SUBMITTALS

Complete product data and engineering data, including shop drawings, shall be submitted to the Engineer in accordance with the requirements of Section 01 33 00 of the Contract Documents.

A. Action Submittals
   1. Product Data: For each type of product indicated. Material test reports shall show compliance with the required standards and be less than one year old.
   2. Design Mixtures: For each concrete mixture. Include minimum required compressive strength and field experience records or trial mix data.
   3. Shop (Erection) Drawings:
      a. Indicate configuration, thickness, dimensions and details of cast-in-place concrete base slab.
      b. Indicate size, spacing and details of all necessary base slab reinforcing.
      c. Indicate plan views, elevations, sections, and details necessary to install the tank.
      d. Indicate locations of all post-tensioned tendons.
      e. Indicate tendon stressing sequence and force, and theoretical elongations for all post-tensioned tendons.
      f. Include and locate all pipe penetrations. Indicate all penetration styles.

g. Coordinate and indicate openings required by other trades.
h. Indicate location of each precast concrete member by same identification mark placed on unit.
i. Indicate relationship of structural precast concrete members to adjacent materials.
j. Indicate locations and details of joint treatment.
k. Indicate shim sizes and grout requirements.
l. Indicate bearing pad sizes and materials.

4. Comprehensive engineering design signed and sealed by a qualified professional engineer responsible for its preparation licensed in the state of Georgia.

B. Informational Submittals

1. Qualification Data: For Tank Supplier and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include list of completed projects with project names and addresses, names and addresses of engineers and owners, and other information specified.
2. Material Certificates: Signed by manufacturers certifying that each of the following items complies with requirements.
   a. Cementitious materials.
   b. Aggregates.
   c. Reinforcing materials and post-tensioning strands.
   d. Post-tensioning duct and anchorages.
   e. Admixtures.
   f. Bearing pads.
   g. Other components specified in Contract Documents with applicable standards.
3. Provide handling procedures, erection sequences, and temporary bracing as required for special conditions.
4. Field quality-control test reports.

1.04 PERFORMANCE REQUIREMENTS

A. Structural Performance for **Staged Reactor**: Provide rectangular precast post-tensioned concrete tanks capable of withstanding the following design loads within limits and under conditions indicated:

1. Internal Fluid Loads: **65 pcf**
2. Superimposed Dead Loads: **75 lbs per horizontal foot for attached piping**
3. Live Loads: **40 psf**
4. Roof Loads: **None**
5. Basic Ground Snow Load: **None**
6. Backfill Loads:
   a. Unit Weight: **115 pcf**
   b. At Rest Earth Pressure Coefficient against Tank Walls: **0.45**
7. Surcharge Loads: **770 psf**
8. Design Groundwater Elevation: **160 ft**

9. Design Flood Elevation: **134 ft**
10. Seismic Loads:
    a. Importance Factor: **1.25**
    b. Risk Category: **III**
    c. Soil Site Classification: **D**
    d. Mapped Spectral Response Coefficients:
        1) Ss: **0.288**
        2) S1: **0.107**
11. Special Loading Considerations: Design moment at davit crane mounting base = 1250 lb-ft

B. Structural Performance for **Aerobic Digestor**: Provide circular precast post-tensioned concrete tanks capable of withstanding the following design loads within limits and under conditions indicated:
1. Internal Fluid Loads: **65 pcf**
2. Superimposed Dead Loads: **None**
3. Live Loads: **40 psf**
4. Roof Loads: **None**
5. Basic Ground Snow Load: **None**
6. Backfill Loads:
    a. Unit Weight: **110 pcf**
    b. At Rest Earth Pressure Coefficient against Tank Walls: **0.45**
7. Surcharge Loads: **770 psf**
8. Design Groundwater Elevation: **143 ft**
9. Design Flood Elevation: **134 ft**
10. Seismic Loads:
    a. Importance Factor: **1.25**
    b. Risk Category: **III**
    c. Soil Site Classification: **D**
    d. Mapped Spectral Response Coefficients:
        1) Ss: **0.288**
        2) S1: **0.107**
11. Special Loading Considerations: The structure wall shall be capable of withstanding loading from the aluminum staircase and landing as shown on the Construction Drawings. Design horizontal point load = 270 lb. Design vertical point load = 430 lbs.

C. General Tank Design Criteria
1. Wall thickness shall be as required by ACI 350.
2. Backfill shall not be used to offset fluid loads.
3. Comply with ACI 350 requirements including, but not limited to:
    a. Load factors.
    b. Limits on stresses at transfer of prestress and under service load.
    c. Minimum bonded reinforcement.
    d. Concrete cover over reinforcement.
4. The tank walls shall be prestressed in accordance with ACI 350.
    a. Tank walls shall have horizontal post-tensioned tendons to provide residual compression stress.

b. Minimum residual compression shall be 125 psi after allowance for all prestress losses.

5. The tank structure shall be designed to resist low to medium strength residential wastewater.
6. The tank structure shall be designed for normal environmental exposure.
7. Design precast post-tensioned concrete tanks to allow for fabrication and construction tolerances, and to accommodate deflection, shrinkage and creep of primary tank structure. Maintain structural precast concrete deflections within limits of ACI 350.

D. Base Slab Design Criteria for **Staged Reactor**

1. Design the base slab to resist all imposed loads within the allowable bearing capacity listed below.
   a. Allowable Bearing Capacity: **1,500 psf**
   b. Subgrade Modulus: **75 pci**
   c. Refer to Geotechnical Engineering Report by Whitaker Laboratory, Inc. dated June 25, 2021 for additional foundation design recommendations.
2. Minimum reinforcement in each orthogonal direction shall be in accordance with ACI 350.
3. Frost depth: **5 inches**

E. Base Slab Design Criteria for **Aerobic Digestor**

1. Design the base slab to resist all imposed loads within the allowable bearing capacity listed below.
   a. Allowable Bearing Capacity: **2,000 psf**
   b. Subgrade Modulus: **150 pci**
   c. Refer to Geotechnical Engineering Report by Whitaker Laboratory, Inc. dated June 25, 2021 for additional foundation design recommendations.
2. Minimum reinforcement in each orthogonal direction shall be in accordance with ACI 350.
3. Frost depth: **5 inches**

1.05 QUALITY ASSURANCE

A. Tank Supplier Qualifications: A firm that complies with the following requirements and is experienced in producing precast post-tensioned concrete tanks that have a record of successful in-service performance.

1. Assumes responsibility for engineering precast post-tensioned concrete tanks to comply with performance requirements. This responsibility includes preparation of Shop Drawings and comprehensive engineering analysis by a qualified professional engineer.
2. Precast Tank Engineer Qualifications: A professional engineer licensed in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for designs and installations of precast post-tensioned concrete tanks.

3. Participates in PCI's Plant Certification program and is designated a PCI-certified plant for Group C, Category C3.
    a. Certification shall be maintained throughout the production of the precast concrete units. Production shall immediately stop if at any time the fabricator's certification is revoked, regardless of the status of completion of contracted work. Production will not be allowed to re-start until the necessary corrections are made and certification has been re-established. In the event certification cannot be re-established in a timely manner to avoid project delays, the fabricator, at no additional cost, will contract out the remainder of the units to be manufactured at a PCI certified plant.
4. Has sufficient production capacity to produce required members to meet the project schedule.
5. The firm shall have a minimum of 15 consecutive years in designing, producing and installing tanks of similar arrangement, size and complexity using the precast post-tensioned concrete system.
6. The firm shall document the successful installation and performance of a minimum of ten similar facilities and certify compliance of those structures with all applicable provisions of ACI 350 for a precast post-tensioned concrete structure.
7. The firm shall employ a full-time engineer on staff who meets the Precast Tank Engineer Qualifications listed above and who has served as the engineer in responsible charge of at least ten similar structures.
8. The firm shall submit with its bid a summary sheet documenting compliance with these qualifications.
9. The firm shall submit with its bid a reference sheet listing contact names and telephone numbers of at least five similar structures built by the firm.

B. Post-Tensioning Manufacturer Qualifications: Fabricating plant certified by PTI according to procedures set forth in PTI's "Manual for Certification of Plants Producing Unbonded Single Strand Tendons."

C. Post-Tensioning Installer Qualifications: A qualified installer whose full-time Project superintendent has successfully completed PTI's Level 1 Unbonded PT - Field Installation and/or PTI's Level 1 Bonded PT – Field Installation course, as applicable.
    1. Superintendent must receive training from post-tensioning supplier in the operation of stressing equipment to be used on Project.

D. Post-Tensioning Inspector Qualifications: Personnel performing field inspections and measuring elongations shall have successfully completed PTI's Level 2 Unbonded PT – Inspector and/or PTI's Level 1 Bonded PT – Field Installation course, as applicable.

E. Design Standards: Comply with ACI 350, "Code Requirements for Environmental Concrete Structures" and the design recommendations of PCI MNL 120, "PCI Design Handbook – Precast and Prestressed Concrete," applicable to types of structural precast concrete members indicated.

F. Quality-Control Standard: For manufacturing procedures and testing requirements and quality control recommendations for types of members required, comply with

PCI MNL 116, "Manual for Quality Control for Plants and Production of Structural Concrete Products."

1. Comply with dimensional tolerances of PCI MNL 135, "Tolerance Manual for Precast and Prestressed Concrete Construction."

G. Plant Quality Control Manager Qualifications: The plant quality control manager shall be currently certified as a PCI Level 2 Plant Quality Control Technician.

H. Plant Manager Qualifications: The plant manager shall be currently certified as a PCI Level 2 Plant Quality Control Technician.

PART 2 PRODUCTS

2.01 GENERAL

A. Tank designs that rely on bolted or welded connections, or ship-lap joints, for primary, fluid-retaining walls shall not be allowed.

B. Shotcrete shall not be allowed.

C. Manufacturers: Provide products of one of the following, or approved equal:

1. Dutchland

2.02 FORM MATERIALS

A. Forms: Rigid, dimensionally stable, nonabsorptive material, warp and buckle free, that will provide precast concrete surfaces within fabrication tolerances indicated; nonreactive with concrete and suitable for producing required surface finishes.

1. Form-Release Agent: Commercially produced form-release agent that will not bond with, stain or affect hardening of precast concrete surfaces and will not impair subsequent surface or joint treatments of precast concrete.

2.03 NON-PRESTRESSED REINFORCING STEEL

A. Reinforcing Bars: ASTM A 615, Grade 60, deformed.

B. Low-Alloy-Steel Reinforcing Bars: ASTM A 706, deformed.

C. Welded Wire Reinforcement: ASTM A 1064, plain or deformed, flat sheet.

D. Supports: Use bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place according to PCI MNL 116.

2.04 BONDED PRESTRESSING TENDONS

A. Bonded Prestressing Strand: ASTM A 416, Grade 270, 7-wire, low-relaxation, 0.6-inch-diameter strand.

B. Anchorage Device and Coupler Assembly: Assembly of strand, wedges, and anchorage device or coupler complying with static and fatigue testing requirements and capable of developing 95 percent of actual breaking strength of strand.

2.05 UNBONDED PRESTRESSING TENDONS

A. ACI Publications: Comply with ACI 423.7, "Specification for Unbonded Single Strand Tendon Materials and Commentary."

B. Prestressing Strand: ASTM A 416, Grade 270, 7-wire, low-relaxation, 0.6-inch-diameter strand with corrosion inhibitor conforming to ACI 423.7, with polypropylene tendon sheathing.

C. Post-Tensioning Coating: Compound with friction-reducing, moisture-displacing, and corrosion-inhibiting properties; chemically stable and nonreactive with prestressing steel, non-prestressed reinforcement, sheathing material, and concrete.

D. Tendon Sheathing:
   1. Virgin high-density polyethylene or polypropylene with a minimum thickness of 50 mils.
   2. Continuous over the length of tendon to provide watertight encapsulation of strand.

E. Anchorage Device and Coupler Assembly: Assembly of strand, wedges, and anchorage device or coupler complying with static and fatigue testing requirements and capable of developing 95 percent of actual breaking strength of strand.
   1. Anchorage devices and coupler assemblies shall be fully encapsulated with either plastic or epoxy coating.

F. Encapsulation System: Watertight encapsulation of prestressing strand consisting of the following:
   1. Wedge-Cavity Caps: Attached to anchorages with a positive mechanical connection and filled with post-tensioning coating.
   2. Sleeves: Attached to anchorage device with positive mechanical connection; overlapped a minimum of 4 inches with sheathing and filled with post-tensioning coating.
   3. The encapsulation system shall meet the hydrostatic pressure testing requirements of ACI 423.7, except with a hydrostatic pressure of 10 psi, instead of the specified 1.25 psi.

2.06 ACCESSORIES

A. Sheathing Repair Tape: Elastic, self-adhesive, moisture-proof tape with minimum width of 2 inches (50 mm), in contrasting color to tendon sheathing; nonreactive with sheathing, coating, or prestressing steel.

B. Duct: Flexible, corrugated, high-density polyethylene.

2.07 CONCRETE MATERIALS

A. Hydraulic Cement:
   1. Portland Cement: ASTM C 150, Type II or Type I/II.
   2. Blended Cement: ASTM C 595 with (MS) designation for moderate sulfate resistance, excluding Type IS ≥70). Blended cements that include ASTM C 1157 cements shall not be permitted.

3. Concrete mixtures shall include either fly ash or slag as shown below, but within the limits stipulated in 2.13.A, unless the proposed combination of cementitious materials has been tested in accordance with ASTM C 1012 and resulted in expansion of not more than 0.10 percent at 6 months.
    a. At least 15 percent fly ash replacement by mass, or
    b. At least 50 percent slag replacement by mass.
4. Different types of cement shall not be mixed or used alternately without specific written approval by the Precast Tank Engineer. Different brands of cement may be used when authorized in writing by the Precast Tank Engineer. A resubmittal will be required if different brands are proposed during the Project.

B. Supplementary Cementitious Materials
1. Fly Ash: ASTM C 618, Class F with alkali content (%Na2Oeq) less than 3.0%.
2. Slag: ASTM C 989, Grade 100 or 120, ground granulated blast furnace slag.
3. Silica Fume: ASTM C 1240.

C. Fine and Coarse Aggregates: ASTM C33, 3/4-inch maximum size.
1. All aggregates shall be evaluated in accordance with ASTM C 1778 for potential alkali-silica reactivity (ASR). All aggregates shall be considered reactive unless they have been examined in accordance with ASTM C 295 and found to be non-reactive.
2. Concrete mixtures using potentially reactive aggregates, except as permitted by 2.3.C.c, shall include either fly ash or slag as shown below, but within the limits stipulated in 2.4.C.
    a. At least 25 percent fly ash replacement by mass where Portland cement alkali content is less than 1.00%, or at least 35 percent fly ash replacement by mass where Portland cement alkali content is 1.00 to 1.25%, or
    b. At least 50 percent slag replacement by mass where Portland cement alkali content is less than 1.00%, or at least 65 percent slag replacement by mass where Portland cement alkali content is 1.00% to 1.25%.
    c. Portland cement alkali loading shall not exceed 3.0 lb/yd3 (LBA). Alkali loading shall be calculated as shown below:
        1) LBA = Portland cement content (lbs) x alkali content (% Na2Oeq) / 100.
3. Aggregates meeting the requirements below may be considered non-reactive.
    a. ASTM C 1260, Potential Alkali Reactivity of Aggregates (Mortar-Bar Method). Average expansion of less than 0.10 percent at 16 days after casting.
    b. ASTM C 1567, Potential Alkali-Silica Reactivity of Combinations of Cementitious Materials and Aggregates (Accelerated Mortar-Bar Method). Average expansion of less than 0.10 percent at 16 days after casting.
4. Stockpile fine and coarse aggregates for each type of exposed finish from a

single source (pit or quarry) for Project.

D. Water: Potable; free from deleterious material that may affect color stability, setting, or strength of concrete and complying with chemical limits of PCI MNL 116.

E. Air Entraining Admixture: ASTM C 260, certified by manufacturer to be compatible with other required admixtures.

F. Chemical Admixtures: Certified by manufacturer to be compatible with other admixtures and to not contain calcium chloride or more than 0.15 percent chloride ions or other salts by weight of admixture.
   1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
   2. Retarding Admixture: ASTM C 494/C 494M, Type B.
   3. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
   4. Water-Reducing and Accelerating Admixture ASTM C494/C 494M, Type E.
   5. High Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type A and F.
   6. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.
   7. Plasticizing Admixture for Flowable Concrete: ASTM C 1017/C 1017M.

2.08 STEEL EMBEDDED MATERIALS

A. Carbon-Steel Shapes and Plates: ASTM A 36/A 36M

B. Carbon-Steel Headed Studs: ASTM A 108, Grades 1010 through 1020, cold finished, AWS D1.1/D1.1M, Type A or B, with arc shields and with the minimum mechanical properties of PCI MNL 116, Table 3.2.3.

C. Deformed-Steel Wire or Bar Anchors: ASTM A 1064 or ASTM A 706/A 706M.

D. Zinc-Coated Finish: For exterior steel items and items indicated for galvanizing, apply zinc coating by hot-dip process according to ASTM A 123, after fabrication.
   1. Galvanizing Repair Paint: Zinc paint with dry film containing not less than 94 percent zinc dust by weight and complying with DOD-P-21035B or SSPC-Paint 20.

2.09 STAINLESS-STEEL EMBEDDED MATERIALS

A. Stainless-Steel Plate: ASTM A 666, Type 304, Type 316, or Type 201, of grade suitable for application.

B. Stainless-Steel Bolts and Studs: ASTM F 593, alloy 304 or 316, hex-head bolts and studs; stainless-steel nuts; and flat, stainless-steel washers.

C. Stainless-Steel Headed Studs: ASTM A 276, with minimum mechanical properties for studs as indicated under MNL 116, Table 3.2.3.

2.10 BEARING PADS AND OTHER ACCESSORIES

A. Provide one of the following bearing pads for structural precast concrete members as recommended by tank supplier for application:

1. Elastomeric Pads: AASHTO M 251, plain, vulcanized, 100 percent polychloroprene (neoprene) elastomer, molded to size or cut from a molded sheet, 50 to 70 Shore A durometer according to ASTM D 2240, minimum tensile strength 2250 psi per ASTM D 412.
2. Random-Oriented, Fiber-Reinforced Elastomeric Pads: Preformed, randomly oriented synthetic fibers set in elastomer. Surface hardness of 70 to 90 Shore A durometer according to ASTM D2240. Capable of supporting a compressive stress of 3000 psi with no cracking, splitting or delaminating in the internal portions of the pad.
3. High-Density Plastic: Multimonomer, nonleaching, plastic strip capable of supporting loads with no visible overall expansion.

B. Erection Accessories: Provide steel plates and brackets, clips, hangers, high density plastic shims, and other accessories required to install precast concrete members.

2.11 GROUT MATERIALS

A. Grout for Bonded Tendons: Provide cement grout for bonded tendons as indicated below:
1. Maximum Water-Cementitious Materials Ratio: 0.43
2. Limit use of fly ash to 15 percent replacement of portland cement by weight.
3. Limit use of slag to 20 percent replacement of portland cement by weight.
4. Add High-Range, Water-Reducing admixture on-site as necessary for placement.
5. Provide admixtures to prevent bleeding and grout settlement. Material shall be added to the mix on-site.
6. Acceptable Products: Sika Intraplast-N®, or equal.
7. Grout shall not contain water-soluble chloride ions in excess of 0.06 percent by weight of cementitious materials.

B. Nonshrink Grout: Premixed, prepackaged, non-metallic, shrink-resistant grout complying with ASTM C 1107, Grade C. Grout shall not contain chlorides.
1. Acceptable Products:
a. SikaGrout 212®, or equal.
b. SikaGrout 328®, or equal.

2.12 PATCHING MATERIALS

A. One-component, polymer-modified, premixed patching material containing selected silica aggregates and portland cement, suitable for vertical and overhead applications. Do not use material containing chlorides or other chemicals known to be deleterious to prestressing steel or material that is reactive with prestressing steel, anchorage device material, or concrete.
1. Acceptable Products:
a. ProSpec® BlendCrete, or equal.

2.13 CONCRETE MIXTURES

A. Prepare design mixtures for each type of concrete required.

1. The inclusion of either fly ash or slag in the concrete mix is mandatory.
2. Where fly ash is used:
    a. The minimum fly ash content shall be 15 percent replacement of cementitious material by weight, and the maximum content shall be 35%.
    b. Additional fly ash shall not be included in concrete mixed with Type IS or IP cement.
3. Where slag is used:
    a. The minimum slag content shall be 15 percent replacement of cementitious material by weight, and the maximum content shall be 65%.
    b. Additional slag shall not be included in concrete mixed with Type IS or IP cement.
4. The inclusion of both fly ash and slag shall not be permitted without specific written approval by the Precast Tank Engineer.
5. Limit water-soluble chloride ions to maximum percentage by weight of cement permitted by ACI 350 when tested in accordance with ASTM C 1218.
6. Limit use of silica fume to 10 percent replacement of Portland cement by weight.

B. Design mixtures may be prepared by a qualified independent testing agency or by qualified precast plant personnel at Tank Supplier's option.

C. Limit water-soluble chloride ions to maximum percentage by weight of cement permitted by ACI 350 or PCI MNL 116 when tested in accordance with ASTM C 1218/C 1218M.

D. Normal-weight Concrete Mixtures: Proportion mixtures by either laboratory trial batch or field test data methods according to ACI 211.1, with materials to be used on Project, to provide normal-weight concrete.

E. Furnish precast concrete as indicated below:
1. Compressive Strength (28 Days): 5,000 psi minimum.
2. Maximum Water-Cementitious Materials Ratio: 0.40.
3. Slump Flow: 24 inches, ±4 inches
4. Minimum cementitious content: 610 pounds per cubic yard

F. Self-Consolidating Cast-in-Place Concrete for Vertical Wall Joints:
1. Compressive Strength (28 Days): 5,000 psi minimum.
2. Maximum Water-Cementitious Materials Ratio: 0.40.
3. Provide High-Range, Water-Reducing, polycarboxylate-based admixture to achieve a spread of 18 to 24 inches.

G. Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having an air content of 6%, ±1-1/2%.

H. When included in design mixtures, add other admixtures to concrete mixtures according to manufacturer's written instructions.

I. Concrete Mixture Adjustments: Concrete mixture design adjustments may be made if characteristics of materials, Project conditions, weather, test results, or other circumstances warrant.

2.14 FORM FABRICATION

A. Form: Accurately construct forms, mortar tight, of sufficient strength to withstand pressures due to concrete placement and vibration operations and temperature changes, and for prestressing and detensioning operations. Coat contact surfaces of forms with release agent before reinforcement is placed. Avoid contamination of reinforcement and prestressing tendons by release agent.

B. Maintain forms to provide completed structural precast concrete members of shapes, lines, and dimensions within fabrication tolerances specified.

1. Edge and Corner Treatment: Uniformly chamfered or as built-in on standard forms.

2.15 FABRICATION

A. Cast-in Plates, Inserts, Angles, and Other Hardware: Fabricate hardware with sufficient anchorage and embedment to comply with design requirements. Accurately position for attachment of loose hardware and secure in place during precasting operations. Locate hardware where it does not affect position of main reinforcement or concrete placement.

1. Weld headed studs and deformed bar anchors used for anchorage according to AWS D1.1/D1.1M and AWS C5.4, "Recommended Practices for Stud Welding."

B. Reinforcement: Comply with recommendations in PCI MNL 116 for fabricating, placing, and supporting reinforcement.

1. Clean reinforcement of loose rust and mill scale, earth, and other materials that reduce or destroy the bond with concrete. When damage to epoxy coated reinforcing exceeds limits specified in ASTM A 775, repair with patching material compatible with coating material and epoxy coat bar ends after cutting.
2. Accurately position, support, and secure reinforcement against displacement during concrete-placement and consolidation operations. Locate and support reinforcement by plastic tipped or corrosion resistant metal or plastic chairs, runners, bolsters, spacers, hangers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place according to PCI MNL 116.
3. Provide cover requirements in accordance with ACI 350. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position while placing concrete.
4. Install welded wire reinforcement in lengths as long as practicable. Lap adjoining pieces in accordance with ACI 350 and wire tie laps, where required by design. Offset laps of adjoining widths to prevent continuous laps in either direction.

C. Reinforce structural precast concrete members to resist handling, transportation, and erection stresses, and specified in-place loads, whichever governs.

D. Comply with requirements in PCI MNL 116 and in this Section for measuring, mixing, transporting, and placing concrete. After concrete batching, no additional water may be added.

E. Place concrete in a continuous operation to prevent cold joints or planes of weakness from forming in precast concrete members.

F. Place self-consolidating concrete with minimal vibration without dislocating or damaging reinforcement and built-in items, and minimize pour lines, honeycombing or entrapped air voids on surfaces. Use equipment and procedures complying with PCI MNL 116.

G. Comply with PCI MNL 116 procedures for hot and cold-weather concrete placement.

H. Identify pickup points of precast concrete members and orientation in structure with permanent markings, complying with markings indicated on Shop Drawings. Imprint or permanently mark casting date on each precast concrete member on a surface that will not show in finished structure.

I. Cure concrete, according to requirements in PCI MNL 116, by moisture retention without heat or by accelerated heat curing using live steam or radiant heat and moisture. Cure members until compressive strength is high enough to ensure that stripping does not have an effect on the performance of final product.

2.16 WATERSTOPS

A. Flexible PVC Waterstops: Corp of Engineers CRD-C 572 for embedding in concrete construction joints to prevent the passage of fluids through joints. Factory-fabricate corners, intersections and directional changes.
   1. Profile: Ribbed without center bulb.
   2. Dimensions: 9 inches by 3/8-inch-thick, non-tapered.
   3. Acceptable Products:
      a. Greenstreak PVC Waterstop #646, or equal.

B. Self-Expanding Rubber Strip Waterstops: Manufactured rectangular or trapezoidal strip, bentonite-free, hydrophilic polymer modified chloroprene rubber, for adhesive bonding to concrete.
   1. Acceptable Products:
      a. Greenstreak Hydrotite® CJ-1030-4M, or equal.

C. Self-Expanding Extrudable Waterstops: Extrudable, swelling, bentonite-free, one-part polyurethane.
   1. Acceptable Products:
      a. SikaSwell® S-2, or equal

2.17 RELATED MATERIALS

A. Joint/Crack Filler: ASTM C 920, Type S, Grade NS, Class 35 one-part polyurethane, elastomeric sealant, for sealing precast panel joints and minor cracks.
   1. Acceptable Products:
      a. Sikaflex®-1a, or equal

B. Sealant/Adhesive Primer: Specially formulated primer to promote adhesion of sealants and adhesives to concrete.
   1. Acceptable Products:
      a. Sikaflex® 429/202, or equal

C. Joint Sealant, Epoxy: High-build, two-part, protective, solvent-free epoxy.
   1. Acceptable Products:
      a. Sikagard® 62, or equal
D. Joint Sealant, Urethane: Liquid-applied, elastomeric, urethane.
   1. Acceptable Products:
      a. CIM 1000, or equal
E. Epoxy Injection Adhesive: Two-part, moisture-tolerant, epoxy injection adhesive.
   1. Acceptable Products:
      a. Sikadur® 52, or equal
F. Chemical Grout: Expanding, polyurethane, chemical grout.
   1. Acceptable Products:
      a. SikaFix® HH+, or equal
      b. SikaFix® HH Hydrophilic, or equal

2.18 FABRICATION TOLERANCES

A. Fabricate structural precast concrete members of shapes, lines and dimensions indicated, so each finished member complies with PCI MNL 135 product tolerances as well as position tolerances for cast-in items.

2.19 FINISHES

A. Form Finish:
   1. Standard Grade: Normal plant-run finish produced in forms that impart a smooth finish to concrete. Surface holes smaller than 1/2 inch caused by air bubbles, normal color variations, form joint marks, and minor chips and spalls are acceptable. Fill air holes greater than 1/4 inch in width that occur in high concentration (more than one per 2 square inches). Major or unsightly imperfections, honeycombs, or structural defects are not permitted. Allowable joint offset limited to 1/8 inch.
B. Smooth steel-trowel finish unformed surfaces. Consolidate concrete, bring to proper level with straightedge, float and trowel to a smooth, uniform finish.

2.20 SOURCE QUALITY CONTROL

A. Quality-Control Testing: Test and inspect precast concrete according to PCI MNL 116 requirements. If using self-consolidating concrete also test and inspect according to ASTM C 1610, ASTM 1611, and ASTM C 1621.
B. Strength of precast concrete members will be considered deficient if units fail to comply with ACI 350 concrete strength requirements.
C. Testing: If there is evidence that strength of precast concrete members may be deficient or may not comply with ACI 350 requirements, fabricator shall employ an independent testing agency to obtain, prepare, and test cores drilled from hardened concrete to determine compressive strength according to ASTM C 42 and ACI 350.
   1. Test results shall be reported in writing on the same day that tests are

performed, with copies to Architect, Contractor, and precast concrete fabricator. Test reports shall include the following:

a. Project identification name and number.
b. Date when tests were performed.
c. Name of Tank Supplier.
d. Name of concrete testing agency.
e. Identification letter, name, and type of precast concrete member(s) represented by core tests; design compressive strength; type of failure; actual compressive strength at breaks, corrected for length-diameter ratio; and direction of applied load to core in relation to horizontal plane of concrete as placed.

D. Patching: If core test results are satisfactory and precast concrete members comply with requirements, clean and dampen core holes and solidly fill with precast concrete mixture or repair material, and finish to match adjacent precast concrete surfaces.

E. Acceptability. Structural precast concrete members that do not comply with acceptability requirements in PCI MNL 116, including concrete strength, and manufacturing tolerances, are unacceptable. Chipped, spalled or cracked members may be repaired. Replace unacceptable units with precast concrete members that comply with requirements.

PART 3 EXECUTION

3.01 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle post-tensioning materials in accordance with PTI.

B. Deliver all precast concrete members in such quantities and at such times to assure compliance with the agreed upon project schedule and setting sequence to ensure continuity of installation.

C. Handle and transport precast concrete members in a manner to avoid excessive stresses that could cause cracking or other damage.

D. Store precast concrete members with adequate dunnage and bracing, and protect units to prevent contact with soil, staining, and to control cracking, distortion, warping or other physical damage.

3.02 INSTALLATION

A. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Section 01 30 00 “Administrative Requirements.”

B. General Contractor’s Responsibilities:

1. General Contractor shall prepare subgrade in accordance with Section 31 20 00 “Earthmoving”.
2. Geotechnical Engineer shall inspect and approve the subgrade supporting the tank. Unsatisfactory conditions shall be corrected to the satisfaction of the Geotechnical Engineer.

3. General Contractor shall notify Tank Supplier in writing that supporting subgrade has been approved by the Owner's Geotechnical Engineer.
4. The stone sub-base shall be prepared, leveled, and graded to within ± one inch of stone grade, as indicated on the approved Tank Supplier's Shop (Erection) drawings.
5. Excavation shall include a minimum of five feet in plan beyond the perimeter of the approved exterior wall line.
6. Site access roads:
    a. Shall be provided and maintained by the General Contractor throughout the installation of the base slab and precast tank structure.
    b. Shall be cleared, leveled, stoned, and free of mud to provide 14-feet of vertical clearance and 14-feet of horizontal clearance.
    c. Shall be capable of handling 80,000 pounds GVWR.
    d. Shall support live loaded trucks operating under their own power.
    e. Shall allow drop-deck, spread axle combinations with 53-ft trailers. This includes a 60-foot-long sweep radius for corners and egress/regress to roadways.
7. Crane and concrete pump pads:
    a. Shall be provided and maintained by the General Contractor.
    b. Shall be cleared, leveled, stoned, and free of mud.
    c. Tank Supplier shall communicate the required locations and sizes of the pads with the General Contractor.

C. Cast-In-Place Concrete Base Slab
1. Install the base slab in accordance with Section 03 30 53 "Cast-in-Place Concrete for Precast Concrete Tank Base Slabs."

D. Erection
1. Erect structural precast concrete level, plumb and square within the specified allowable erection tolerances. Provide temporary bracing as required to maintain position, stability, and alignment of members until permanent connections are completed.
    a. Install temporary plastic spacing shims as necessary as precast concrete members are being erected.
    b. Use patching material to fill voids within recessed lifting devices flush with surface of adjacent precast concrete surfaces when recess is exposed.
2. Install post-tensioning tendons as soon as practical.
3. Place concrete in the vertical wall joints after installing post-tensioning tendons and duct connectors between wall panels.
4. Grouting or Dry-Packing Connections and Joints: Indicate joints to be grouted and any critical grouting sequences on Shop (Erection) Drawings. Grout open spaces at keyways, connections and joints where required or indicated with non-shrink, non-metallic grout. Retain flowable grout in place until it gains sufficient strength to support itself. Fill joints completely without seepage to other surfaces. Alternatively, pack spaces with stiff dry pack grout material, tamping until voids are completely filled. Promptly

remove grout material from exposed surfaces before it hardens.

5. Field cutting of precast concrete members is not permitted without approval of the Precast Tank Engineer.

E. Erection Tolerances
   1. Erect structural precast concrete members level, plumb, square and in alignment without exceeding the noncumulative erection tolerances of PCI MNL 135.

F. Tendon Installation
   1. Inspect prestressing strand for damage before installing tendons.
   2. Inspect sheathing for damage before installing tendons. Repair damaged areas by restoring post-tensioning coating and repairing or replacing tendon sheathing.
      a. Ensure that sheathing is watertight and there are no air voids.
      b. Follow tape repair procedures in PTI's "Field Procedures Manual for Unbonded Single Strand Tendons."
   3. Immediately remove and replace tendons that have damaged strand.

G. Tendon Stressing
   1. Stressing jacks and gauges shall be individually identified and calibrated to known standards at intervals not exceeding six months. Exercise care in handling stressing equipment to ensure that proper calibration is maintained.
   2. Stress tendons only under supervision of a qualified post-tensioning superintendent.
   3. Tendon stressing shall not begin until grout/concrete strength in the (vertical wall) joints has attained at least 2,500 psi compressive strength.
   4. Tendon stressing shall be performed in the sequence indicated on the Shop (Erection) Drawings.
   5. Mark and measure elongations according to PTI's "Field Procedures Manual for Unbonded Single Strand Tendons." Measure elongations to closest 1/8-inch.
   6. Tendon elongations shall be recorded and compared to the theoretical elongations indicated on the Shop (Erection) Drawings. Prestressing will be considered acceptable if gage pressures shown on stressing record correspond to required stressing force and theoretical and measured elongations agree.
   7. In the event that measured elongations exceed the tolerances indicated on the Shop (Erection) Drawings, the Precast Tank Engineer shall be notified for resolution.

H. Tendon Finishing
   1. Strand tails may be cut once prestressing has been deemed acceptable.
   2. Do not cut strand tails or cover anchorages of tendons where elongations exceed tolerances until all discrepancies have been resolved to the satisfaction of the Precast Tank Engineer.
   3. Cut strand tails as soon as possible after approval of elongations.
   4. The tendon tails shall be cut using hydraulic shears.
   5. The strand length protruding beyond the wedges after cutting of the tendon

tail shall be between 0.5-inch and 0.75-inch.

6. Wedge-cavity caps shall be installed within one working day after cutting tendon tails.
7. Patch stressing pockets within one day of cutting strand tail. Clean inside surface of pocket to remove laitance or post-tensioning coating before installing patch material. Finish patch material flush with adjacent concrete.
8. If stressing pockets are not able to be filled within ten days after tendon tail cutting, then temporary protection shall be provided.

I. Grouting of Bonded Tendons

1. Execute grouting within 10 days after approval of tendon elongations. If grouting will not be performed within this time period, provide weather protection for the jacking access pockets.
2. Pump grout through ports into the ducts under pressure.
3. Temperature of concrete walls at time of grouting shall be above 35° F and shall be maintained above 35° F until field-cured 2-inch grout cubes reach a minimum of 800 psi.
4. Grout temperatures shall not be above 90° F during mixing and pumping.
5. Coat tendon anchor plates with epoxy coating after grouting is complete.
6. Patch jacking access pockets.

J. Protection of Prestressed Reinforcement

1. Do not expose tendons to electric ground currents, welding sparks, or temperatures that would degrade components.
2. Prevent water from entering tendons during installation and stressing.
3. Provide weather protection to stressing-end anchorages if strand tails are not cut within 10 days of stressing the tendons.

K. Repairs

1. Repairs will be permitted provided structural adequacy, serviceability and durability of members are not impaired.
2. Prepare and repair damaged galvanized coatings with galvanizing repair paint according to ASTM A 780.
3. Repair base slab shrinkage cracks as required for watertightness. Rout a ¼-inch vee-notch along the crack and fill the crack with epoxy injection adhesive.
4. Surface chips or spalls shall be cleaned and then patched with patching material.
5. Misaligned grout ports or connection ports in walkways may be repaired by either enlarging the existing port, or drilling a new one, as required. Coordinate with the Precast Tank Engineer to avoid internal reinforcing and hardware.
6. Damage that occurs during the shipping, installation or construction process shall be brought to the attention of the Precast Tank Engineer for resolution.
7. Additional repairs, if necessary, shall be performed as directed by the Precast Tank Engineer.
8. Remove and replace damaged structural precast concrete members when repairs do not comply with specified requirements.

L. Cleaning

1. Clean grout and any other deleterious material from concrete surfaces and adjacent materials immediately.
2. Clean exposed surfaces of precast concrete members after erection and completion of joint treatment to remove weld marks, other markings, dirt, and stains.
    a. Perform cleaning procedures, if necessary, according to precast concrete fabricator's recommendations. Protect adjacent work from staining or damage due to cleaning operations.
    b. Do not use cleaning materials or processes that could change the appearance of exposed concrete finishes or damage adjacent materials.

M. Backfill
1. General Contractor shall place and compact backfill in accordance with Section 31 20 00 "Earth Moving."
2. Do not commence backfilling around the tank until the tank has been examined and approved by the Engineer of Record.
3. The General Contractor shall be responsible to protect the tank from damage by construction activity, equipment and vehicles. Damaged structures shall be repaired or replaced to the satisfaction of the Tank Supplier.
4. When backfilling against the tank, place backfill material in equal lifts and to similar elevations on opposite sides of structures in order to equalize opposing horizontal pressures, except where required for final grading.
5. The excavation shall be kept free of water by the General Contractor at all times.

3.03 FIELD TESTING

A. Owner may engage accredited independent testing and inspecting agency to perform field tests and prepare reports.
1. Testing agency will report test results promptly and in writing to Contractor, Engineer of Record and Tank Supplier.

B. Repair or remove and replace work where tests and inspections indicate that it does not comply with specified requirements.

C. Tightness Testing
1. Each cell of multi-cell tanks shall be considered a single containment structure and shall be tested individually, unless otherwise specified.
2. The General Contractor shall commence tightness testing within five business days of notification that the structure is ready for testing.
3. Testing shall be performed using the hydrostatic tightness test, which consists of two parts. Part 2 may be waived if approved by the Project Engineer-of-Record.
    a. Part 1 shall be a qualitative criterion.
    b. Part 2 shall be a quantitative criterion expressed as a maximum allowable volume loss of 0.05 percent per 24-hour period.
4. No backfill may be placed against the walls or on the wall footings of the containment structures to be tested, unless otherwise specified.

5. The initial filling of a new containment structure shall not exceed four feet per hour. Filling shall be continued until the water surface is at the design maximum liquid level, or either one inch below any fixed overflow level in covered containment structures or four inches in open containment structures, whichever is lower.
6. Water for the initial filling shall be provided by the General Contractor. Use potable water unless otherwise specified.
7. Part 1 – Qualitative criteria
    a. If any water is observed on the containment structure exterior wall surfaces where moisture can be picked up on a dry hand, the containment structure shall be considered to have failed Part 1 of the hydrostatic test.
    b. Wet areas on top of the wall footing shall not be cause to fail Part 1 unless the water can be observed to be flowing.
    c. Although Part 2 of the test may begin prior to completion of repairs for Part 1, all defects causing the failure of Part 1 shall be repaired before acceptance of the containment structure.
    d. The standard repair procedure for areas failing Part 1 is to inject chemical grout into the affected area. Consult with the Precast Tank Engineer before commencing any such repairs.
8. Part 2 – Quantitative criteria
    a. Part 2 of the hydrostatic tightness test shall not be scheduled for a period when the forecast is for a difference of more than 35°F between the ambient temperature readings at the times of the initial and final level measurements of the water surface. The test shall also not be scheduled when the weather forecast indicates the water surface could freeze before the test is completed.
    b. The vertical distance to the water surface shall be measured to within 1/16 inch from a fixed point on the containment structure above the water surface. The initial measurement shall not be taken until at least 24 hours after the tank is completely filled. Measurements shall be recorded at 24-hour intervals.
    c. The test period shall be the theoretical time required to lower the water surface 3/8 inch, assuming a loss of water at the maximum allowable rate. However, the test period shall not be longer than five days.
    d. In uncovered containment structures, evaporation and precipitation shall be measured.
    e. At the end of the test period, the water surface shall be recorded to within 1/16 inch at the location of the original measurements. The water temperature and precipitation measurements shall be recorded.
    f. The change in water volume in the containment structure shall be calculated and corrected, if necessary, for evaporation, precipitation, and temperature. If the loss exceeds the required criterion, the containment shall be considered to have failed Part 2 of the test.

9. Retesting
    a. A restart of the test shall be required when test measurements become unreliable due to unusual precipitation or other external factors.
    b. It shall be permitted to immediately retest a containment structure failing Part 2 of the hydrostatic test when Part 1 is passed. If the containment structure fails the second test or if not immediately retested after the first test failure, the interior of the containment structure shall be observed for probable problem areas by the Tank Supplier. The containment structure shall only be retested after the probable problem areas are repaired.
    c. Containment structures shall be retested until they meet the required Part 1 and Part 2 criteria. Repairs shall be made before each retest.
10. The containment structure shall be deemed substantially complete upon successful completion of tightness testing. All final payments, including retainage, for all structural elements related to the precast, post-tensioned concrete tank, including the foundation system and cast-in-place base slab, shall be made at this time. This clause supersedes any conflicting clauses in the contract documents.

3.04 SPECIAL WARRANTY

A. The Tank Supplier shall provide a two-year structural warranty to the Owner. The warranty shall at minimum include the following items:
    1. The Tank Supplier shall provide a corporate guarantee not covered by any form of insurance or bond as a warranty for the precast post-tensioned concrete tank that warrants the tank is free from structural defect due to faulty design, workmanship, or structural materials.
    2. The Tank Supplier shall warrant the structural aspects of the tank for a period of two years from the substantial completion date of the precast post-tensioned concrete tank.
    3. The Owner must report in a timely manner any claim to the warranty in writing to the tank manufacturer within the effective coverage dates of the warranty.
    4. The Tank Supplier shall furnish, without charge to the Owner, all necessary labor and materials required to repair all structural defects subject to this warranty with a maximum cost of repair not exceeding the Tank Supplier's contract value of the tank and under the condition that the Tank Supplier has been paid in full for the project.
B. Specific Exclusions from Warranty:
    1. Maintenance items (sealants, coatings, equipment, plumbing, etc.), all non-structural items.
    2. Consequential damages, punitive damages, incidental costs, bodily injury, death, and damage to the property other than the tank.
    3. Emptying of tanks, inspection of tanks, processing of the water/wastewater, drying or cleaning of the tanks, filling of tanks, etc. complete in preparation

for, and completion of repairs.

4. Defects or issues caused by accident, abuse, misuse, storage or processing of corrosive liquids, improper maintenance, negligence, modifications, additions, or deletions not made by tank manufacturer, improper or defective application, acts of God, force majeure, untimely action by Owner to minimize damage or losses, unstable or improperly designed or constructed soil/subgrade, or defects caused by work supplied by any party other than the Tank Supplier.
5. A loss or defect that is covered by insurance.

C. All materials and labor for work performed by the Tank Supplier which is not covered under the standard two-year limited structural warranty shall be warranted for a period of one (1) year from substantial completion of the tank per the Contract Documents.

PART 4 SCHEDULE

END OF SECTION

SECTION 46 33 00

LIQUID CHEMICAL FEED EQUIPMENT

PART 1 GENERAL

1.01 SCOPE

Furnish all materials, labor, and equipment to properly install all chemical feed pumps and related accessories at the locations shown on the plans or as directed by the Engineer for the proper completion of the work included under this contract whether shown expressly on the plans or implied by other requirements.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. 26 00 00 – General Electrical Provisions
B. 43 40 00 – Liquid Storage Tanks

1.03 SUBMITTALS

Complete product data and engineering data, including shop drawings, shall be submitted to the Engineer in accordance with the requirements of Section 01 33 00 of the Contract Documents.

PART 2 PRODUCTS

2.01 GENERAL

A. The manufacturer shall provide minimum a two (2) year warranty against defects in materials and workmanship.
B. The skid and pump equipment shall be supplied by the same manufacturer and shall be delivered pre-assembled.
C. Manufacturers: Provide products of one of the following:
    1. Blue White
    2. Prominent
D. This contract is partially funded by the GEFA CWSRF and the equipment manufacturer shall meet the requirements identified in the SRF Supplemental General conditions.

2.02 CHEMICAL FEED PUMPS

A. The chemical feed pumps shall meet the following requirements:

1. Quantity: 2
2. Style Peristaltic
3. Chemical Magnesium Hydroxide – $Mg(OH)_2$
4. Flowrate 0 – 8.5 gallons per hour
5. Pressure 10 psi

B. Enclosure shall be NEMA 4X.

C. Pump head cover shall be clear to allow quick visual inspection of the pump tube.

D. Pump shall be self-priming and capable of running dry without damage.

E. Provide tubing recommended by the manufacturer for the specified application. Connection fittings shall be permanently attached to tubing at the factory.

F. Pumps shall operate on 110/130 VAC 50/60 Hz, or 208//250 VAC 50/60 Hz, 1 phase.

G. Motors shall be rated variable speed DC, rated for continuous duty.

H. Control circuitry shall be integral to the pump and capable of adjusting the pump motor speed from 0.5 % to 100.00% in 0.1% increments.

1. Control panel shall be integral to the pump allowing user configuration of pump settings and display of operating parameters, such as pump output volume, tube timer hour counter, motor direction, and alarms.
2. A tube failure detection system shall be integrated in the pump.

2.03 SKID

A. The skid shall be manufactured of chemically resistant polyethlylene and shall be of the floor mount style.

B. The skid shall be sized to accommodate the number of pumps specified above and shall be capable of fitting in the space shown in the drawings.

C. Skid mounted piping and fittings shall be PVC Schedule 80 rated for a working pressure of 150 psi.

1. Inlet piping shall be 1-inch
2. Outlet piping shall be ½-inch

D. The skid shall be complete with the following components, as shown in the drawings:

1. Ball valves (V)
2. Pressure relief valves (PRV)
3. Calibration cylinder (CC)
4. Pulsation dampener (PD)
5. Pressure gauge (G)
6. Check valves (CV)
7. Flow indicator (F)
8. Y-strainer (S)
9. Pressure switch (PSH)
10. Back-pressure valve (BPV)
11. Stainless steel pump mounting hardware and skid mounting pads/hardware

E. Flexible tubing shall be furnished for pump inlet and outlet connections.

1. Tubing shall be reinforced braided PVC, 200 psi max, meeting NSF std. 51.
2. Pump inlet and outlet flexible tubing connections shall be terminated to half

unions and secured to the barbed fitting with stainless steel clamps.

PART 3 EXECUTION

3.01 DELIVERY, STORAGE, AND HANDLING

A. Chemical feed system shall be delivered pre-assembled on the skid, ready for connection to input and output piping.

3.02 INSTALLATION

A. Install skid according to manufacturers instructions.
B. Securely anchor skid to floor to prevent

3.03 SPARE PARTS

A. System manufacturer shall supply the following spare parts as well as any additional parts recommended for one year's operation:
   (1) Pump head assembly complete with pump tubing.
   (1) Set of flexible pump connection tubing.

3.04 FIELD TESTING

A. Chemical feed system shall be operated in the presence of the Engineer or Owner to ensure proper dosing of the chemical.
B. Provide service of a manufacturer’s representative for startup, troubleshooting, and testing.

END OF SECTION

SECTION 46 43 21

WEIR AND LAUNDER BRUSH SYSTEM

PART 1 GENERAL

1.01 SCOPE

Furnish all materials, labor, and equipment to properly install a Weir and Launder Brush System suitable for installation on a single skimmer arm clarifier mechanism in each of the three (3) existing 40-ft interior diameter concrete basins as shown on the Drawings.

1.02 SUBMITTALS

Complete product data and engineering data, including shop drawings, shall be submitted to the Engineer in accordance with the requirements of Section 01 33 00 of the Contract Documents.

PART 2 PRODUCTS

2.01 GENERAL

A. The weir and launder brush system shall be an apparatus for cleaning algae and debris from the baffles, weirs, spillway and effluent launder of a circular clarifier. The system shall consist of an attachment sleeve(s) mounted to the skimmer(s) of the clarifier, a main frame member(s) to which the individual brush arms shall be attached, collars, spring mounts, brush arms, numerous brushes of various sizes, and an assortment of springs in different configurations to provide the biasing forces. A series of brush arm assemblies shall be mounted to the main frame member and biased into engagement with the scum baffle, weirs, spillway and walls of the effluent flow channel. Additionally, a ramp shall be attached to the scum beach to provide for trouble free entrance and exit of inner baffle brush assembly. Furthermore, a bridging ramp shall also be positioned over the effluent discharge outlet to support the launder brush assembly as it passes. All metallic parts of the weir and launder brush system and ramps shall be made of stainless steel.

B. Because of the custom designed application of the weir and launder brush systems, variations in poured concrete, differences in various clarifier designs, variances in the height of the skimmer as it travels around the tank, and the out of round of each clarifier, the weir and launder brush system shall be custom designed, field assembled, and installed for the individual clarifier it is to be installed on.

C. The weir and launder brush system for algae and debris control shall be designed for a brush to make contact with each of the following surfaces:
   1. Inner Scum Baffles

2. Outer Scum Baffles
3. Inner Weirs
4. Outer Weirs
5. Top Spillway Surface
6. Angle Spillway Surface
7. Inner Launder Wall
8. Launder Bottom
9. Outer Launder Wall

D. The weir and launder brush system shall be designed to work off the power of the existing clarifier drive motor. The system shall be constructed to avoid any noticeable torque increases. The unit shall be capable of encountering an indefinite stall without incurring damage.

E. The weir and launder brush system shall weigh no more than 100 lbs. per skimmer arm in order to minimize skimmer deflection. By installing half of the weir and launder brush system per skimmer, the clarifier shall remain in balance to preserve the integrity of the clarifier drive and bearings. Weir and launder brush system installations shall weigh no more than 100 lbs. per side that will be installed on each skimmer.

F. The unit shall be designed with an engaged position for cleaning and a disengaged position allowing the system to ride idle around the clarifier.

G. Weir and launder brush cleaning system must be approved by the clarifier manufacturer on which it is to be installed to address compatibility and prevent any warranty issues. The clarifier manufacturer is Amwell.

H. Qualifications of manufacturer: The manufacturer of the weir and launder brush systems shall have a minimum of thirty (30) years of experience in the manufacturing and installation of weir and launder brush systems, have weir and launder brush systems presently in operation for more than ten (10) years as examples of quality, longevity, and clarifier compatibility. The manufacturer shall have a minimum of five hundred (500) weir and launder brush systems (of their own units) in operation in the United States. A history of successful installations with contact names and phone numbers must be included and contacted for confirmation before approval.

I. This contract is partially funded by the GEFA CWSRF and the equipment manufacturer shall meet the requirements identified in the SRF Supplemental General conditions.

2.02 PRODUCTS/EQUIPMENT

A. Manufacturers:
1. The automated brush system and additional stainless steel scum baffle supports shall be designed and manufactured by Ford Hall Company, Inc. Weir-Wolf (or approved equal) and supplied by AMWELL for their original three (3) Model HVS clarifiers previously installed at this location under their SO# 103291 & 103292.

B. General
1. The clarifier mechanism manufacturer shall ensure the following

compatibility items are achieved in the clarifier mechanism and related equipment for proper functionality of the weir and launder brush system:

a. Walkway support – walkway should extend freely to the outer effluent launder wall or beyond and not be supported on the spillway, trough, and/or launder surfaces.

b. Upper scum baffle brackets shall be L-shaped. This shall allow the free passage of the brush system and to promote more efficient cleaning. These shall be provided and installed by the automated brush system manufacturer.

c. Bolt protrusions – bolt protrusions should be minimized. Bolts / studs, which attach the weirs and scum baffles, should protrude no more than 1/4 inch past the nuts.

d. Skimmer arms shall be of a standard design (no "ducking" or submersible skimmers). Skimmer arm must remain at consistent elevation (plus or minus 1- inch) around the entire periphery of the clarifier. Skimmer arms must be able to support addition of approximately 100 lbs. without inducing metal fatigue.

e. Distance between scum baffle and weirs shall be at least eight (8) inches.

f. A clearance of at least eighteen (18) inches shall be provided between the top of the scum baffle and the lowest point of the walkway (includes water lines and electrical conduit).

g. Interior concrete surfaces of the launder should be finished as smoothly as possible. This will allow for maximum brush life and increase the effectiveness of algae and debris removal.

C. Construction

1. Attachment Assembly

a. The attachment assembly shall provide a means of attaching the weir and launder brush system to the skimmer arm so as not to interfere with any other operations of the skimmer arm (such as the effective skimming of floatable solids or the operation of the skimmer blade assembly at the scum trough/box).

b. The attachment assembly shall be custom designed and approved for each specific clarifier. It shall be constructed of 304 stainless steel.

2. Main Frame

a. The weir and launder brush system main frame shall be constructed of 304 stainless steel and designed to slip easily into the attachment assembly and be tightened in position with the use of set screws. The main frame shall be designed so that the brush arms can be positioned at any point on the main frame.

3. Brush Arms

a. Brush arms shall be constructed of stainless steel tubing to allow for adequate strength to support spring loaded brush assembly and to keep the weir and launder brush system within the required weight limits. Each brush arm shall allow/contain the following:

b. Designed to allow flexibility to clean effluent surfaces within a plus or minus four (4) inch radial variance (specifically: clarifier launders, both sides of weirs and scum baffles).
c. A brush holder component allowing for the insertion of a brush opposite the main frame end.
d. Designed to allow brush holder to be adjusted so that a maximum number of brush arm adjustments are possible.
e. An adjustable means of biasing the arm to the main frame so as to provide sufficient force to remove algae and debris.
f. A component that allows for each brush arm to be "locked out" or disengaged. This will allow operators to customize cleaning schedule and extend life of the brushes.

4. Spring Assemblies
   a. Each brush arm requires spring tension to bias the brush arm with the brush holder and brushes into tight engagement with the appropriate surface to be cleaned. The spring assemblies require the following:
   b. A minimum of one (1) spring assembly of 316 stainless steel is required for each brush arm.
   c. Spring assemblies consist of two (2) 316 stainless steel springs and three (3) stainless steel guides to allow for maximum adjustability.
   d. Each spring shall be composed of 316 stainless steel wire with a minimum diameter of 0.093 inches and a minimum of 240 active coils per spring length.
   e. Spring coils shall have a mean diameter 0.093 inches. A minimum inner coil diameter of 0.56 inches and an outer diameter of 0.75 inches are required for each spring.
   f. Springs shall have a minimum initial spring tension of 9.8 lbs.
   g. Each end of the spring shall include a self-aligning captured swivel hook with heavier diameter wire, making for a more rugged (long lasting) low wire stress design. The last three to four coils of the spring are gradually tapered by reducing the coil end diameters, leaving a proper interference that prevents the captured swivel hook from pulling out.

5. Brush Holder
   a. At the end of each brush arm there shall be a 316 stainless steel brush holder to allow the insertion of a cleaning brush.
   b. A brush holder shall be aligned with each of the following surfaces: both sides of the scum baffles, both sides of the weirs, and each of the effluent launder surfaces.
   c. Each brush holder shall consist of a "bolted clamp design" to allow for the easy insertion of a cleaning brush.
   d. Each brush holder shall include a factory supplied brush in the proper size suitable for prolonged exposure to wastewater environment.
   e. Brush holder shall incorporate an anti-slip that compresses into the

brush backing as brush holder is tightened. This feature shall provide additional security to ensure brush is firmly in brush holder.

6. Brushes
   a. Each brush holder shall contain one (1) cleaning brush. Brushes shall be provided that slip easily into the brush holder and provide the cleaning means necessary to remove algae and debris from their respective surfaces. A brush shall be aligned to make contact with both sides of the scum baffles, both sides of the weirs, and all of the effluent launder surfaces.
   b. Brush construction shall be as follows:
      1) The brush base shall be made of durable injection molded polypropylene that is infused with a foaming agent to reduce the weight of the block. The material shall be impervious to UV rays, temperature fluctuations, and the corrosive elements found in wastewater.
      2) The brush bristles shall consist of extruded polypropylene or polyester monofilament. Each filament type shall be extruded at a specific diameter to allow for different levels of stiffness and abrasion resistance. The filaments shall be secured into the base and utilize a corrosion resistant anchor to secure the bristles into the molded base. Each brush shall carry a unique penetrating trim which allows the filaments to penetrate into irregular concrete surfaces.
      3) The brushes shall be cut and shaped appropriately in order to clean their response surfaces without binding.
   c. Replacement brushes shall be stocked by the manufacturer to the exact dimensions per clarifier and shall be made available for purchase when desired by Owner. Brushes provided by the automatic brush system manufacturer shall average at least a twelve (12) month life span.
7. Lock In / Lock Out Design
   a. Each weir and launder brush system shall be designed with the engaged or locked in position for cleaning and a disengaged or locked out position for riding idle around the clarifier.
   b. Each brush arm shall have a permanently mounted lock out ring that corresponds to a lock out hook which allows disengagement of the individual brush assembly. The lock out ring shall be mounted to a lock out boss that is attached to the brush arm.
   c. Each weir and launder brush system shall be designed so that the entire brush system can be disengaged, or individual brush arms can be disengaged, allowing for customized cleaning of weir and effluent surfaces.
8. Brush Bridges
   a. Each weir and launder brush system shall provide a “bridge”

over/across the effluent discharge outlet.

b. Brush bridge/ramp shall be provided at the scum trough/box. An incline and a decline guide ramp shall be provided for each scum trough/box in the clarifier.

c. Brush bridge(s) shall be constructed entirely of stainless steel.

9. Brush System Weight And Counterbalances

a. Weight of the Automated Brush System will be less than 200 lbs. including all Brush System attachments, brush arms, components and parts for a single skimmer arm design.

b. Single skimmer designs require counterbalances to be installed on the rake mechanism opposite the skimmer to offset the weight of the Automated Brush System. Manufacturer of the Automated Brush System will need to provide additional counterbalances totaling the weight of the installed Brush System, attachment sleeve, and mainframe and be responsible for the correct placement and installation. (This is an additional counterweight beyond the counterbalances provided by the clarifier manufacturer.)

PART 3 EXECUTION

3.01 INSTALLATION

A. The automated brush systems and new stainless steel scum baffle brackets shall be installed, started- up, certified and training provided by the manufacturer.

B. Factory trained and employed technician(s) with five (5) plus years' experience shall be onsite for a minimum of two (2) days per clarifier to custom install and certify the custom designed weir and launder brush system.

C. In addition to the installation services of a factory trained technician, an Amwell technician shall be on-site a minimum of two (2) days for service and inspection of Clarifier No. 3 prior to startup.

PART 4 SCHEDULE

A. Final Clarifier No. 1 – One (1) Weir and Launder Brush System for single-skimmer arm clarifier.

B. Final Clarifier No. 2 – One (1) Weir and Launder Brush System for single-skimmer arm clarifier.

C. Final Clarifier No. 3 – One (1) Weir and Launder Brush System for single-skimmer arm clarifier.

END OF SECTION

SECTION 46 53 00

PHASED ACTIVATED SLUDGE SYSTEM

PART 1 GENERAL

1.01 SCOPE

Furnish all materials, labor, and equipment to properly install an operational Phased Activated Sludge System (PASS) as shown on the plans or as directed by the Engineer for the proper completion of the work included under this contract whether shown expressly on the plans or implied by other requirements.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. 03 31 00 - Cast-in-Place Concrete

B. 26 00 00 - General Electrical Provisions

C. 33 11 13 - Ductile Iron Pipe and Fittings

D. 40 71 00 - Flow Measurement Instrumentation

E. 40 05 59 – Downward Opening Weir Gates

F. 40 05 51 - Valves

G. 41 22 00 – Cranes and Hoists

1.03 SUBMITTALS

Complete product data and engineering data, including shop drawings, shall be submitted to the Engineer in accordance with the requirements of Section 01 33 00 of the Contract Documents.

PART 2 PRODUCTS

2.01 GENERAL

A. The Phased Activated Sludge System shall be supplied by a company of good reputation that is regularly engaged in the manufacture and fabrication of biological wastewater treatment systems. As a minimum, the supplier shall be the manufacturer of the following components: mixer(s), aerator(s), and controls.

B. The Contractor shall assign full responsibility for the functional operation of all the PASS components to a Single Source Supplier. This Supplier shall be responsible

for all engineering necessary in order to select, furnish, inspect the installing contractor's equipment installation and connections, calibrate, and place into operation the System along with all other equipment and accessories as specified herein.

C. These specifications and accompanying drawings are based upon the use of a system manufactured by Aqua-Aerobic Systems, Inc. Additional manufacturers will be acceptable with similar process components and proof of consistent treatment performance. All costs associated with any redesign necessary for a different manufacturer shall be the responsibility of the Contractor.

D. The manufacturer of the system shall be completely responsible for the proper design of their system, including but not limited to; transfer pump(s), mixer(s), aerator(s), and controls. All equipment shall perform as specified and the completed installation shall operate in accordance with the requirements of the plans and specifications. The system shall incorporate, to the greatest extent practical, existing features on the site, including, but not limited to: existing aeration basins and existing aeration equipment.

E. The system shall include, but not necessarily be limited to, the following unit processes: Anaerobic Reactor, Pre-Anoxic Reactor, and Phase Separator (collectively referred to as the Staged Reactor), and Aeration Reactor.

F. The manufacturer shall provide a written Process Performance Guarantee to guarantee the PASS, in conjunction with other equipment listed in the Bid Form and shown on the plans, will meet the effluent criteria specified in this section. The guarantee period shall commence at time of plant start-up, once the system has reached stable operation or within six months of equipment shipment whichever first shall occur, and shall be in force for a period of one year. The Process Performance Guarantee shall be submitted as part of the engineer's submittal data.

G. The manufacturer shall provide a written warranty against defects in materials and workmanship. Manufacturer shall warrant the goods provided by the Manufacturer to be free from defects in materials and workmanship under normal conditions and use for a period of one (1) year from the date the goods are put into service, or eighteen (18) months from shipment of equipment, whichever first shall occur. This warranty shall not apply to any goods or part which has been altered, applied, operated or installed contrary to the manufacturer's instructions or subject to misuse, chemical attack/degradation, negligence or accident.

H. Design Loadings:

1. Flow = 1.51 MGD Average Daily, 3.54 MGD Peak Daily
2. Five-Day BOD = 250 mg/l
3. TSS = 250 mg/l
4. Ammonia, as N = 25 mg/l
5. Phosphorus = 7 mg/l
6. Wastewater Temperature = 54°F – 77°F
7. Ambient Temperature = 30°F – 90°F

I. Effluent Parameters may not exceed:

1. Five-Day BOD = 5.0 mg/l
2. TSS = 20 mg/l
3. Ammonia, as N = 0.7 mg/l

J. This contract is partially funded by the GEFA CWSRF and shall meet the requirements identified in the SRF Supplemental General Conditions.

2.02 ANAEROBIC REACTOR

A. General
1. The Anaerobic Reactor shall receive raw influent and provide anaerobic conditions while mixing conditioned return activated sludge from the Pre-Anoxic Reactor with the influent.
2. The Anaerobic Reactor shall be field constructed of concrete as shown on the drawings.

B. Equipment
1. Mixer
a. Furnish one (1) mechanical floating mixer and related equipment accessories as described herein for the Anaerobic Reactor basin. The mixer shall be capable of maintaining complete mixed conditions, with biological suspension of all mixed liquor suspended solids without the introduction of air.
b. The mixer shall consist of a motor, direct-drive impeller driven at a constant speed, an integral flotation unit, and impeller volute. The mixer shall incorporate design enhancements that provide for three (3) years without routine maintenance (greasing).
c. The drive motor shall be vertical P base design, totally enclosed fan cooled TEFC, and generally rated for severe duty. The motor shall in all cases equal or exceed standard NEMA specifications. A minimum service factor of 1.15 shall be furnished. The motor winding shall be nonhygroscopic, and insulation shall equal or exceed NEMA Class "F". A lip seal shall be provided below the bottom bearing to prevent moisture from penetrating around the motor shaft. A condensate drain shall be located at the lowest point in the lower-end bell housing. Unit shall have a one-piece motor shaft continuous from the top motor bearing, through the lower bearing and down to and through the propeller. The shaft shall be manufactured from 17-4 PH stainless steel. Motor bearings shall be regreasable. Top bearing shall be shielded on the bottom side only. Bottom bearing shall be open. The top and bottom motor bearings shall be of combined radial and axial thrust type. The lower motor bearing inner brace shall be locked to the motor shaft via a special washer and locking nut arrangement. The shaft shall be threaded just below the lower bearing and shall have a keyway cut into the motor shaft. This key shall accept a tab from the inner diameter of the locking washer, and the locking nut shall have recesses to accept a tab from the outer diameter of the locking washer to prevent the

nut from backing off. Snap ring type bearing retainers will not be acceptable. Submerged motors, jet pumps, submerged gear motors or gearboxes shall not be acceptable.

d. The motor shall be securely mounted onto a solid base, which is integral with the motor base extension. All submersed wetted motor mounting base components shall be constructed of 304 stainless steel. The upper portion of the motor mounting base, immediately below the lower motor bearing, shall include two independent acting air seals. The two seals shall be capable of sealing off the flow of air from the suction action of the pumped flow, and prevent backflow of liquid during impeller reversal. The lower end of the motor base extension shall be provided with a rotating backflow seal that will prevent grit from being introduced into the anti-deflection insert reservoir, but shall allow liquid to contact the shaft. The backflow seal shall not require scheduled lubrication or maintenance.

e. Each unit shall be equipped with a modular float with a central float passage of a size to allow installation and removal of the pump impeller. The float shall be foamed full of polyurethane foam of the closed cell type, and shall be totally sealed to prevent the foam from being in contact with the external environment.

f. The impeller shall be designed to pump the liquid from near the surface and direct it down toward the vessel/basin bottom. The impeller shall be a two-blade marine type precision casting of 316 or 15/5 stainless steel and shall be specifically designed for the application intended. It shall be dynamically and hydraulically balanced. The propeller must be attached to the motor shaft with a hardened stainless steel pin and set screw. Impeller shall be capable of being reversed to cause back flow liquid movement without causing damage to the mixer chassis and without causing upflow liquid damage to the motor bearing and windings. No liquid spray or other liquid leakage upward onto the surface of the motor support surface or flotation chassis will be allowed. The impeller shall operate in a volute made of stainless steel plate, minimum 3/16 inch thick.

g. The entire rotating assembly including the motor rotor, shaft, shaft accessories, and impeller shall be dynamically balanced within 2.0 mils peak-to-peak horizontal displacement measured at the upper and lower motor bearing. Measurements shall be taken at a frequency equivalent to the motor RPM. Measurements shall be taken with the motor in a vertical, shaft down position with the entire power section mounted on resilient pads.

h. Each unit shall be provided with a mooring system consisting of three (3) mooring cables made of 304 stainless steel. The mooring system shall also consist of clips, thimbles, quick disconnects, extension springs, and adhesive stainless steel anchors for

connection to basin walls.

i. Each unit shall include power cable wired into the motor conduit box and terminating at the basin wall. Electrical cable shall be supplied with kellems grips at the motor and basin wall terminations. Electrical cable(s) shall be attached with cable ties provided by the equipment supplier. Attachment of cable and supply of junction box/disconnect at the basin wall shall be the responsibility of the installing contractor.

j. The mixer shall meet the following criteria:

Mixer Quantity	(1)	Total
Mixer Properties		
Zone of Complete Mix	55	ft
Direct Pumping Rate	4,520	gpm
Recirculation Rate	149,000	gpm
Motor		
Size	5	HP
RPM	1200	RPM
Efficiency	Standard	
Mounting Base Materials	304	Stainless Steel
Float		
Diameter (minimum)	71	inches
Shell Material	Fiber Reinforced Polyester Skin FRP	
Impeller Volute Material	304	SS

k. The mixer shall be the AquaDDM® by Aqua Aerobics, or approved equal.

2. Pressure Transducer

a. Furnish one (1) submersible pressure transducer unit constructed of stainless steel as specified herein.

b. Transducer shall utilize a diffused silicone semiconductor sensor protected by an integral stainless steel diaphragm with seal fluid. Transducer output shall be a 4-20 mA signal. Electrical connection shall be 2-wire, loop powered through a shielded integral cable comprised of 22 AWG conductors and separate drain wire.

c. Transducers shall be suspended on a removable assembly consisting of a PVC support pipe and EPDM hose. Removable assembly shall be supported by stainless steel supports, guide rail, and anchors. A moisture excluding aneroid bellows shall be supplied loose for installation in the junction box/ disconnect. Attachment and supply of the junction box/disconnect at the basin wall shall be the responsibility of the installing contractor.

d. Field attachment of the pressure transducer mounting brackets to the tank shall be the responsibility of the installing contractor.

e. The Pressure Transducer shall be manufactured by Keller or approved equal.

3. Level Sensor

a. Furnish one (1) level sensor assembly consisting of a float switch with a smooth, chemical resistant polypropylene casing, and 316 stainless steel mounting bracket for the Anaerobic Reactor basin.
b. Each float switch shall be provided with a three conductor electrical cable. Electrical cable shall terminate at a junction box/disconnect located at the basin wall. Field wiring and junction box/disconnect shall be provided by the installing contractor.
c. The Level Sensor shall be the Anchor Scientific model GSI 40NONC or approved equal.

2.03 AERATION REACTOR

A. General
1. The Aeration Reactor shall receive mixed liquor from the Anaerobic Reactor and provide staged aeration through cyclic operation aerators and mixers to achieve anoxic and aerobic conditions in a complete mix, flow-through basin.
2. The Aeration Reactor shall utilize the three (3) existing aeration basins shown on the drawings, each having approximately 0.55 million gallons in capacity. The aeration basins are constructed of concrete with 2:1 sloped sides, 95 feet wide, and 130 feet long, with a side water depth of 12 feet.
3. The existing aeration basins shall be updated with new aeration and mixing equipment as well as controls per the manufacturers design and shown in the drawings.

B. Equipment
1. Aerator
a. Furnish one (1) mechanical floating aerator and related equipment accessories as described herein for each aeration basin.
b. Each aerator shall consist of a motor, a direct drive impeller driven at a constant speed, and an integral flotation unit. The Aerator shall incorporate design enhancements that provide operation for three years without routine maintenance (greasing).
c. The drive motor shall be wired for three phase service. The motor shall be vertical P base design, totally enclosed fan cooled TEFC and generally rated for severe chemical duty with a 1.15 service factor. The motor windings shall be nonhygroscopic, and insulation shall equal or exceed NEMA Class "F". A lip seal shall be provided below the bottom bearing to prevent moisture from penetrating around the motor shaft. A condensate drain shall be located at the lowest point in the lower-end bell housing. Unit shall have a one-piece motor shaft continuous from the top motor bearing, through the lower bearing and down to and through the propeller. The shaft will be manufactured from 17-4 PH stainless steel. Motor bearings shall be regreasable. Sealed bearings are not acceptable. Top bearing shall be shielded on the bottom side only. Bottom bearing shall be open. The top and bottom motor bearings shall be of

combined radial and axial thrust type. The lower motor bearing inner race shall be locked to the motor shaft via a special washer and locking nut arrangement. The shaft shall be threaded just below the lower bearing and shall have a keyway cut into the motor shaft. This key shall accept a tab from the inner diameter of the locking washer, and the locking nut shall have recesses to accept a tab from the outer diameter of the locking washer to prevent the nut from backing off. Snap ring type bearing retainers will not be acceptable.

d. The design of the diffusion head shall be such that the liquid spray shall discharge at an angle of 90 degrees to the motor shaft over a 360 pattern in the horizontal plane and shall be a monolithic casting. The diffusion head casting shall act as a base for the aerator motor and alignment of the motor to this base shall be controlled by machined index fittings that engage the P base of the motor. To minimize vibration and provide adequate strength the diffusion head casting shall weigh not less than that stated above. Specifically, diffusion head designs that employ studs and spacers or shoulder bolts are not allowed. Load bearing flange-to-flange connections are mandatory. The diffusion head shall contain an anti-deflection journal insert to limit the radial deflection of the motor shaft. The journal insert shall be machined from Delrin or molded from moly-filled urethane and shall be a minimum of 0.060-inch diameter or larger through the bore than the diameter of the motor shaft. There shall be a fluid deflector located on the motor shaft immediately below the anti-deflection journal, which shall cover completely the anti-deflection journal insert and the lower portion of the diffusion head. This fluid deflector shall be molded from black neoprene and shall be press fit onto the motor shaft.

e. The impeller shall be a precision casting of 316 or 15/5 stainless steel and shall be specifically designed for the application intended. Impeller shall be the self-cleaning type and shall be dynamically and hydraulically balanced. The propeller must be attached to the motor shaft with a hardened stainless steel pin and set screw.

f. Each unit shall be equipped with a modular float filled with closed cell polyurethane foam having a minimum 2.0 lbs./ft3 density. Float shall be completely sealed to prevent the foam from being in contact with the external environment.

g. The impeller shall operate in a volute made of 304 stainless steel. It shall be round and true so that impeller blade tip clearance is uniform within the volute as it rotates. The volute shall have a minimum of 3/16 inch wall thickness and a minimum of four full length stainless steel gussets shall be welded on 90° spacing around the circumference of the volute between the top and bottom flanges.

h. The intake cone shall be fabricated having a gradually expanding opening outward to the intake end. The length and inlet diameter shall be sufficient to provide uniform inlet hydraulics so that no

increase in vibration is caused due to its shape or size.

i. The entire rotating assembly including the motor rotor, shaft, shaft accessories, and impeller shall be dynamically balanced within 2.0 mils peak-to-peak horizontal displacement measured at the upper and lower motor bearing. Measurements shall be taken at a frequency equivalent to the motor RPM. Measurements shall be taken with the motor in a vertical, shaft down position with the entire power section mounted on resilient pads.

j. Each unit shall be provided with a mooring system, as described below:

Mooring Post Quantity:	Three
Mooring Post Diameter:	6-inch
Pylon Material:	Sch. 40
Base Plate Material:	Galvanized Steel
Floor Connection:	Adhesive Anchors
Electrical Cable:	#8-Four Conductor

The system shall consist of vertical pylons with base plate. Each pylon shall be filled with concrete by the installing contractor. Furnished, as part of the unit, shall be a triangular mooring frame. The frame shall permit the assembly to move up and down following the change in liquid level while restrained within the vertical pylons. Removable 304 stainless steel U bolts shall be attached to each frame and fit around the pylons

k. Each unit shall include power cable(s) wired into the motor conduit box and terminating at the basin wall. Electrical cable shall be supplied with kellems grips at the motor and basin wall terminations. Electrical cable floats for flotation of power cable(s) shall be provided. Attachment of cable(s) and supply of junction box/disconnect at the basin wall shall be the responsibility of the installing contractor.

l. The aerator shall meet the following criteria:

Aerator Quantity	(3)	Total	
Motor			
Size	60	HP	
RPM	1200	RPM	
Efficiency	Standard		
Mounting Base Materials		304	Stainless Steel
Diffusion Head			
Casting Material		304	Stainless Steel
Float			
Diameter (minimum)		114.5	inches
Shell Material		fiber reinforced polyester skin FRP	
Intake Cone Material		304	Stainless Steel

m. The Aerator shall be the Aqua-Jet by Aqua Aerobics, or approved

equal.

2. Mixer
   a. Furnish two (2) mechanical floating mixers and related equipment accessories as described herein for each aeration basin.
   b. The mixer shall meet the requirements described in Section 2.02.B.1 of this specification, unless otherwise noted herein.
   c. Each unit shall be provided with a mooring system consisting of three (3) mooring cables made of 304 stainless steel. The mooring system shall also consist of clips, thimbles, quick disconnects, extension springs, and stainless steel anchors for connection to mooring posts. Installation of and connection to mooring posts is the responsibility of the installing contractor.
   d. The mixer shall meet the following criteria:

Mixer Quantity	(6)	Total
Mixer Properties		
Zone of Complete Mix	65	ft
Direct Pumping Rate	7,680	gpm
Recirculation Rate	253,000	gpm
MLSS	3,500	mg/l or less
Motor		
Size	10	HP
RPM	900	RPM
Efficiency	Standard	
Mounting Base Materials	304	Stainless Steel
Float		
Diameter (minimum)	84	inches
Shell Material	Fiber Reinforced Polyester Skin FRP	
Impeller Volute Material	304	SS

3. Low Load Recycle Pump
   a. Furnish a single external non-clog pump for one (1) aeration basin as specified herein. The Low Load Recycle Pump will transfer flows as needed during low flow operations to the Anoxic Reactor to maintain desired dissolved oxygen levels.
   b. The pump shall be provided with a 2.0 hp TEFC motor and gearmotor and shall be wired for 460 volt, three phase, 60 hertz operation. Pump shall be provided with 3" suction and discharge flanged connections. The pump shall be provided with a pump base and 304 stainless steel anchors for field anchoring to concrete slab. Supply of all piping, supports, gaskets, and hardware from the pump inlet and discharge connections shall be the responsibility of the installing contractor.
   c. The pump shall be supplied with two (2) manual plug valves and a single check valve for intake and discharge connections. Plug valves shall have 125# flanged end connections, ASTM A-126 Class B cast iron body with welded in nickel seat, EPDM or neoprene coated

ductile iron plug. The valve shall be a non-lubricated type with a port area of at least 80% of full pipe size. Plug valves shall be of the manual hand lever type. Check valve shall be a Nibco F-918-B with cast iron body and bronze disk to prevent backflow. Valve(s) shall be provided loose for installation within the discharge piping by the installing contractor. Valve gaskets and hardware shall be supplied by the installing contractor.

d. The recycle pump shall meet the following criteria:

Pump Quantity	(1)	Total
Motor Size	2.0	HP
Pump Flow rate and Required total dynamic head (TDH)		
100 GPM at 21 TDH		
Pump Manufacturer	Flygt, Gorman-Rupp, approved equal	
Intake/Discharge Valve(s)		
Actuator type	Manual, hand lever	
Manufacturer	Milliken, or approved equal	
Diameters		
Discharge pipe	3	inches
Valve(s)	3	inches

4. Dissolved Oxygen Sensor and Controller
   a. Furnish one (1) controller with dissolved oxygen sensor per aeration basin.
   b. The dissolved oxygen sensor shall be suspended on a removable mounting pipe assembly. Stainless steel pipe, stainless supports and stainless steel anchors shall be provided. Field attachment of the pipe and supports to the basin shall be the responsibility of the installing contractor. Field wiring, conduit, and installation of cable shall be the responsibility of the installing contractor.
   c. The controller will communicate with the main PLC via 4-20 mA signals. The controller will have a NEMA 4X enclosure with corrosion-resistant finish and shall be AC powered from a 100-230VAC, power source. The controller shall have a maximum of 2 inputs. Each module shall include a sun shield.
   d. The dissolved oxygen sensor and controller shall be manufactured by ABB, or approved equal.

2.04 PHASE SEPARATOR

A. General
   1. The Phase Separator shall receive return activated sludge and allow for enhanced concentration of the sludge, while withdrawing supernatant for return to the aeration basins.
   2. The Phase Separator shall be field constructed of concrete as shown on the drawings.

B. Equipment
   1. Phase Separator Inlet Baffle

a. Furnish one (1) Phase Separator Inlet Baffle to diffuse incoming RAS flow from the secondary clarifiers, as shown on the drawings. The baffle shall be constructed of 304 stainless steel and include mounting hardware and adhesive anchors. Field attachment of the baffle assembly to the basin shall be the responsibility of the installing contractor.

2. Phase Separator Supernatant Weir
   a. Furnish one (1) v-notch weir, located on the phase separator supernatant trough as shown on the drawings. The weir shall consist of 7.5" center v-notches and shall extend the length of the phase separator. Weir shall be constructed of 304 stainless steel and include mounting hardware and adhesive anchors. Field attachment of the weir to the basin shall be the responsibility of the installing contractor.

2.05 PRE-ANOXIC REACTOR

A. General
   1. The Pre-Anoxic Reactor shall receive concentrated return activated sludge from the Phase Separator and provide anoxic conditions, while allowing for the withdrawal of waste activated sludge.
   2. The Pre-Anoxic Reactor shall be field constructed of concrete as shown on the drawings.

B. Equipment
   1. Rotating Scum Skimmer
      a. Furnish one (1) 10" diameter slotted pipe. The skimmer shall be 3 ft long and constructed of 304 stainless steel. Mounting hardware, support brackets and adhesive anchors shall be 304 stainless steel. To be installed by the installing contractor.
   2. Mixer
      a. Furnish one (1) mechanical floating mixers and related equipment accessories as described herein for the Pre-Anoxic Reactor.
      b. The mixer shall meet the requirements described in Section 2.02.B.1 of this specification, unless otherwise noted herein.
      c. The mixer shall meet the following criteria:

Mixer Quantity	(1)	Per basin
Mixer Properties		
Zone of Complete Mix	45	ft
Direct Pumping Rate	3,560	gpm
Recirculation Rate	117,000	gpm
Motor		
Size	3	HP
RPM	1200	RPM
Efficiency	Standard	
Mounting Base Materials	304 Stainless Steel	
Float		

Diameter (minimum)	71	inches
Shell Material	Fiber Reinforced Polyester Skin FRP	
Impeller Volute Material	304 SS	

3. Transfer Pump
   a. Furnish three (3) submersible non-clog pump(s) for the Pre-Anoxic Reactor basin as specified herein.
   b. Each pump shall be equipped with a submersible electrical motor connected for three phase operation. Pump housing shall be painted cast iron. Pump shall include an adequate length of multi-conductor chloroprene jacketed type SPC cable suitable for submersible pump applications. The power cable shall also be sized according to NEC and ICEA standards. The pump shall be supplied with a mating cast iron discharge elbow. Each unit shall be fitted with an adequate length of steel lifting chain of adequate strength to permit raising and lowering the pump.
   c. The pump shall be capable of handling raw, unscreened sewage. The discharge connection elbow shall be permanently installed with the discharge piping. The pump shall be automatically connected to the discharge connection elbow when lowered into place, and shall be easily removed for inspection or service. There shall be no need for personnel to enter the basin or pump well. Sealing of the pumping unit to the discharge connection elbow shall be accomplished by a simple linear downward motion of the pump.
   d. An upper guide bar bracket shall be provided with each pump. The entire weight of the pumping unit shall follow guide bars into the operating position and pressed tightly against the discharge connection elbow with metal-to-metal contact. No sealing of the discharge interface by means of a diaphragm, O-ring, or other devices shall be acceptable. The pump, with its appurtenances and cable, shall be capable of continuous submergence underwater without loss of watertight integrity to a depth of 65 ft.
   e. Supply of all discharge piping, supports, gaskets, and hardware beyond the flanged connection specified above shall be the responsibility of the installing contractor.
   f. Each pump shall include a discharge valve to control the design transfer flow rate. Valve shall have a 125# flanged end connection, ASTM A-126 Class B cast iron body with welded in nickel seat, EPDM or neoprene coated ductile iron plug. The valve shall be a non-lubricated type with a port area of at least 80% of full pipe size. The valve operator shall be of the manual hand lever type. Each pump shall include a Nibco F-918-B check valve with cast iron body and bronze disk to prevent backflow. Valve(s) shall be provided loose for installation within the discharge piping by the installing contractor. Valve gaskets and hardware shall be supplied by the installing contractor.

g. The transfer pumps shall meet the following criteria:

Pump Quantity	(3)	Total
Motor Size	5.5	HP
Pump Flow rate and Required total dynamic head (TDH)		
100 GPM at 31.0 ft. TDH and 740 GPM at 15 TDH		
Pump Manufacturer	Flygt, or approved equal	
Discharge Valve		
Actuator type	Manual, hand lever	
Manufacturer	Milliken, or approved equal	
Diameters		
Discharge connection elbow	4	inches
Discharge pipe	4	inches
Valve(s)	4	inches
Materials of Construction		
Lifting chain	304 SS	
Upper guide bars and bracket	Galvanized	

4. Waste Sludge Pump

a. Furnish one (1) submersible non-clog Waste Sludge Pump for the Pre-Anoxic basin as specified herein.

b. The pump shall be equipped with a submersible electrical motor connected for three phase operation. Pump housing shall be painted cast iron. Pump shall include an adequate length of multi-conductor chloroprene jacketed type SPC cable suitable for submersible pump applications. The power cable shall also be sized according to NEC and ICEA standards. The pump shall be supplied with a mating cast iron discharge elbow. Each unit shall be fitted with an adequate length of steel lifting chain of adequate strength to permit raising and lowering the pump.

c. The pump shall be capable of handling raw, unscreened sewage. The discharge connection elbow shall be permanently installed with the discharge piping. The pump shall be automatically connected to the discharge connection elbow when lowered into place, and shall be easily removed for inspection or service. There shall be no need for personnel to enter the basin or pump well. Sealing of the pumping unit to the discharge connection elbow shall be accomplished by a simple linear downward motion of the pump.

d. An upper guide bar bracket shall be provided with each pump. The entire weight of the pumping unit shall follow guide bars into the operating position and pressed tightly against the discharge connection elbow with metal-to-metal contact. No sealing of the discharge interface by means of a diaphragm, O-ring, or other devices shall be acceptable. The pump, with its appurtenances and cable, shall be capable of continuous submergence underwater without loss of watertight integrity to a depth of 65 ft.

e. Supply of all discharge piping, supports, gaskets, and hardware beyond the flanged connection specified above shall be the

responsibility of the installing contractor.

f. The waste sludge pump shall meet the following criteria:

Pump Quantity	(1)	Total
Motor Size	2.4	HP
Pump Flow rate and Required total dynamic head (TDH)		
40 GPM at 27 ft. TDH and 100 GPM at 21 TDH		
Pump Manufacturer	Flygt, or approved equal	
Diameters		
Discharge connection elbow	3	inches
Discharge pipe	3	inches
Materials of Construction		
Lifting chain	304	SS
Upper guide bars and bracket	Galvanized	

5. Pressure Transducer
   a. Furnish one (1) submersible pressure transducer unit constructed of stainless steel as specified herein.
   b. The pressure transducer shall meet the requirements described in Section 2.02.B.2 of this specification.
6. Level Sensor
   a. Furnish one (1) level sensor assembly consisting of a float switch with a smooth, chemical resistant polypropylene casing, and 316 stainless steel mounting bracket for the Pre-Anoxic Reactor basin.
   b. The level sensor shall meet the requirements described in Section 2.02.B.3 of this specification.

2.06 CONTROL PANEL WITH MOTOR STARTERS

A. General
   1. The control system shall be designed to optimize the PASS process while minimizing operator attention and to accommodate the continuous maximum daily flow. The control software program shall be factory tested prior to installation at the jobsite.
   2. The control system shall provide control, sequence, monitoring, and alarm annunciation capabilities. The operator shall be able to access the timer values and set points through the operator interface panel to allow for adjustment and system flexibility. The control system shall be designed to automatically accommodate the plant's full range of loads and flows.

B. Construction
   1. A complete control system shall be provided as described below and as shown on the contract drawings.
   2. The control system shall include a circuit breaker disconnect, control transformer, branch protection, motor starters, microprocessor control, indicator lights, HAND-OFF-AUTOMATIC selector switches.
   3. The incoming service of the control system shall be 460 volt, 60 hertz, three-phase.
   4. Motor starters for the equipment listed below shall be provided within the

PASS control panel. Variable Frequency Drives shall be provided in the control panel where indicated below. Elapsed time indication shall be provided through the operator interface of the PASS control panel for equipment indicated by an asterisk (*).

a. Anaerobic Reactor
   - 5 hp Mixer (1)

b. Aeration Reactor
   - 60 hp Aerator(s)* (3)
   - 10 hp Mixer(s)* (6)
   - Low Load Recycle Pump* (1)

c. Pre-Anoxic Reactor
   - 3 hp Mixer (1)
   - 5.5 hp Transfer Pump(s)* (3)
   - 2.4 hp Waste Sludge Pump* w/ VFD (1)

5. In addition, controls as shown on the contract drawings for the following equipment shall be included in the PASS control panel.

a. Anaerobic Reactor
   - 4-20 mA Pressure Transducer (1)
   - Level Switch (1)

b. Aeration Reactor
   - 4-20 mA D.O. signals (3)
   - 4-20 mA Flow Signal (3)
   - Common Alarm (1)

c. Pre-Anoxic Reactor
   - 4-20 mA Pressure Transducer (1)
   - Level Switch (1)

6. All control enclosures shall be custom assembled and wired in an Underwriters Laboratories (UL) certified cabinet shop using quality materials and labor. Short circuit rating of control enclosure shall be 5 kA RMS symmetrical @ 480VAC maximum. Enclosure shall be NEMA 4X as specified in the related specification.
7. A 304 10 gauge stainless steel sun shield shall be included. A sunshield shall over hang the front of the panel a minimum of 10".
8. A thermostat controlled air conditioner with noise suppression shall be supplied to protect control components mounted inside the enclosure from high temperatures, humidity and ambient air contaminants. The air conditioner shall be constructed of brushed finish stainless steel 304 material and provide NEMA 4X Type protection from outdoor and hose-down applications. The air conditioner unit shall use CFC-free or environmentally safe refrigerant that is universally accepted. The air conditioner shall be manufactured by Hoffman or approved equal.
9. A full voltage non-reversing Integrated Motor Starter-Controller shall be provided for motor applications up to 15 kW. Each starter shall provide control, protection and monitoring functions for the motor. The starter shall be NEMA rated IEC form factor and shall have certifications according to UL and CSA standards and shall bear the CE marking. The starter shall have

a maximum rated operational voltage of 690V and provide a 42kA @ 480 VAC rated breaking capacity on short circuit. The starter shall have a mechanical durability of 15 million operations. The starter shall provide short circuit trip, thermal overload trip with selectable tripping class, under current trip and phase imbalance trip.

10. A solid state reduced voltage starter shall be provided for motor applications over 15 kW. The starter shall be 480V AC, 3-phase, rated and used for the controlled starting and/or stopping of AC induction motors. The controller shall comply with UL, CSA, EN/IEC standards. Each controller shall have selectable (off, 10, 15 or 20) overload trip class protection, over-temperature monitoring, phase reversal protection, phase loss, and phase imbalance features. The 120/240V AC integral control module provides reset and test pushbuttons with fault LEDs. Each controller provides auxiliary contacts rated for 0.6 Amps at 120V AC. The solid state reduced voltage starter shall be Allen Bradley SMC-3 or approved equal.
11. Operator devices (pushbuttons and selector switches) shall be mounted through the control enclosure door for all automatic controlled equipment. All operator devices shall be UL Listed, 30.5mm style, NEMA Type 4X rated, oil and water tight with finger safe guards located on the contact blocks to prevent accidental contact with wire connections. Operator device function shall be identified with an engraved white Gravoply nameplate with black letters. Operator devices shall be Square D 9001 or approved equal. Transformer type pilot lights and illuminated pushbuttons shall be provided for indication of an operation status. Lights shall be a 6 VAC incandescent type lamp. Color coding shall be applied as required and is as follows:

    Amber – Alarm active, caution
    Green – Valve open, motor running
    Red – Valve closed
    White - Information

12. A UL listed, industrial grade, compact power supply shall be supplied to provide 24 VDC power to such rated components. The power supply shall be DIN rail mounted and functional with input voltage of 100 to 240 VAC (single-phase) incoming control power. The power supply shall have a green LED which shall be illuminated when output voltage is “OK”. The power supply shall be an Allen Bradley 1606 or approved equal.
13. Automatic operation of the PASS shall be controlled through a programmable logic controller (PLC) mounted inside the PASS control panel. The PLC components shall consist of a power supply, CPU, discrete input and output modules and analog input and output modules. The processor unit shall include built-in USB and two (2) Ethernet IP communication ports. All input and output points supplied (including unused) shall be wired to terminal blocks. Processor design characteristics shall include: 1.0MB user memory size, real-time clock and calendar, battery backed RAM and an operating temperature range between 32 °F and 140°F. The PLC processor shall be an Allen-Bradley CompactLogix 1769-

L30ER or approved equal.

14. Modular equipment shall be provided to complete the PLC system. These Allen-Bradley components include: 1769-PA4 – Power Supply, 1769-IA16 – Discrete input (16 point) modules, 1769-OW16 – Discrete output (16 point) modules and 1769-IF8 – Analog input (8 point) modules, 1769-OF4CI – Analog output (4 point) modules.
    d. PLC Power Supply - Input voltage range of 85-265 / 170-265 VAC, 47-63 Hz, maximum inrush current of 30 amps, backplane output current of 4 amps @ 5V or 2 amps @ 24V, internal fuse protection, ambient operating temperature of 32°F to 140°F, Class I, Division 2 hazardous location certified, UL Listed.
    e. Discrete Input Module - Operating voltage of 79 to 132 VAC at 47 to 63 Hz, backplane current draw at 5VDC = 115mA , off-state current 2.5mA maximum, maximum inrush current 250mA, LED status indication of each point, ambient operating temperature of 32°F to 140°F, UL Listed.
    f. Discrete Output Module - Operating voltage of 5 to 265 VAC at 47 to 63 Hz / 5 to 125 VDC, backplane current draw at 5 VDC = 205mA , at 24VDC = 180mA, off-state current leakage is 1.0mA, LED status indication of each point, ambient operating temperature of 32°F to 140°F, UL Listed.
    g. Analog Input Module - Backplane current draw at 5 VDC = 120mA, at 24VDC = 70mA, LED status indication of each point, ambient operating temperature of 32°F to 140°F, UL Listed.
    h. Analog Output Module - Backplane current draw at 5 VDC = 120mA, at 24VDC = 170mA, LED status indication of each point, ambient operating temperature of 32°F to 140°F, UL Listed.
15. A human machine interface (HMI) shall be furnished with the control panel. The operator interface shall be a NEMA Type 12, 13, 4X rated, 10.4" diagonal, color touchscreen display with Ethernet and serial communications. The interface shall be a liquid crystal display (LCD). The display type shall be color active matrix thin-film transistor (TFT) with 800 x 600 pixel resolution. The rated operating temperature shall be 32° to 131° F (0° to 55° C). The operator interface shall be an Allen Bradley PanelView Plus 7 Performance 10".
16. Additional control panel components shall be as shown in the drawings and specified in related sections.
17. Panel shall include 120V/2A fuse blocks for all 120V field mounted transmitters, including, but not limited to, DO Controllers (1-3), WAS Flow Transmitter, and RAS Flow Transmitter.
18. The control panel shall include the following outputs for remote monitoring by Owner's SCADA system:
    a. Analog Outputs for Basin 1, 2, and 3 DO
    b. Analog Output for RAS Flow
    c. Auxiliary Sets of Contacts for Mixer 1A, 1B, 2A, 2B, 3A, 3B RUN and Aerator 1, 2, 3 RUN.

d. Auxiliary Sets of Contact for System Fault

PART 3 EXECUTION

3.01 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials and equipment to site in a timely manner as to prevent delaying the work.

B. Inspect all boxes, crates, and packages upon delivery to site and notify Engineer in writing of loss or damage to materials or equipment. Promptly remedy loss and damage to new condition in accordance with manufacturer's instructions.

C. Store materials to permit easy access for inspection and identification. Keep materials and equipment off ground using pallets, platforms, or other supports in an organized manner. Protect steel, packaged materials, motors, and electronics from corrosion and deterioration.

D. Install materials and equipment in conformance with applicable standards, manufacturer's instructions and recommendations, and the Contract Documents.

3.02 SPARE PARTS

A. System manufacturer shall supply the following spare parts as well as any additional parts recommended for one year's operation:
   1. (1) of each PLC I/O module
   2. (1) of each fuse, control relay, and indicating light replacement bulb
   3. (1) Input card
   4. (1) Output card

B. Parts shall be packaged in protective enclosure suitable for storage and shipped separately to minimize possibility of damage.

3.03 STARTUP AND FIELD TESTING

A. Following complete installation of all equipment, the PASS should be operated under normal operating conditions to test performance. The system shall, at minimum, meet the effluent parameters outlined in 2.01.I.

B. The manufacturer shall furnish the services of a factory trained representative to inspect the Contractor's equipment installation, supervise the initial operation of the equipment, instruct the plant operating personnel in proper operation and maintenance, and provide process assistance

C. Partial startup may be warranted to maintain normal plant flows during construction. In the event that a phased startup is necessary, coordinate with the manufacturer and Engineer for recommended phasing instructions, and schedule activities with plant operations staff.

END OF SECTION

SECTION 46 61 00

TERTIARY FILTER

PART 1 GENERAL

1.01 SCOPE

Furnish all materials, labor, and equipment to properly install an operational tertiary filter system as shown on the plans or as directed by the Engineer for the proper completion of the work included under this contract whether shown expressly on the plans or implied by other requirements. The tertiary filter system shall be comprised of two (2) basins or filter trains for redundancy.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. 03 31 00 - Cast-in-Place Concrete

B. 26 00 00 - General Electrical Provisions

C. 33 11 13 - Ductile Iron Pipe and Fittings

D. 40 05 51 - Valves

1.03 SUBMITTALS

A. Complete product data and engineering data, including shop drawings, shall be submitted to the Engineer in accordance with the requirements of Section 01 33 00 of the Contract Documents.

B. Submittals shall include: drawings, cut sheets, media area calculations, hydraulic loading rate calculations, solids loading rate calculations, and hydraulic profile through the filter.

PART 2 PRODUCTS

2.01 GENERAL

A. The filter supplier shall have experience in the design and manufacture of cloth media filters for a minimum of ten (10) years and shall be able to demonstrate a minimum of fifty (50) installations within the United States in municipal wastewater applications with cloth media.

B. These specifications and accompanying drawings are based upon the use of a system manufactured by Aqua-Aerobic Systems, Inc. Additional manufacturers

will be acceptable with similar components and proof of equivalent performance. All costs associated with any redesign necessary for a different manufacturer shall be the responsibility of the Contractor.

C. The Manufacturer shall provide a written warranty against defects in materials and workmanship. Manufacturer shall warrant the goods provided by the Manufacturer to be free from defects in materials and workmanship under normal conditions and use for a period of one (1) year from the date the goods are put into service, or eighteen (18) months from shipment of equipment, whichever first shall occur. This warranty shall not apply to any goods or parts which have been altered, applied, operated or installed contrary to the Manufacturer's instructions or subject to misuse, chemical attack/degradation, negligence or accident.

D. Manufacturer shall provide certified third-party testing or peer reviewed journal article demonstrating the ability of the filtration technology to remove greater than 90% of microplastics.

E. Design Parameters

1.	Average Daily Flow	1.51 MGD
2.	Maximum Daily Flow	3.54 MGD
3.	Filter Influent TSS	10 mg/l (avg) and 15 mg/l (max)
4.	Filter Effluent TSS	< 10 mg/l monthly average
5.	Filter Influent BOD	10 mg/l average daily
6.	Filter Effluent BOD	< 5 mg/l average daily
7.	Filter Influent Total Phosphorus	2 mg/l average daily
8.	Filter Effluent Total Phosphorus	< 1 mg/l monthly average

F. This contract is partially funded by the GEFA CWSRF and the equipment manufacturer shall meet the requirements identified in the SRF Supplemental General conditions.

2.02 FILTER TANK

A. The filter tank shall be field constructed of concrete as shown on the drawings.

B. Pre-assembled tanks shall be allowed; however, the Contractor shall be responsible for any costs related to redesign that may be necessary. Any alternate tank design shall be submitted to the Engineer for approval.

2.03 DRIVE ASSEMBLY

A. Each filter shall include an adjustable drive assembly with a gearbox, nylon drive sprocket, acetal drive chain with 304 stainless steel link pins, and a 304 stainless steel chain guard. The gearbox shall be parallel in-line helical type, AGMA Class 1 with a ¾ HP drive motor rated for 230 volt, 3 phase, 60 Hz. Gear reducer shall be Nord or approved equal. Drive motor shall be Nord, Weg, Baldor, or approved equal.

B. To reduce energy demand, the drive assembly shall rotate the disks only during

backwash. Systems requiring constantly rotating disks during filtration will not be acceptable.

C. If motors and gearboxes require routine maintenance, and are not accessible from the outside tank side walls, the equipment manufacturer shall provide an internal access platform between the tank side walls and motors and gearboxes.

2.04 CENTERTUBE ASSEMBLY

A. Each centertube assembly shall include a minimum 3/16", 304 stainless steel centertube weldment, driven sprocket, wheel assemblies, 304 stainless steel disk segment rods, and frame and cloth assemblies. Each centertube assembly shall also include a Viton v-ring effluent port seal which provides superior chlorine resistance. Materials other than Viton are not acceptable for seal materials. Systems with swivel joints requiring routine lubrication are not acceptable. The driven sprocket shall be multi segment made of UHMW polyethylene. All fasteners shall be stainless steel.

B. Each centertube assembly shall be capable of accepting eight (8) filter disc assemblies.

2.05 FILTER MEDIA

A. Each cloth disk assembly shall be comprised of six (6) individual segments, each consisting of a cloth media sock supported by an injection molded glass filled polypropylene frame with corrosion resistant assembly hardware. Cloth/frame assemblies shall be constructed such that each segment is easily removable from the centertube, without special tools, to allow for removal and replacement of the cloth at the point of installation. Systems requiring special tools and/or the return of media segments to the factory for replacement will not be considered.

B. If the wet weight of the filter disk segment is greater than 50 pounds, a lifting mechanism shall be provided.

C. Each basin shall include four (4) cloth disk assemblies.

D. Cloths shall be of fiber pile construction having a nominal filtration rating of 10 microns. The pile cloth shall be free chlorine resistant cloth.

E. The cloth media shall have an active filter depth of 3 to 5 mm to provide additional collisions between solids particles and the media within the media depth, resulting in capture of solids across a broader particle range. The cloth depth shall also provide storage of captured solids, reducing backwash volumes while maintaining an operational headloss. Woven mesh or microscreen type media with no filtration depth are not acceptable.

F. Individual pile fibers shall be held in place by a support backing integral to the media. To facilitate proper flow of backwash water through the cloth, the medium's back side shall be of open construction consisting of 10% open area at least 50 times larger than the nominal filtration media in any direction. Media that uses sewn in support structures, which have the potential to prevent free flow through the media, shall not be allowed.

G. Cloth media breaking strength and elongation shall be tested in accordance with

ASTM Standard D5035 2R-E method by an ISO certified laboratory specializing in textile testing. Breaking strength shall be in excess of 200 lbf (890 N) in the warp and the weft direction. Elongation shall be less than 10% at 60 lbf (270 N) in the warp and the weft direction. Test reports shall be provided with submittals to demonstrate compliance with this requirement.

H. To avoid excessive media movement, deformation and folding during backwash, the maximum distance between cloth restraints must not exceed 36 inches.

2.06 FILTER HYDRAULICS

A. Filter isolation shall be possible by operation of a valve as shown in the drawings. Refer to Specification 40 05 51 for details of these isolation valves.

B. During filtration, the filter unit shall operate in a static condition with no moving parts. Filtered effluent shall be used for backwashing. The filter system shall provide for the collection of filtered solids on the outside of the cloth media surface to allow for the direct contact of cleaning systems. The filter flow path shall be from the outside of the cloth frame to the inside. Systems with flow paths from the inside to the outside of the cloth frame that collect filtered solids and plastic debris on the interior surfaces of the cloth frame will not be acceptable.

C. Only media area below the effluent weir elevation will be considered in the filtration area calculation since this is the only area that is submerged and available for filtration 100% of the time.

D. Submittal information shall include calculations that verify the effective filtration surface area. Media surface fused directly to support structure such that water cannot pass through the media shall not be included in these calculations

E. The filter shall be capable of operating with a headloss not to exceed 1.5 feet.

2.07 BACKWASH SYSTEM

A. The backwash function shall incorporate a pump that draws filter effluent through the filter media as the media rotates past the fixed backwash shoe, thereby removing accumulated solids from the media surface. Each disk shall be cleaned by a minimum of two backwash shoes, one on each side. The backwash shoes shall remain in a fixed position. Springs shall be used to maintain the proper tensioning of the backwash shoe against the media surface.

B. The backwash shoe shall be in direct contact with the media to ensure effective media cleaning. Systems utilizing media cleaning mechanisms that do not contact the filter media will not be acceptable.

C. Neither the cloth / support assemblies nor the backwash shoes shall include any gridwork overlays or other interferences that would prevent direct contact of the backwash shoes with the cloth fibers.

D. The backwash system shall include 304 stainless steel backwash shoe supports with UHMW backwash shoes, 316 stainless steel springs reinforced PVC flexible hose with stainless steel hose clamps, 304 stainless steel backwash manifolds.

E. Each backwash/waste pump assembly shall include a backwash/waste pump, valves, and gauges. In the external piping shall be backwash and solids waste

valves, recirculation ball valve(s), 3" manually operated flow control gate valve for each pump, vacuum gauge(s), and pressure gauge(s).

F. The backwash/waste pump(s) shall be shipped loose for field installation by the installing contractor. Backwash piping between the filter tank and pump(s) as well as piping following the pump(s) shall be supplied by the installing contractor. Installing contractor shall supply unions or flanges for service, wiring, and factory installed conduit shall be provided within 3 feet of the pump(s).

G. The backwash/waste pump(s) shall be a Gorman Rupp model 12B20-B, externally mounted centrifugal pump, or approved equal. Pump shall be provided with a 2 HP, 230 volt, 3 phase, 60 Hz motor and operate at 1750 RPM. Pump shall be rated for 130 gpm at 23.2 ft TDH with 12.2 ft allowable discharge head after losses in internal filter piping have been accounted for. Motor shall be Baldor, Teco, Weg or approved equal.

H. Backwashing shall be initiated by tank water level, timer, or manually through the operator interface. Operator shall have the ability to specify backwash time interval elapses through the operator interface. The backwash water shall be pressurized by the filter's backwash/waste pump for discharging from the filter system. Systems utilizing non-pressurized backwash flow will not be accepted. Backwash pumps using a belt drive shall not be acceptable due to routine tensioning and other maintenance requirements.

I. The vacuum gauge(s) shall have a minimum 2.5" dial with all stainless steel welded construction, 0-30" Hg vacuum range, liquid filled, ¼" NPT process connection, 316 stainless steel bourdon tube and tip material, and bronze socket material, Ashcroft or approved equal.

J. The pressure gauge(s) shall have a 2.5" dial with a black painted steel case, 0-15 psi, heat resistant polycarbonate window, ¼" NPT process connection, "C" shaped bronze bourdon tube, and brass socket material, Ashcroft or approved equal.

K. Filtering shall not be interrupted during normal backwashing and solids waste discharge.

2.08 VALVES

A. Each filter shall include four 2" backwash valve(s). Valve(s) shall be 3 piece, grooved end, ASTM A351 Grade CF8M stainless steel body, 316 stainless steel ball and stem, fullport, installed with painted cast iron Victaulic couplings, with a 115 volt, single phase, 60 Hz, open / close service electric actuator. Valve / actuator combination shall be TCI / RCI (RCI, a division of Rotork), Nibco, or equal. Valve actuator shall include a compartment heater and limit switch feedback to the microprocessor in both the open and closed positions. Non full port valves such as butterfly valves or plastic valves shall not be acceptable.

B. Each filter shall include one 2" solids waste valve. Valve shall be 3 piece, grooved end, ASTM A351 Grade CF8M stainless steel body, 316 stainless steel ball and stem, fullport, "installed with" painted cast iron Victaulic couplings, with a 115 volt, single phase, 60 Hz, open / close service electric actuator. Valve / actuator combination shall be TCI / RCI (RCI, a division of Rotork), Nibco, or equal. Valve actuator shall include a compartment heater and limit switch feedback to the

microprocessor in both the open and closed positions.

C. The pump control valve shall be a manually operated threaded gate valve, Class 125 bronze with screw in bonnet, non-rising stem, and solid wedge. Valve shall conform to MSS SP-80 and shall be Nibco or approved equal.

D. The recirculation ball valves shall be 3-inch threaded ball valves with a two-piece, full port, and a brass body. Valves shall be Nibco or approved equal.

E. Each filter shall include a solids waste removal system in the floor of the filter tank. The manifold shall be designed to siphon settled solids waste for discharge through the backwash/waste pump. The operation of the solids waste removal system shall be automatic with user adjustable intervals and duration through the operator interface. Filters that are designed without a solids waste removal system will not be acceptable.

2.09 PROCESS INSTRUMENTATION

A. A pressure transmitter shall be provided for each filter. The pressure transmitter shall have stainless steel wetted parts and provide a 4-20 mA signal over a range of 0 psi to 5 psi. Unit shall monitor the water level of each filter tank. Transmitter shall be flush mounted to the tank wall. Transmitter shall be manufactured by Keller or approved equal.

B. A float switch shall be furnished with each filter to indicate emerging overflow level. The float switch shall be Anchor Scientific Model GSI 40NONC-STO or approved equal. The float shall contain a non-mercury switch, chemical resistant polypropylene casing and a PVC #18 AWG three conductor cable. Switch rating shall be minimum 4.5 amps non-inductive at 120 VAC.

C. A vacuum transmitter shall be provided with each filter. The vacuum transmitter shall have stainless steel wetted parts and provide a 4-20 mA signal over a range of -30 to 0 inHg. Transmitter shall be an IFM Effector PX series or approved equal.

2.10 CONTROL SYSTEM

A. The automatic and manual controls for operation of the Filter system shall be furnished fully assembled, wired and pre-programmed in a UL 508A Certified Industrial Control Panel. Controls shall be provided to control or monitor equipment as described in the contract drawings.

B. All Control panels shall be UL certified. Testing by manufacturer's electrical engineering prior to releasing for shipment shall be completed. Testing shall consist of the following:

Point to point testing of all wiring prior to application of power
Intended supply voltage shall be applied to the enclosure
All components shall be tested for proper operation and calibration
The PLC and operator interface program shall be loaded and functionally checked
All components shall be checked to confirm proper mounting specifications have been followed
Enclosure shall be inspected for defects and repaired if necessary
All labeling of wires and devices are correct, properly installed and clean

C. The manufacturer shall finalize the factory checkout by completing a control panel checklist to document all testing completed above. Upon the successful completion of the control testing of the enclosure assembly, all applicable documentation (i.e. finalized drawing set, signed control checklist cover page, device data sheets, etc.) shall be placed in the drawing pocket of the enclosure.

D. The automatic controls shall be provided in a UL listed, NEMA Type 4X 304 stainless steel (14 gauge) rail mounted enclosure that provides insulation and protection for electrical controls and components from highly corrosive environments indoors and outdoors. Enclosure shall include a seamless foam-in-place gasket to assure watertight and dust-tight seal. An internal 3-point latch and 316SS padlocking POWERGLIDE® handle shall be provided. Enclosures shall be unpainted, with a smooth #4 brushed finish. Enclosure shall include a painted white mild steel (12 gauge) sub-panel mounted with collar studs. Enclosure shall be manufactured by Hoffman or approved equal.

E. A 304 10 gauge stainless steel sun shield shall be included. A sunshield shall over hang the front of the panel a minimum of 10".

F. A full voltage non-reversing Integrated Motor Starter-Controller shall be provided for motor applications up to 15 kW. Each starter shall provide control, protection and monitoring functions for the motor. The starter shall be IEC rated and shall have certifications according to UL and CSA standards and shall bear the CE marking. The starter shall have a maximum rated operational voltage of 690V and provide a 42kA @ 480 VAC rated breaking capacity on short circuit. The starter shall have a mechanical durability of 15 million operations. The starter shall provide short circuit trip, thermal overload trip with selectable tripping class, under current trip and phase imbalance trip.

G. A full voltage non-reversing IEC Style motor starter shall be provided for motor applications over 15 kW. Each starter shall consist of a circuit breaker, contactor and overload relay. The starter shall be IEC rated and shall have certifications according to UL and CSA standards and shall bear the CE marking. The starter shall have a maximum rated operational voltage of 690V and provide a minimum 18 kA @ 480VAC and 25 kA @ 240 VAC interrupt rating on short circuit when used in combination with a PowerPact circuit breaker. The starter shall have a mechanical durability of 15 million operations. The solid state overload relay shall have class 10 tripping characteristics with trip current adjustment, phase loss and unbalance protection.

H. Operator devices (pushbuttons and selector switches) shall be mounted through the control enclosure door for manual operation of the filter. All operator devices shall be UL Listed, 30.5mm style, NEMA Type 4X rated, oil and water tight with finger safe guards located on the contact blocks to prevent accidental contact with wire connections. Operator device function shall be identified with an engraved white Gravoply nameplate with black letters. Operator devices shall be Square D 9001 or approved equal. Transformer type pilot lights and illuminated pushbuttons shall be provided for indication of an operation status. Lights shall be a 6 VAC incandescent type lamp. Color coding shall be applied as required and is as follows:

Amber – Alarm active, caution

Green – Valve open, motor running

Red – Valve closed
White - Information

I. A UL listed, industrial grade, compact power supply shall be supplied to provide 24 VDC power to such rated components. The power supply shall be DIN rail mounted and functional with input voltage of 100 to 240 VAC (single-phase) incoming control power. The power supply shall have a green LED which shall be illuminated when output voltage is "OK". The power supply shall be an Allen Bradley 1606 or approved equal.

J. Automatic operation of the Filter shall be controlled through an Allen Bradley MicroLogix 1400 programmable logic controller (PLC) mounted inside the Filter control panel. The PLC components shall consist of a base unit, expansion I/O modules, and memory module. All input and output points supplied (including unused) shall be wired to terminal blocks. The PLC user memory shall consist of a minimum of 20K words of program and data. All PLC hardware shall be UL listed and operate at an ambient temperature of -4° to 140° F (-20° to 60° C).

K. The control system shall be equipped with a UL listed operator interface that provides control display screens. These screens shall be used by the operator to monitor and control filter status, setpoint and alarm information.

1. The Interface shall allow the Operator access to adjust the following operating parameters:
   a. Backwash interval, Backwash duration, Solids Waste interval, Solids Waste duration, Number of Backwashes between Solids Waste interval.
2. The operator interface shall provide information to assist the Operator in assessing the status of the filter system. The interface screen shall display, at minimum, the following parameters:
   a. Water level in the filter, Time since last Backwash, Time since last Solids Waste withdrawal, Elapsed time on the Drive Motor, Elapsed time on the Backwash/Waste Pump(s), Total Backwash time and cycles, Total Solids Waste withdrawal time and cycles.
3. The operator interface shall allow the Operator to initiate a backwash and control all electric actuated valves.
4. The interface shall display the alarm history. The alarm history shall include the time and date of the most recent 25 alarms along with the description of the alarm.
5. The interface shall also display current alarms, including the date, time and a description of the alarm.
6. As a diagnostic aid to the Operator, the interface shall display the time between Backwashes for the most recent 40 Backwashes.
7. The operator interface shall be a NEMA Type 12, 13, 4X rated, 6.5" diagonal, color touchscreen display with Ethernet and serial communications. The interface shall be a liquid crystal display (LCD). The display type shall be color active matrix thin-film transistor (TFT) with 640 x 480 pixel resolution. The rated operating temperature shall be 32° to 131° F (0° to 55° C). The operator interface shall be an Allen Bradley PanelView Plus 7 Performance 7".

PART 3 EXECUTION

3.01 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials and equipment to site in a timely manner as to prevent delaying the work.

B. Inspect all boxes, crates, and packages upon delivery to Site and notify Engineer in writing of loss or damage to materials or equipment. Promptly remedy loss and damage to new condition in accordance with manufacturer's instructions.

C. Keep materials and equipment off ground using pallets, platforms, or other supports. Protect steel, packaged materials, motors, and electronics from corrosion and deterioration.

D. Protect filter media from direct sunlight unlight startup.

E. Install materials and equipment in conformance with applicable standards, manufacturer's instructions and recommendations, and the Contract Documents.

3.02 SPARE PARTS

A. Filter manufacturer shall supply the following spare parts as well as any additional parts recommended for one year's operation:

(2) Frame and cloth assemblies
(1) Backwash/solids waste valve and actuator
(1) Viton V-ring effluent port centertube seal
(1) of each PLC I/O module(s) (if applicable)
At least (1) of each fuse, control relay, and indicating light replacement bulb.

B. Parts shall be packaged in protective enclosure suitable for storage and shipped separately to minimize possibility of damage.

3.03 STARTUP AND FIELD TESTING

A. Following complete installation of all equipment, the filter system should be operated under normal operating conditions to test performance. The system shall, at minimum, meet the effluent parameters outlined in 2.01.E

B. The equipment manufacturer shall furnish the services of a factory trained representative to inspect the installing contractor's equipment installation, supervise the initial operation of the equipment, instruct the plant operating personnel in proper operation and maintenance, and provide process assistance.

C. Coordinate startup with completion of downstream improvements and schedule with plant operations staff.

END OF SECTION

SECTION 46 73 21

AEROBIC DIGESTOR

PART 1 GENERAL

1.01 SCOPE

Furnish all materials, labor, and equipment to properly install an aerobic digestor with all related accessories at the locations shown on the plans or as directed by the Engineer for the proper completion of the work included under this contract whether shown expressly on the plans or implied by other requirements.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. 03 31 00 – Cast-in-Place Concrete
B. 26 00 00 – General Electrical Provisions
C. 40 05 51 - Valves
D. 40 23 00 – Wastewater Process Piping

1.03 SUBMITTALS

Complete product data and engineering data, including shop drawings, shall be submitted to the Engineer in accordance with the requirements of Section 01 33 00 of the Contract Documents.

PART 2 PRODUCTS

2.01 GENERAL

A. The Aerobic Digestor shall be field constructed of concrete as shown on the drawings.
B. The digestor shall utilize existing 25 hp floating mechanical aerators from the project site for primary mixing and aeration. One (1) floating aerator shall be installed for each digestor.
C. Additional equipment required for adequate operation of the each Aerobic Digestor includes:
    (1) 10 hp floating mixer assembly
    (1) Pressure transducer
    (1) Float switch
    (2) Restrained mooring systems
    (1) FRP dome assembly for the floating aerator to prevent splashing of

nearby equipment
(1) Control panel

D. These specifications and accompanying drawings are based upon the use of a system manufactured by Aqua-Aerobic Systems, Inc. Additional manufacturers will be acceptable with similar process components and proof of consistent performance. All costs associated with any redesign necessary for a different manufacturer shall be the responsibility of the Contractor

E. The manufacturer shall provide a written warranty against defects in materials and workmanship. Manufacturer shall warrant the goods provided by the Manufacturer to be free from defects in materials and workmanship under normal conditions and use for a period of one (1) year from the date the goods are put into service, or eighteen (18) months from shipment of equipment, whichever first shall occur. This warranty shall not apply to any goods or part which has been altered, applied, operated or installed contrary to the manufacturer's instructions or subject to misuse, chemical attack/degradation, negligence or accident.

F. This contract is partially funded by the GEFA CWSRF and shall meet the requirements identified in the SRF Supplemental General Conditions.

2.02 FLOATING MIXER ASSEMBLY

A. General
1. Furnish one (1) mechanical floating mixer and related equipment accessories as described herein for the Aerobic Digestor. The mixer shall be capable of maintaining complete mixed conditions, with biological suspension of all mixed liquor suspended solids without the introduction of air.

B. Construction
1. The mixer shall consist of a motor, direct-drive impeller driven at a constant speed, an integral flotation unit, and impeller volute. The mixer shall incorporate design enhancements that provide for three (3) years without routine maintenance (greasing).
2. The drive motor shall be vertical P base design, totally enclosed fan cooled TEFC, and generally rated for severe duty. The motor shall in all cases equal or exceed standard NEMA specifications. A minimum service factor of 1.15 shall be furnished. The motor winding shall be nonhygroscopic, and insulation shall equal or exceed NEMA Class "F". A lip seal shall be provided below the bottom bearing to prevent moisture from penetrating around the motor shaft. A condensate drain shall be located at the lowest point in the lower-end bell housing. Unit shall have a one-piece motor shaft continuous from the top motor bearing, through the lower bearing and down to and through the propeller. The shaft shall be manufactured from 17-4 PH stainless steel. Motor bearings shall be regreasable. Top bearing shall be shielded on the bottom side only. Bottom bearing shall be open. The top and bottom motor bearings shall be of combined radial and axial thrust

type. The lower motor bearing inner brace shall be locked to the motor shaft via a special washer and locking nut arrangement. The shaft shall be threaded just below the lower bearing and shall have a keyway cut into the motor shaft. This key shall accept a tab from the inner diameter of the locking washer, and the locking nut shall have recesses to accept a tab from the outer diameter of the locking washer to prevent the nut from backing off.

3. The motor shall be securely mounted onto a solid base, which is integral with the motor base extension. All submersed wetted motor mounting base components shall be constructed of 304 stainless steel. The upper portion of the motor mounting base, immediately below the lower motor bearing, shall include two independent acting air seals. The two seals shall be capable of sealing off the flow of air from the suction action of the pumped flow, and prevent backflow of liquid during impeller reversal. The lower end of the motor base extension shall be provided with a rotating backflow seal that will prevent grit from being introduced into the anti-deflection insert reservoir, but shall allow liquid to contact the shaft. The backflow seal shall not require scheduled lubrication or maintenance.
4. Each unit shall be equipped with a modular float with a central float passage of a size to allow installation and removal of the pump impeller. The float shall be foamed full of polyurethane foam of the closed cell type, and shall be totally sealed to prevent the foam from being in contact with the external environment.
5. The impeller shall be designed to pump the liquid from near the surface and direct it down toward the vessel/basin bottom. The impeller shall be a two-blade marine type precision casting of 316 or 15/5 stainless steel and shall be specifically designed for the application intended. It shall be dynamically and hydraulically balanced. The propeller must be attached to the motor shaft with a hardened stainless steel pin and set screw. Impeller shall be capable of being reversed to cause back flow liquid movement without causing damage to the mixer chassis and without causing upflow liquid damage to the motor bearing and windings. No liquid spray or other liquid leakage upward onto the surface of the motor support surface or flotation chassis will be allowed. The impeller shall operate in a volute made of stainless steel plate, minimum 3/16 inch thick.
6. The entire rotating assembly including the motor rotor, shaft, shaft accessories, and impeller shall be dynamically balanced within 2.0 mils peak-to-peak horizontal displacement measured at the upper and lower motor bearing. Measurements shall be taken at a frequency equivalent to the motor RPM. Measurements shall be taken with the motor in a vertical, shaft down position with the entire power section mounted on resilient pads.
7. Each unit shall be provided with a restrained mooring system, as described below:

Mooring Post Quantity:	Two
Mooring Post Diameter:	4 inch
Pylon Material:	Schedule 40

Base Plate Material:	Galvanized steel
Floor Connection:	Adhesive anchors by System Mfr
Electrical Cable:	#12-four conductor

The system shall consist of vertical pylons with base plate. Each pylon shall be filled with concrete by the installing contractor.

Furnished, as part of the unit, shall be a triangular mooring frame. The frame shall permit the assembly to move up and down following the change in liquid level while restrained within the vertical pylons. Removable 304 stainless steel U bolts shall be attached to each frame and fit around the pylons.

8. Each unit shall include power cable wired into the motor conduit box and terminating at the basin wall. Electrical cable shall be supplied with kellems grips at the motor and basin wall terminations. Electrical cable(s) shall be attached with cable ties provided by the equipment supplier. Attachment of cable and supply of junction box/disconnect at the basin wall shall be the responsibility of the installing contractor.
9. The mixer shall meet the following criteria:
   a. Zone of Complete Mix 55 ft
   b. Direct Pumping Rate 4,520 gpm
   c. Recirculation Rate 149,000 gpm
   d. Motor
      - Size 10 HP
      - RPM 1200 RPM
      - Efficiency Standard
      - Mounting Base Materials 304 Stainless Steel
   e. Float
      - Diameter (minimum) 71 inches
      - Shell Material Fiber Reinforced Polyester Skin FRP
   f. Impeller Volute Material 304 SS
   g. The mixer shall be the AquaDDM® by Aqua Aerobics, or approved equal.

2.03 PRESSURE TRANSDUCER

A. Furnish one (1) submersible pressure transducer unit constructed of stainless steel as specified herein.

B. Transducer shall utilize a diffused silicone semiconductor sensor protected by an integral stainless steel diaphragm with seal fluid. Transducer output shall be a 4-20 mA signal. Electrical connection shall be 2-wire, loop powered through a shielded integral cable comprised of 22 AWG conductors and separate drain wire.

C. Transducers shall be suspended on a removable assembly consisting of a PVC support pipe and EPDM hose. Removable assembly shall be supported by stainless steel supports, guide rail, and anchors. A moisture excluding aneroid bellows shall be supplied loose for installation in the junction box/ disconnect. Attachment and

supply of the junction box/disconnect at the basin wall shall be the responsibility of the installing contractor.

D. The Pressure Transducer shall be manufactured by Keller.

2.04 FLOAT SWITCH

A. Furnish one (1) level sensor assembly consisting of a float switch with a smooth, chemical resistant polypropylene casing, and 316 stainless steel mounting bracket for the Aerobic Digestor.

B. Each float switch shall be provided with a three conductor electrical cable. Electrical cable shall terminate at a junction box/disconnect located at the basin wall. Field wiring and junction box/disconnect shall be provided by the installing contractor.

C. The Level Sensor shall be the Anchor Scientific model GSI 40NONC or approved equal.

2.05 RESTRAINED MOORING SYSTEM

A. General

1. Each digestor basin shall be equipped with two (2) restrained mooring systems. One will anchor the existing 25 hp floating aerators, while the second will anchor the 10 hp floating mixer assembly, as described in 2.02.B.7.

B. Construction

1. Each Restrained Mooring System shall consist of vertical posts, or pylons, with base plates for mounting to the structure floor. Each post shall be filled with concrete after installation.
2. The mooring system shall include a triangular mooring frame. The frame shall permit the assembly to move up and down following the change in liquid level while restrained within the vertical pylons. Removable 304 stainless steel U bolts shall be attached to each frame and fit around the pylons.
3. The mooring system shall constructed as described below:

a.	Mooring point quantity	two (2)
b.	Post diameter	4-inches
c.	Post material	Schedule 40 Galvanized steel
d.	Base plate material	Galvanized steel
e.	Floor connection	stainless steel adhesive anchors
f.	Mooring frame material	Galvanized steel

2.06 CONTROL PANEL

A. The control system shall be designed to optimize the efficiency of the Aerobic Digestor while minimizing operator attention. The control software program shall be factory tested prior to installation at the jobsite.

B. The control system shall provide control of the aerator and mixer units using input

from the level sensors.

1. The aerator unit shall operate at all times, unless the digestor is in a decant cycle.
2. The mixer unit shall only be called on at water levels greater than 13 feet.
3. The operator shall be able to access the timer values and set points through the operator interface panel to allow for adjustment and system flexibility.
4. Operation or decant cycles shall be signaled by operator input.

C. Construction

1. A complete control system shall be provided as described below and as shown on the contract drawings.
2. The control system shall include a circuit breaker disconnect, control transformer, branch protection, motor starters, microprocessor control, indicator lights, HAND-OFF-AUTOMATIC selector switches.
3. The incoming service of the control system shall be 460 volt, 60 hertz, three-phase.
4. Motor starters for the equipment listed below shall be provided within the Digestor control panel. Elapsed time indication shall be provided through the operator interface of the control panel for equipment indicated by an asterisk (*).
   a. 25 hp Aerator (2)
   b. 10 hp Mixer (2)
5. In addition, controls as shown on the contract drawings for the following equipment shall be included in the Digestor control panel.
   a. 4-20 mA Pressure Transducer (2)
   b. Level Switch (2)
6. All control enclosures shall be custom assembled and wired in an Underwriters Laboratories (UL) certified cabinet shop using quality materials and labor. Short circuit rating of control enclosure shall be 5 kA RMS symmetrical @ 480VAC maximum. Enclosure shall be NEMA 4X as specified in the related specification.
7. A 304 10 gauge stainless steel sun shield shall be included. A sunshield shall over hang the front of the panel a minimum of 10”.
8. A full voltage non-reversing Integrated Motor Starter-Controller shall be provided for motor applications up to 15 kW. Each starter shall provide control, protection and monitoring functions for the motor. The starter shall be NEMA rated IEC form factor and shall have certifications according to UL and CSA standards and shall bear the CE marking. The starter shall have a maximum rated operational voltage of 690V and provide a 42kA @ 480 VAC rated breaking capacity on short circuit. The starter shall have a mechanical durability of 15 million operations. The starter shall provide short circuit trip, thermal overload trip with selectable tripping class, under current trip and phase imbalance trip.
9. A full voltage non-reversing NEMA Style motor starter shall be provided for motor applications over 15 kW. Each starter shall consist of a circuit breaker, contactor and overload relay. The starter shall be NEMA rated and shall have certifications according to UL and CSA standards and shall bear

the CE marking. The starter shall have a maximum rated operational voltage of 600V and provide a minimum 18 kA @ 480VAC and 25 kA @ 240 VAC interrupt rating on short circuit when used in combination with a PowerPact circuit breaker. The starter shall have a mechanical durability of 2 million operations. The solid state overload relay shall have class 10/20 (selectable) tripping characteristics with trip current adjustment, phase loss and unbalance protection.

10. The solid state reduced voltage starter shall be 480V AC, 3-phase, rated and used for the controlled starting and/or stopping of AC induction motors. The controller shall comply with UL, CSA, EN/IEC standards. Each controller shall have selectable (off, 10, 15 or 20) overload trip class protection, over-temperature monitoring, phase reversal protection, phase loss, and phase imbalance features. The 120/240V AC integral control module provides reset and test pushbuttons with fault LEDs. Each controller provides auxiliary contacts rated for 0.6 Amps at 120V AC. The solid state reduced voltage starter shall be Allen Bradley SMC-3 or approved equal.
11. Operator devices (pushbuttons and selector switches) shall be mounted through the control enclosure door for all automatic controlled equipment. All operator devices shall be UL Listed, 30.5mm style, NEMA Type 4X rated, oil and water tight with finger safe guards located on the contact blocks to prevent accidental contact with wire connections. Operator device function shall be identified with an engraved white Gravoply nameplate with black letters. Operator devices shall be Square D 9001 or approved equal. Transformer type pilot lights and illuminated pushbuttons shall be provided for indication of an operation status. Lights shall be a 6 VAC incandescent type lamp. Color coding shall be applied as required and is as follows:
    a. Amber – Alarm active, caution
    b. Green – Valve open, motor running
    c. Red – Valve closed
    d. White - Information
12. A UL listed, industrial grade, compact power supply shall be supplied to provide 24 VDC power to such rated components. The power supply shall be DIN rail mounted and functional with input voltage of 100 to 240 VAC (single-phase) incoming control power. The power supply shall have a green LED which shall be illuminated when output voltage is “OK”. The power supply shall be an Allen Bradley 1606 or approved equal.
13. Automatic operation of the digestor shall be controlled through a programmable logic controller (PLC) mounted inside the Digestor control panel. The PLC components shall consist of a power supply, CPU, discrete input and output modules and analog input and output modules. The processor unit shall include built-in USB and two (2) Ethernet IP communication ports. All input and output points supplied (including unused) shall be wired to terminal blocks. Processor design characteristics shall include: 1.0MB user memory size, real-time clock and calendar, battery backed RAM and an operating temperature range between 32 °F and

140°F. The PLC processor shall be an Allen-Bradley CompactLogix 1769-L30ER or approved equal.

14. Modular equipment shall be provided to complete the PLC system. These Allen-Bradley components include: 1769-PA4 – Power Supply, 1769-IA16 – Discrete input (16 point) modules, 1769-OW16 – Discrete output (16 point) modules and 1769-IF8 – Analog input (8 point) modules, 1769-OF4CI – Analog output (4 point) modules.
    a. PLC Power Supply - Input voltage range of 85-265 / 170-265 VAC, 47-63 Hz, maximum inrush current of 30 amps, backplane output current of 4 amps @ 5V or 2 amps @ 24V, internal fuse protection, ambient operating temperature of 32°F to 140°F, Class I, Division 2 hazardous location certified, UL Listed.
    b. Discrete Input Module - Operating voltage of 79 to 132 VAC at 47 to 63 Hz, backplane current draw at 5VDC = 115mA , off-state current 2.5mA maximum, maximum inrush current 250mA, LED status indication of each point, ambient operating temperature of 32°F to 140°F, UL Listed.
    c. Discrete Output Module - Operating voltage of 5 to 265 VAC at 47 to 63 Hz / 5 to 125 VDC, backplane current draw at 5 VDC = 205mA , at 24VDC = 180mA, off-state current leakage is 1.0mA, LED status indication of each point, ambient operating temperature of 32°F to 140°F, UL Listed.
    d. Analog Input Module - Backplane current draw at 5 VDC = 120mA, at 24VDC = 70mA, LED status indication of each point, ambient operating temperature of 32°F to 140°F, UL Listed.
    e. Analog Output Module - Backplane current draw at 5 VDC = 120mA, at 24VDC = 170mA, LED status indication of each point, ambient operating temperature of 32°F to 140°F, UL Listed.
15. A human machine interface (HMI) shall be furnished with the control panel. The operator interface shall be a NEMA Type 12, 13, 4X rated, 10.4" diagonal, color touchscreen display with Ethernet and serial communications. The interface shall be a liquid crystal display (LCD). The display type shall be color active matrix thin-film transistor (TFT) with 800 x 600 pixel resolution. The rated operating temperature shall be 32° to 131° F (0° to 55° C). The operator interface shall be an Allen Bradley PanelView Plus 7 Performance 10".
16. Additional control panel components shall be as shown in the drawings and specified in related sections.

PART 3 EXECUTION

3.01 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials and equipment to site in a timely manner as to prevent delaying the work.

B. Inspect all boxes, crates, and packages upon delivery to site and notify Engineer in writing of loss or damage to materials or equipment. Promptly remedy loss and damage to new condition in accordance with manufacturer's instructions.

C. Store materials to permit easy access for inspection and identification. Keep materials and equipment off ground using pallets, platforms, or other supports in an organized manner. Protect steel, packaged materials, motors, and electronics from corrosion and deterioration.

D. Install materials and equipment in conformance with applicable standards, manufacturer's instructions and recommendations, and the Contract Documents.

3.02 STARTUP AND FIELD TESTING

A. Following complete installation of all equipment, the Aerobic Digestor should be operated under normal operating conditions to test performance.

B. The manufacturer shall furnish the services of a factory trained representative to inspect the Contractor's equipment installation, supervise the initial operation of the equipment, instruct the plant operating personnel in proper operation and maintenance, and provide process assistance

END OF SECTION