

CITY OF LAKE CITY

Lake City, South Carolina

Contract Documents
for the Construction of

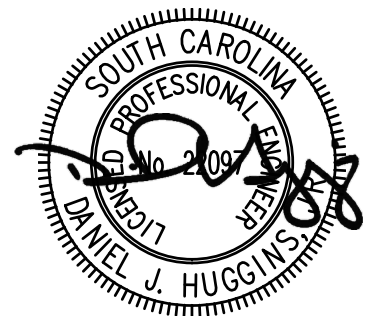
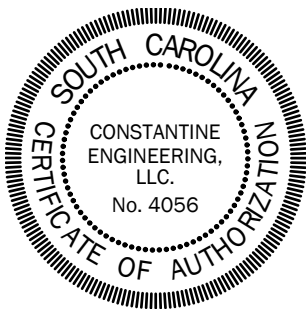
LAKE SWAMP WWTP UPGRADE

CONSISTING OF:

BIDDING REQUIREMENTS
CONTRACT FORMS
CONDITIONS OF THE CONTRACT
SPECIFICATIONS
DRAWINGS
(Bound Separately)

SRF Project No.: 413-01

Prepared By:



April 19, 2021

Constantine Project No. 100392.02
March 2021

BID DOCUMENTS

TABLE OF CONTENTS

PART 1 - BIDDING REQUIREMENTS

EJCDC C-111	Advertisement for Bids
EJCDC C-200	Instruction to Bidders
EJCDC C-410	Bid Form (Rural Utilities Service)
EJCDC C-410	Bid Form (State Revolving Fund)
EJCDC C-430	Bid Bond (Rural Utilities Service)
EJCDC C-430	Bid Bond (State Revolving Fund)
EJCDC C-451	Qualifications Statement
EJCDC C-510	Notice of Award (Rural Utilities Service)
EJCDC C-510	Notice of Award (State Revolving Fund)

PART 2 - CONTRACT FORMS

EJCDC C-520	Agreement (Rural Utilities Service)
EJCDC C-520	Agreement (State Revolving Fund)
EJCDC C-550	Notice to Proceed (Rural Utilities Service)
EJCDC C-550	Notice to Proceed (State Revolving Fund)
EJCDC C-610	Performance Bond
EJCDC C-615	Payment Bond

PART 3 - CONDITIONS OF THE CONTRACT

EJCDC C-620	Contractor's Application for Payment
EJCDC C-625	Certificate of Substantial Completion
EJCDC C-700	Standard General Conditions
EJCDC C-800	Supplementary Conditions
EJCDC C-941	Change Order
RD 400-6	Compliance Statement
AD-1048	Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion – Lower Tier Covered Transactions
RUS 1780-26 Ex. I	Certificate of Owner's Attorney and Agency Concurrence
RUS 1780-26 Ex. J	Engineer's Certification of Final Plans and Specifications
RD Instruction 1940-Q	Certification for Contracts, Grants, and Loans
SCDHEC SRF	Permit Guide for Federally Funded Projects

PART 4 - SPECIFICATIONS

DIVISION 1 – General Requirements

01001	General Requirements
01010	Summary of Work
01014	Coordination with Owner's Operations
01111	Permits & Rights-of-Way
01500	Pre-Construction Video
01720	Project Record Documents

DIVISION 2 – Site Construction

02060	Demolition
02101	Civil Sitework
02140	Dewatering
02200	Earthwork

02260	Erosion and Sediment Control
02281	Termite Control
02512	Fabric Underlay Material
02515	Roads and Driveways

DIVISION 3 – Concrete

03300	Cast-in-Place Concrete
03410	Precast Concrete Wetwell
03800	Leakage Testing of Hydraulic Structures

DIVISION 4 – Masonry

04810	Unit Masonry Assemblies
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DIVISION 5 – Metals

05500	Metal Fabrications
05521	Aluminum Pipe and Tube Railings
05530	Aluminum Grating and Stair Treads

DIVISION 6 – Not Used

DIVISION 7 – Thermal and Moisture Protection

07210	Building Insulation
07540	Single Ply Membrane Roofing
07620	Sheet Metal Flashing and Trim
07920	Joint Sealants

DIVISION 8 – Doors and Windows

08332	Aluminum Rolling Service Door
08400	Aluminum Doors and Frames
08421	Aluminum Floor Hatches
08505	Aluminum Windows
08710	Finish Hardware

DIVISION 9 – Finishes

09900	Painting
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DIVISION 10 – Specialties

10400	Identifying Devices
10445	Piping Identification Systems
10520	Fire Extinguishers & Cabinets
10539	Aluminum Man Door Canopy

DIVISION 11 – Equipment

11220	Submersible Sewage Pumps
11289	Electric Actuators
11291	Metal Slide Gates
11312	Self-Priming Wastewater Pumps
11335	Clarifier Equipment Refurbishment
11350	Belt Filter Press Refurbishment
11372	Positive Placement Blowers
11375	Fine Bubble Membrane Diffusers
11379	Septage Receiving Station
11380	Submersible Mixers

DIVISION 12 – Not Used

DIVISION 13 – Special Construction

13329 Temporary Sludge Dewatering and Disposal
13300 Controls

DIVISION 14 – Not Used

DIVISION 15 – Mechanical

15110 Piping and Accessories
15200 Valves and Accessories
15700 Heating, Ventilating, and Air Conditioning

DIVISION 16 – Electrical

16160 Variable Frequency Drives
16260 Standby Electrical Power System
16400 Electrical
16910 Control Panel Construction

**SECTION C-111
ADVERTISEMENT FOR BIDS**

**CITY OF LAKE CITY
LAKE CITY, SOUTH CAROLINA
LAKE SWAMP WWTP UPGRADE**

Sealed Bids for the construction of the Lake Swamp WWTP Upgrade will be received by City of Lake City located at 202 Kelley Street, Lake City, SC 29560 until 2:00pm local time on May 25, 2021, at which time the Bids received will be publicly opened and read. The Project consists of an upgrade to existing 5.4 MGD WWTP and includes the following summary of work:

- Demolition of existing rotating biological contact basins, Aeration Basin No. 3, and Aerobic Digester No. 4. Demolition to include removal and disposal of solid and liquid waste.
- Rehabilitation of clarifier equipment for Clarifier Nos. 1, 2, and 3.
- Replacement of dry pit RAS pumps with self-priming pumps.
- Submersible scum pump replacement.
- Blower replacement.
- Refurbishment of belt press.
- New septage receiving station.
- New aeration basin.
- New blower building.
- New generator and automatic transfer switch.
- New transfer switch for effluent pump generator.
- Associated civil, electrical, and HVAC work required for construction of the facilities.

Bids will be received for a single prime Contract. Bids shall be on a lump sum basis as indicated in the Bid Form.

The Issuing Office for the Bidding Documents is Constantine Engineering, Inc., ATTN; Dan Huggins, PE, 4000 Faber Place Drive, Suite 330, North Charleston, SC 29405. Prospective Bidders may examine the Bidding Documents at the Issuing Office on Mondays through Fridays between the hours of 9:00am until 3:00 pm, and may obtain copies of the Bidding Documents from Duncan-Parnell.

Bidding Documents also may be examined at the office of the City of Lake City, South Carolina located at 202 Kelley Street, Lake City, SC 29560, on Mondays through Fridays between the hours of 9:00am until 3:00pm.

Bidding Documents may be viewed and ordered online by registering with Duncan Parnell via their bid room <http://www.dpibidroom.com>. Registration with Duncan Parnell is required to obtain the bid documents. Following registration, complete sets of Bidding Documents may be downloaded from Duncan Parnell's website as "zipped" portable document format (PDF) files. The cost of printed Bidding Documents from Duncan Parnell will depend on the number and size of the Drawings and Project Manual, applicable taxes, and shipping method selected by the prospective Bidder. Cost of Bidding Documents and shipping is non-refundable. Upon Duncan Parnell's receipt of payment, printed Bidding Documents will be sent via the prospective Bidder's delivery method of choice; the shipping charge will depend on the shipping method chosen. The date that the Bidding Documents are transmitted by

Duncan Parnell will be considered the Bidder's date of receipt of the Bidding Documents. Partial sets of the Bidding Documents will not be available.

A pre-bid conference will be held at 10:00 am local time on May 12, 2021 at the Lake Swamp WWTP, 100 Cemetery Rd, Lake City, SC. Attendance at the pre-bid conference is mandatory.

Bid security shall be furnished in accordance with the Instructions to Bidders.

A Bid must be accompanied by Bid security made payable to the Owner in an amount of 5 percent of the Bidder's maximum bid price.

The project is being funded by a loan from USDA-Rural Utilities Service and by the State Revolving Fund and bidders must comply with all applicable state and federal requirements identified in the bid documents including Davis-Bacon and "American Iron and Steel" provisions.

Prospective contractors shall follow the "Good Faith Efforts" strategies outlined in the "Disadvantaged Business Enterprise (DBE) Compliance" section of the Federal Requirements guide to aid in successfully meeting the DBE requirements. If subcontracts are awarded, the prime contractor will be required to follow the "Good Faith Efforts" strategies outlined in the bid documents and provide required documentation. Prospective bidders must implement procedures that ensure that DBE firms are given opportunities for meaningful participation if subcontracts are awarded. A fair share goal of 2.5% MBE and 2.5% WBE of the funds awarded for prime contracts or subcontracts for supplies, construction, equipment or services, must be made available to organizations owned and controlled by socially and economically disadvantaged individuals. Prime contractors must include the fair share goal in their bid documents for subcontracts.

Owner: City of Lake City, South Carolina
202 Kelley Street
Lake City, SC 29560

+ + END OF ADVERTISEMENT FOR BIDS + +

INSTRUCTIONS TO BIDDERS

TABLE OF CONTENTS

	Page
Article 1 – Defined Terms.....	1
Article 2 – Copies of Bidding Documents.....	1
Article 3 – Qualifications of Bidders.....	1
Article 4 – Site and Other Areas; Existing Site Conditions; Examination of Site; Owner’s Safety Program; Other Work at the Site.....	1
Article 5 – Bidder’s Representations.....	3
Article 6 – Pre-Bid Conference.....	4
Article 7 – Interpretations and Addenda	4
Article 8 – Bid Security	5
Article 9 – Contract Times.....	5
Article 10 – Liquidated Damages	5
Article 11 – Substitute and “Or-Equal” Items	5
Article 12 – Subcontractors, Suppliers, and Others.....	6
Article 13 – Preparation of Bid.....	7
Article 14 – Basis of Bid.....	7
Article 15 – Submittal of Bid	8
Article 16 – Modification and Withdrawal of Bid	8
Article 17 – Opening of Bids.....	8
Article 18 – Bids to Remain Subject to Acceptance	9
Article 19 – Evaluation of Bids and Award of Contract.....	9
Article 20 – Bonds and Insurance	9
Article 21 – Signing of Agreement	10
Article 22 – Sales and Use Taxes.....	10
Article 23 – Contracts to be Assigned	10

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. *Issuing Office* – The office from which the Bidding Documents are to be issued.

ARTICLE 2 – COPIES OF BIDDING DOCUMENTS

2.01 Complete sets of the Bidding Documents may be obtained from the Issuing Office in the number and format stated in the advertisement or invitation to bid.

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, after submitting its Bid and within 5-days of Owner's request, Bidder shall submit (a) written evidence establishing its qualifications such as financial data, previous experience, and present commitments, and (b) the following additional information:

A. Qualifications Statement EJCDC C451.

3.02 A Bidder's failure to submit required qualification information within the times indicated may disqualify Bidder from receiving an award of the Contract.

ARTICLE 4 – SITE AND OTHER AREAS; EXISTING SITE CONDITIONS; EXAMINATION OF SITE; OWNER'S SAFETY PROGRAM; OTHER WORK AT THE SITE

4.01 *Site and Other Areas*

A. The Site is identified in the Bidding Documents. By definition, the Site includes rights-of-way, easements, and other lands furnished by Owner for the use of the Contractor. Any additional lands required for temporary construction facilities, construction equipment, or storage of materials and equipment, and any access needed for such additional lands, are to be obtained and paid for by Contractor.

4.02 *Existing Site Conditions*

A. Subsurface and Physical Conditions; Hazardous Environmental Conditions

1. The Supplementary Conditions identify:

- a. those reports known to Owner of explorations and tests of subsurface conditions at or adjacent to the Site.
- b. those drawings known to Owner of physical conditions relating to existing surface or subsurface structures at the Site (except Underground Facilities).

- c. reports and drawings known to Owner relating to Hazardous Environmental Conditions that have been identified at or adjacent to the Site.
 - d. Technical Data contained in such reports and drawings.
2. Owner will make copies of reports and drawings referenced above available to any Bidder on request. These reports and drawings are not part of the Contract Documents, but the Technical Data contained therein upon whose accuracy Bidder is entitled to rely, as provided in the General Conditions, has been identified and established in 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.
 3. If the Supplementary Conditions do not identify Technical Data, the default definition of Technical Data set forth in Article 1 of the General Conditions will apply.
 4. Geotechnical Baseline Report: The Bidding Documents contain a Geotechnical Baseline Report (GBR). The GBR describes certain select subsurface conditions that are anticipated to be encountered by Contractor during construction in specified locations ("Baseline Conditions"). The GBR is a Contract Document.

The Baseline Conditions in the GBR are intended to reduce uncertainty and the degree of contingency in submitted Bids. However, Bidders cannot rely solely on the Baseline Conditions. Bids should be based on a comprehensive approach that includes an independent review and analysis of the GBR, all other Contract Documents, Technical Data, other available information, and observable surface conditions. Not all potential subsurface conditions are baselined.

Nothing in the GBR is intended to relieve Bidders of the responsibility to make their own determinations regarding construction costs, bidding strategies, and Bid prices, nor of the responsibility to select and be responsible for the means, methods, techniques, sequences, and procedures of construction, and for safety precautions and programs incident thereto.

- B. Underground Facilities: Information and data shown or indicated in the Bidding Documents with respect to existing Underground Facilities at or adjacent to the Site are set forth in the Contract Documents and are based upon information and data furnished to Owner and Engineer by owners of such Underground Facilities, including Owner, or others.
- C. Adequacy of Data: 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 5.03, 5.04, and 5.05 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 5.06 of the General Conditions.

4.03 *Site Visit and Testing by Bidders*

- A. Bidder shall conduct the required Site visit during normal working hours, and shall not disturb any ongoing operations at the Site.

- B. Bidder is not required to conduct any subsurface testing, or exhaustive investigations of Site conditions.
- C. On request, and to the extent Owner has control over the Site, and schedule permitting, the Owner will provide Bidder access to the Site to conduct such additional examinations, investigations, explorations, tests, and studies as Bidder deems necessary for preparing and submitting a successful Bid. Owner will not have any obligation to grant such access if doing so is not practical because of existing operations, security or safety concerns, or restraints on Owner's authority regarding the Site.
- D. Bidder shall comply with all applicable Laws and Regulations regarding excavation and location of utilities, obtain all permits, and comply with all terms and conditions established by Owner or by property owners or other entities controlling the Site with respect to schedule, access, existing operations, security, liability insurance, and applicable safety programs.

4.04 *Owner's Safety Program*

- A. Site visits and work at the Site may be governed by an Owner safety program. As the General Conditions indicate, if an Owner safety program exists, it will be noted in the Supplementary Conditions.

4.05 *Other Work at the Site*

- A. Reference is made to Article 8 of the Supplementary Conditions for the identification of the general nature of other work of which Owner is aware (if any) that is to be performed at the Site by Owner or others (such as utilities and other prime contractors) and relates to the Work contemplated by these Bidding Documents. If Owner is party to a written contract for such other work, then on request, Owner will provide to each Bidder access to examine such contracts (other than portions thereof related to price and other confidential matters), if any.

ARTICLE 5 – BIDDER'S REPRESENTATIONS

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

- A. examine and carefully study the Bidding Documents, and any data and reference items identified in the Bidding Documents;
- B. visit the Site, conduct a thorough, alert visual examination of the Site and adjacent areas, and become familiar with and satisfy itself as to the general, local, and Site conditions that may affect cost, progress, and performance of the Work;
- C. become familiar with and satisfy itself as to all Laws and Regulations that may affect cost, progress, and performance of the Work including but not limited to American Iron and Steel requirements as mandated by Section 746 of Title VII of the Consolidated Appropriations Act of 2017 (Division A - Agriculture, Rural Development, Food and Drug Administration, and Related Agencies Appropriations Act, 2017) and subsequent statutes mandating domestic preference which apply to the following products made primarily of iron or steel: lined or unlined pipes and fittings, manhole covers and other municipal castings, hydrants, tanks, flanges, pipe clamps and restraints, valves, structural steel, reinforced precast concrete, and construction materials.

- D. carefully study all: (1) reports of explorations and tests of subsurface conditions at or adjacent to the Site and all drawings of physical conditions relating to existing surface or subsurface structures at the Site that have been identified in the Supplementary Conditions, especially with respect to Technical Data in such reports and drawings, and (2) reports and drawings relating to Hazardous Environmental Conditions, if any, at or adjacent to the Site that have been identified in the Supplementary Conditions, especially with respect to Technical Data in such reports and drawings;
- E. consider the information known to Bidder itself; 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; and (3) Bidder's safety precautions and programs;
- F. agree, based on the information and observations referred to in the preceding paragraph, that at the time of submitting its Bid 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 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;
- I. determine that the Bidding Documents are generally sufficient to indicate and convey understanding of all terms and conditions for the performance and furnishing of the Work; and
- J. agree that the submission of a Bid will constitute an incontrovertible representation by Bidder that Bidder has complied with every requirement of this Article, that without exception the Bid and all prices in the Bid are premised upon performing and furnishing the Work required by the Bidding Documents.

ARTICLE 6 – PRE-BID CONFERENCE

- 6.01 A pre-Bid conference will be held at the time and location stated in the invitation or advertisement to bid. Representatives of Owner and Engineer will be present to discuss the Project. Bidders are required to attend the conference. Engineer will transmit to all prospective Bidders of record such Addenda as Engineer considers necessary in response to questions arising at the conference. Oral statements may not be relied upon and will not be binding or legally effective.

ARTICLE 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. Interpretations or clarifications considered necessary by Engineer in response to such questions will be issued by Addenda delivered to all parties recorded as having

received the Bidding Documents. Questions received less than seven 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, supplement, or change the Bidding Documents.

ARTICLE 8 – BID SECURITY

8.01 A Bid must be accompanied by Bid security made payable to Owner in an amount of 5-percent of Bidder's maximum Bid price (determined by adding the base bid and all alternates) and in the form of a certified check, bank money order, or a Bid bond (on the form included in the Bidding Documents) issued by a surety meeting the requirements of Paragraphs 6.01 and 6.02 of the General Conditions.

8.02 The Bid security of the apparent Successful Bidder will be retained until Owner awards the contract to such Bidder, and 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 released. If the Successful Bidder fails to execute and deliver the Contract Documents and furnish the required contract security within 15 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.

8.03 The Bid security of other Bidders that Owner believes to have a reasonable chance of receiving the award may be retained by Owner until the earlier of seven days after the Effective Date of the Contract or 61 days after the Bid opening, whereupon Bid security furnished by such Bidders will be released.

8.04 Bid security of other Bidders that Owner believes do not have a reasonable chance of receiving the award will be released within seven days after the Bid opening.

ARTICLE 9 – CONTRACT TIMES

9.01 The number of days within which, or the dates by which, the Work is to be substantially completed, and completed and ready for final payment, are set forth in the Agreement.

ARTICLE 10 – LIQUIDATED DAMAGES

10.01 Provisions for liquidated damages, if any, for failure to timely attain a Milestone, Substantial Completion, or completion of the Work in readiness for final payment, are set forth in the Agreement.

ARTICLE 11 – SUBSTITUTE AND "OR-EQUAL" ITEMS

11.01 The Contract for the Work, if awarded, will be on the basis of materials and equipment specified or described in the Bidding Documents, and those "or-equal" or substitute or materials and equipment subsequently approved by Engineer prior to the submittal of Bids and identified by Addendum. No item of material or equipment will be considered by Engineer as an "or-equal" or substitute unless written request for approval has been submitted by Bidder and has been received by Engineer at least 15 days prior to the date for receipt of Bids in the case of a proposed substitute and 5 days prior in the case of a proposed "or-equal". Each such request shall comply with the requirements of Paragraphs 7.04 and 7.05 of the General Conditions. Each such request shall include Manufacturer's Certification letter for compliance with Section 746 of

Title VII of the Consolidated Appropriations Act of 2017 (Division A - Agriculture, Rural Development, Food and Drug Administration, and Related Agencies Appropriations Act, 2017) and subsequent statutes mandating domestic preference, if applicable. Refer to Manufacturer's Certification Letter provided in these Contract Documents. 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 such 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. Substitutes and "or-equal" materials and equipment may be proposed by Contractor in accordance with Paragraphs 7.04 and 7.05 of the General Conditions after the Effective Date of the Contract.

- 11.02 All prices that Bidder sets forth in its Bid shall be based on the presumption that the Contractor will furnish the materials and equipment specified or described in the Bidding Documents, as supplemented by Addenda. Any assumptions regarding the possibility of post-Bid approvals of "or-equal" or substitution requests are made at Bidder's sole risk.
- 11.03 If an award is made, Contractor shall be allowed to submit proposed substitutes and "or-equals" in accordance with the General Conditions.

ARTICLE 12 – SUBCONTRACTORS, SUPPLIERS, AND OTHERS

- 12.01 N/A
- 12.02 N/A
- 12.03 If required by the bid documents the apparent Successful Bidder, and any other Bidder so requested, shall within five days after Bid opening, submit to Owner a list of the Subcontractors or Suppliers proposed for the following portions of the Work:

If requested by Owner, 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, or other individual or entity. If Owner or Engineer, after due investigation, has reasonable objection to any proposed Subcontractor, Supplier, individual, or entity, Owner may, before the Notice of Award is given, request apparent Successful Bidder to submit an acceptable substitute, in which case apparent Successful Bidder shall submit a 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.
- 12.04 If apparent Successful Bidder declines to make any such substitution, Owner may award the Contract to the next lowest Bidder that proposes to use acceptable Subcontractors, Suppliers, or other individuals or entities. Declining to make requested substitutions will constitute grounds for forfeiture of the Bid security of any Bidder. Any Subcontractor, Supplier, individual, or entity so listed and against which Owner or Engineer makes no written objection prior to the giving of the Notice of Award will be deemed acceptable to Owner and Engineer subject to subsequent revocation of such acceptance as provided in Paragraph 7.06 of the General Conditions.
- 12.05 Contractor shall not be required to employ any Subcontractor, Supplier, individual, or entity against whom Contractor has reasonable objection.
- 12.06 The Contractor shall not award work to Subcontractor(s) in excess of the limits stated in SC 7.06A.

ARTICLE 13 – PREPARATION OF BID

- 13.01 The Bid Form is included with the Bidding Documents.
- A. 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, alternate, adjustment unit price item, and unit price item listed therein.
 - B. If the Bid Form expressly indicates that submitting pricing on a specific alternate item is optional, and Bidder elects to not furnish pricing for such optional alternate item, then Bidder may enter the words “No Bid” or “Not Applicable.”
- 13.02 A Bid by a corporation shall be executed in the corporate name by a corporate officer (whose title must appear under the signature), accompanied by evidence of authority to sign. The corporate address and state of incorporation shall be shown.
- 13.03 A Bid by a partnership shall be executed in the partnership name and signed by a partner (whose title must appear under the signature), accompanied by evidence of authority to sign. The partnership’s address for receiving notices shall be shown.
- 13.04 A Bid by a limited liability company shall be executed in the name of the firm by a member or other authorized person and accompanied by evidence of authority to sign. The state of formation of the firm and the firm’s address for receiving notices shall be shown.
- 13.05 A Bid by an individual shall show the Bidder’s name and address for receiving notices.
- 13.06 A Bid by a joint venture shall be executed by an authorized representative of each joint venturer in the manner indicated on the Bid Form. The joint venture’s address for receiving notices shall be shown.
- 13.07 All names shall be printed in ink below the signatures.
- 13.08 The Bid shall contain an acknowledgment of receipt of all Addenda, the numbers of which shall be filled in on the Bid Form.
- 13.09 Postal and e-mail addresses and telephone number for communications regarding the Bid shall be shown.
- 13.10 The Bid shall contain evidence of Bidder’s authority and qualification to do business in the state where the Project is located, or 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

- 14.01 *Lump Sum*
- A. Bidders shall submit a Bid on a lump sum basis as set forth 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 unit price section of the Bid Form.
 - B. The “Bid Price” (sometimes referred to as the extended price) for each unit price Bid item will be the product of the “Estimated Quantity” (which Owner or its representative has set

forth in the Bid Form) for the item and the corresponding "Bid Unit Price" offered by the Bidder. The total of all unit price Bid items will be the sum of these "Bid Prices"; such total will be used by Owner for Bid comparison purposes. The final quantities and Contract Price will be determined in accordance with Paragraph 13.03 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 Bidder 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 13.02.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. The unbound copy of the Bid Form is to be completed and submitted with the Bid security and the other documents required to be submitted under the terms of Article 7 of the Bid Form.
- 15.02 A Bid shall be received 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: ATTN: Glenn Bodenheimer, Deputy Finance Director, City of Lake City, 202 Kelley St., Lake City, SC 29560.
- 15.03 Bids received after the date and time prescribed for the opening of bids, or not submitted at the correct location or in the designated manner, will not be accepted and will be returned to the Bidder unopened.

ARTICLE 16 – MODIFICATION AND WITHDRAWAL OF BID

- 16.01 A Bid may be 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. Upon receipt of such notice, the unopened Bid will be returned to the Bidder.
- 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 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 will reject the Bid of any Bidder that Owner finds, after reasonable inquiry and evaluation, to not be responsible. If Bidder purports to add terms or conditions to its Bid, takes exception to any provision of the Bidding Documents, or attempts to alter the contents of the Contract Documents for purposes of the Bid, then the Owner will reject the Bid as nonresponsive; provided that Owner also reserves the right to waive all minor informalities not involving price, time, or changes in the Work.

19.02 If Owner awards the contract for the Work, such award shall be to the responsible Bidder submitting the lowest responsive Bid.

19.03 Evaluation of Bids

A. 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.

B. In the comparison of Bids, alternates will be applied in the same order of priority as listed in the Bid Form. To determine the Bid prices for purposes of comparison, Owner shall announce to all bidders a “Base Bid plus alternates” budget after receiving all Bids, but prior to opening them. For comparison purposes alternates will be accepted, following the order of priority established in the Bid Form, until doing so would cause the budget to be exceeded. After determination of the Successful Bidder based on this comparative process and on the responsiveness, responsibility, and other factors set forth in these Instructions, the award may be made to said Successful Bidder on its base Bid and any combination of its additive alternate Bids for which Owner determines funds will be available at the time of award.

19.04 In evaluating whether a Bidder is responsible, Owner will consider the qualifications of the Bidder and may consider the qualifications and experience of Subcontractors and Suppliers proposed for those portions of the Work for which the identity of Subcontractors and Suppliers must be submitted as provided in the Bidding Documents.

19.05 Owner may conduct such investigations as Owner deems necessary to establish the responsibility, qualifications, and financial ability of Bidders and any proposed Subcontractors or Suppliers.

ARTICLE 20 – BONDS AND INSURANCE

20.01 Article 6 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 Agreement (executed by Successful Bidder) to Owner, it shall be accompanied by required bonds and insurance documentation.

ARTICLE 21 – SIGNING OF AGREEMENT

21.01 When Owner issues a Notice of Award to the Successful Bidder, it shall be accompanied by the unexecuted counterparts of the Agreement along with the other Contract Documents as identified in the Agreement. Within 15 days thereafter, Successful Bidder shall execute and deliver the required number of counterparts of the Agreement (and any bonds and insurance documentation required to be delivered by the Contract Documents) to Owner. Within ten days thereafter, Owner shall deliver one fully executed counterpart of the Agreement to Successful Bidder, together with printed and electronic copies of the Contract Documents as stated in Paragraph 2.02 of the General Conditions.

ARTICLE 22 – SALES AND USE TAXES

22.01 Owner is not claiming exemption from South Carolina state sales and use taxes on materials and equipment to be incorporated in the Work. Said taxes shall be included in the Bid.

ARTICLE 23 – CONTRACTS TO BE ASSIGNED

23.01 NONE

ARTICLE 24 – ARTICLE 24 FEDERAL REQUIREMENTS

24.01 Federal requirements at Article 19 of the Supplementary Conditions apply to this Contract.

24.02 Section 746 of Title VII of the Consolidated Appropriations Act of 2017 (Division A - Agriculture, Rural Development, Food and Drug Administration, and Related Agencies Appropriations Act, 2017) and subsequent statutes mandating domestic preference applies an American Iron and Steel requirement to this project. All iron and steel products used in this project must be produced in the United States. The term “iron and steel products” means the following products made primarily of iron or steel: lined or unlined pipes and fittings, manhole covers and other municipal castings, hydrants, tanks, flanges, pipe clamps and restraints, valves, structural steel, reinforced precast concrete, and construction materials. The de minimis and minor components waiver {add project specific waivers as applicable} apply to this contract.

SECTION C-410

BID FORM (RURAL UTILITIES SERVICE)

ARTICLE 1 – BID RECIPIENT

1.01 This Bid is submitted to:

City of Lake City

202 Kelley St.

Lake City, SC 29560

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 funded by the USDA Rural Utilities Service 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 for Lake Swamp WWTP Upgrade. The USDA scope of work is identified in Section 01010 – Summary of Work.

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 90 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, and any data and reference items identified in the Bidding Documents, and hereby acknowledges receipt of the following Addenda:

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

B. Bidder has visited the Site, conducted a thorough, alert visual examination of the Site and adjacent areas, and become familiar with and satisfied itself as to the general, local, and Site conditions that may affect cost, progress, and performance of the Work.

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

D. Bidder has carefully studied all: (1) reports of explorations and tests of subsurface conditions at or adjacent to the Site that have been identified in the Supplementary Conditions, especially with respect to Technical Data in such reports and drawings.

E. Bidder has considered the information known to Bidder itself; 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 any 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; and (3) Bidder's safety precautions and programs.

- F. Bidder agrees, based on the information and observations referred to in the preceding paragraph, that no further examinations, investigations, explorations, tests, studies, or data are necessary for the determination of this Bid for performance of the Work at the price 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 confirms that 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 and furnishing of the Work.
- J. The submission of this Bid constitutes an incontrovertible representation by Bidder that Bidder has complied with every requirement of this Article, and that without exception the Bid and all prices in the Bid are premised upon performing and furnishing the Work required by the Bidding Documents.

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

See section 01010-Summary of Work for RUS scope of work. Bidder will complete the Work in accordance with the Contract Documents for the following price(s):

Item No.	Description	Unit	Est. Qty.	Unit Price	Total
1	LUMP SUM WORK-Furnishing all products, materials and equipment and performing all labor necessary to complete the Lake Swamp WWTP Upgrade Project including all Work Shown on the Drawings and/or specified, exclusive of unit price and contingency items below.	LS	1		
2	Sludge Removal and Disposal (payment based on actual weight disposed at landfill).	Tons	2,006		
3	20-Diffuser Membrane Assemblies for Replacement in Existing Aeration Basins Nos. 1 & 2	EA	1		
4	Owner Contingency	LS	1	\$250,000.00	\$250,000.00

Total of Unit Price Bids = Total Bid Price \$ _____
 _____ Dollars _____ Cents
 (Both figures and words)

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 15.06 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. Required Bid security;
 - B. Evidence of authority to do business in the state of the Project; or a written covenant to obtain such license within the time for acceptance of Bids;
 - C. Contractor’s License No.: [redacted] Evidence of Bidder’s ability to obtain a State Contractor’s License and a covenant by Bidder to obtain said license within the time for acceptance of Bids;
 - D. USDA Form RD 400-6.
 - E. USDA Form AD-1048.

F. RD Instructions 1940-Q.

7.02 Major Equipment Items

- A. The project will be awarded based on the base bid equipment listed below. The bidder must base his lump sum base bid on the listed equipment/suppliers in the Base Bid column of the schedule. Deductions for equipment substitutions will not be considered in determining the basis of award. The bidder may indicate substitute equipment/supplier items by writing in the substitute equipment/supplier item and the amount of deduction for that substitute name write-in.
- B. Substitute equipment/supplier will be deemed as equal if the substitute is the same or better than the product named and described in the specifications in function, performance, reliability, quality and general configuration. Determination of the equality of a substitute shall be determined by the Engineer after the bid, based on submittal data received with the Contractor's bid documents. Should the write-in substitute be determined "not equal", then the bidder shall supply the equipment listed in the Base Bid column. The Owner may determine any substitute "not equal" as the Owner determines to suit his sole best interests at any time.
- C. Evaluation data to determine if a substitute equipment manufacturer/ supplier is an acceptable substitute must be submitted by the bidder with the bid. Information submitted after the bid will not be considered. Information submitted directly by equipment manufacturers/suppliers will not be evaluated. Minimum evaluation data shall include submittal information in conformance with Section 01001 of the contract documents. Data and drawing submittal shall be prepared specifically for this project. Incomplete submittals that do not conform with Section 01001 will not be considered. Sales catalog cuts or marked up drawings from previous projects will not be reviewed. The Bidder shall reimburse the Owner for any engineering costs associated with the review of any substitutes in accordance with the terms of the Engineer's Agreement with the Owner. The Owner is no way obligated to review substitute equipment submittals.
- D. No substitute equipment/supplier will be considered unless, in the opinion of the Owner or Engineer, it conforms to the contract drawings and specifications in all respects, except for the make and manufacture and minor details. Design and preparation of these plans and specifications are based on the equipment/supplier noted in the Base Bid column of the schedule. The bidder shall be responsible for any and all changes necessary to accommodate the substitute equipment/supplier items. The Owner shall be reimbursed for any and all associated redesign and/or construction drawings in accordance with the terms of the Engineer's Agreement with the Owner. The bidder shall also include any and all costs associated with additional construction costs (mechanical, structural, electrical, architectural, engineering, construction observation, etc.) as the result of a substitute item. The bid shall also include any paid up licenses necessary for the use of the equipment as required.

EQUIPMENT/SUPPLIER SCHEDULE				
SPEC SECTION	DESCRIPTION	EQUIPMENT MANUFACTURERS/SUPPLIERS		AMOUNT OF DEDUCTION FOR SUBSTITUTION
		Base Bid	Substitute	
11289	Electric Actuators	Rotrok Controls, Inc.		
11291	Metal Slide Gates	Whipps, Inc. Waterman		
11312	Self-Priming Wastewater Pumps	Gorman Rupp Co.		
11372	Positive Displacement Blowers	Gardner Denver		
11375	Fine Bubble Membrane Diffusers	Evoqua Water Technologies		
11379	Septage Receiving Station	JWC Environmental		
11380	Submersible Mixers	ABS Flygt		

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

BIDDER: *[Indicate correct name of bidding entity]*

By:

[Signature] _____

[Printed name] _____

(If Bidder is a corporation, a limited liability company, a partnership, or a joint venture, attach evidence of authority to sign.)

Attest:

[Signature] _____

[Printed name] _____

Title: _____

Submittal Date: _____

Address for giving notices:

Telephone Number: _____

Fax Number: _____

Contact Name and e-mail address: _____

Bidder's License No.: _____
(where applicable)

SECTION C-410

BID FORM (STATE REVOLVING FUND)

ARTICLE 1 – BID RECIPIENT

1.01 This Bid is submitted to:

City of Lake City

202 Kelley St.

Lake City, SC 29560

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 funded by the State Revolving Fund 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 for Lake Swamp WWTP Upgrade. The SRF scope of work is identified in Section 01010 – Summary of Work.

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 90 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, and any data and reference items identified in the Bidding Documents, and hereby acknowledges receipt of the following Addenda:

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

B. Bidder has visited the Site, conducted a thorough, alert visual examination of the Site and adjacent areas, and become familiar with and satisfied itself as to the general, local, and Site conditions that may affect cost, progress, and performance of the Work.

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

D. Bidder has carefully studied all: (1) reports of explorations and tests of subsurface conditions at or adjacent to the Site that have been identified in the Supplementary Conditions, especially with respect to Technical Data in such reports and drawings.

E. Bidder has considered the information known to Bidder itself; 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 any 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; and (3) Bidder's safety precautions and programs.

- F. Bidder agrees, based on the information and observations referred to in the preceding paragraph, that no further examinations, investigations, explorations, tests, studies, or data are necessary for the determination of this Bid for performance of the Work at the price 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 confirms that 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 and furnishing of the Work.
- J. The submission of this Bid constitutes an incontrovertible representation by Bidder that Bidder has complied with every requirement of this Article, and that without exception the Bid and all prices in the Bid are premised upon performing and furnishing the Work required by the Bidding Documents.

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

See section 01010-Summary of Work for SRF scope or work. Bidder will complete the Work in accordance with the Contract Documents for the following price(s):

Lump Sum Bid Price	\$ _____
Owner Contingency Allowance	\$ 50,000
Total Bid	\$ _____

_____ Dollars _____ Cents
 (Both figures and words)

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 15.06 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. Required Bid security;
 - B. Evidence of authority to do business in the state of the Project; or a written covenant to obtain such license within the time for acceptance of Bids;
 - C. Contractor’s License No.: _____ Evidence of Bidder’s ability to obtain a State Contractor’s License and a covenant by Bidder to obtain said license within the time for acceptance of Bids;
 - D. DHEC 2556 – Bidder’s American Iron and Steel Certification
 - E. DHEC 3590 – Certification Regarding Debarment, Suspension, and Other Responsibility Matters

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

BIDDER: *[Indicate correct name of bidding entity]*

By:

[Signature] _____

[Printed name] _____

(If Bidder is a corporation, a limited liability company, a partnership, or a joint venture, attach evidence of authority to sign.)

Attest:

[Signature] _____

[Printed name] _____

Title: _____

Submittal Date: _____

Address for giving notices:

Telephone Number: _____

Fax Number: _____

Contact Name and e-mail address: _____

Bidder's License No.: _____

(where applicable)

SECTION C-430
BID BOND (RURAL UTILITIES SERVICE)

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

BIDDER (*Name and Address*):

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

OWNER (*Name and Address*):

City of Lake City
202 Kelley St.
Lake City, SC 29560

BID

Bid Due Date:
Lake Swamp WWTP Upgrade

BOND

Bond Number:

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:

Signature

By:

Signature (Attach Power of Attorney)

Print Name

Print Name

Title

Title

Attest:

Signature

Title

Attest:

Signature

Title

Note: Addresses are to be used for giving any required notice.

Provide execution by any additional parties, such as joint venturers, if necessary.

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 the 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 the Bid due date.
7. Any suit or action under this Bond shall be commenced only in a court of competent jurisdiction located in the state in which the Project is located.
8. Notices required hereunder shall be in writing and sent to Bidder and Surety at their respective addresses shown on the face of this Bond. Such notices may be sent by personal delivery, commercial courier, or by United States Registered or Certified Mail, return receipt requested, postage pre-paid, and shall be deemed to be effective upon receipt by the party concerned.
9. Surety shall cause to be attached to this Bond a current and effective Power of Attorney evidencing the authority of the officer, agent, or representative who executed this Bond on behalf of Surety to execute, seal, and deliver such Bond and bind the Surety thereby.
10. This Bond is intended to conform to all applicable statutory requirements. Any applicable requirement of any applicable statute that has been omitted from this Bond shall be deemed to be included herein as if set forth at length. If any provision of this Bond conflicts with any applicable statute, then the provision of said statute shall govern and the remainder of this Bond that is not in conflict therewith shall continue in full force and effect.
11. The term "Bid" as used herein includes a Bid, offer, or proposal as applicable.

SECTION C-430
BID BOND (STATE REVOLVING FUND)

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

BIDDER (*Name and Address*):

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

OWNER (*Name and Address*):

City of Lake City
202 Kelley St.
Lake City, SC 29560

BID

Bid Due Date:
Lake Swamp WWTP Upgrade

BOND

Bond Number:

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:

Signature

By:

Signature (Attach Power of Attorney)

Print Name

Print Name

Title

Title

Attest:

Signature

Title

Attest:

Signature

Title

Note: Addresses are to be used for giving any required notice.

Provide execution by any additional parties, such as joint venturers, if necessary.

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 the 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 the Bid due date.
7. Any suit or action under this Bond shall be commenced only in a court of competent jurisdiction located in the state in which the Project is located.
8. Notices required hereunder shall be in writing and sent to Bidder and Surety at their respective addresses shown on the face of this Bond. Such notices may be sent by personal delivery, commercial courier, or by United States Registered or Certified Mail, return receipt requested, postage pre-paid, and shall be deemed to be effective upon receipt by the party concerned.
9. Surety shall cause to be attached to this Bond a current and effective Power of Attorney evidencing the authority of the officer, agent, or representative who executed this Bond on behalf of Surety to execute, seal, and deliver such Bond and bind the Surety thereby.
10. This Bond is intended to conform to all applicable statutory requirements. Any applicable requirement of any applicable statute that has been omitted from this Bond shall be deemed to be included herein as if set forth at length. If any provision of this Bond conflicts with any applicable statute, then the provision of said statute shall govern and the remainder of this Bond that is not in conflict therewith shall continue in full force and effect.
11. The term "Bid" as used herein includes a Bid, offer, or proposal as applicable.

SECTION C-451

QUALIFICATIONS STATEMENT

THE INFORMATION SUPPLIED IN THIS DOCUMENT IS CONFIDENTIAL TO THE EXTENT PERMITTED BY LAWS AND REGULATIONS

1. SUBMITTED BY:

Official Name of Firm: _____

Address: _____

2. SUBMITTED TO:

3. SUBMITTED FOR:

Owner: _____

Project Name: _____

TYPE OF WORK:

4. CONTRACTOR'S CONTACT INFORMATION

Contact Person: _____

Title: _____

Phone: _____

Email: _____

5. AFFILIATED COMPANIES:

Name: _____

Address: _____

6. TYPE OF ORGANIZATION:

SOLE PROPRIETORSHIP

Name of Owner: _____

Doing Business As: _____

Date of Organization: _____

PARTNERSHIP

Date of Organization: _____

Type of Partnership: _____

Name of General Partner(s): _____

CORPORATION

State of Organization: _____

Date of Organization: _____

Executive Officers:

- President: _____

- Vice President(s): _____

- Treasurer: _____

- Secretary: _____

LIMITED LIABILITY COMPANY

State of Organization: _____

Date of Organization: _____

Members: _____

JOINT VENTURE

Sate of Organization: _____

Date of Organization: _____

Form of Organization: _____

Joint Venture Managing Partner

- Name: _____

- Address: _____

Joint Venture Managing Partner

- Name: _____

- Address: _____

Joint Venture Managing Partner

- Name: _____

- Address: _____

7. LICENSING

Jurisdiction: _____

Type of License: _____

License Number: _____

Jurisdiction: _____

Type of License: _____

License Number: _____

8. CERTIFICATIONS

CERTIFIED BY:

Disadvantage Business Enterprise: _____

Minority Business Enterprise: _____

Woman Owned Enterprise: _____

Small Business Enterprise: _____

Other (_____): _____

9. BONDING INFORMATION

Bonding Company: _____

Address: _____

Bonding Agent: _____

Address: _____

Contact Name: _____

Phone: _____

Aggregate Bonding Capacity: _____

Available Bonding Capacity as of date of this submittal: _____

10. FINANCIAL INFORMATION

Financial Institution: _____

Address: _____

Account Manager: _____

Phone: _____

INCLUDE AS AN ATTACHMENT AN AUDITED BALANCE SHEET FOR EACH OF THE
LAST 3 YEARS

11. CONSTRUCTION EXPERIENCE:

Current Experience:

List on **Schedule A** all uncompleted projects currently under contract (If Joint Venture list each participant's projects separately).

Previous Experience:

List on **Schedule B** all projects completed within the last 5 Years (If Joint Venture list each participant's projects separately).

Has firm listed in Section 1 ever failed to complete a construction contract awarded to it?

YES NO

If YES, attach as an Attachment details including Project Owner's contact information.

Has any Corporate Officer, Partner, Joint Venture participant or Proprietor ever failed to complete a construction contract awarded to them in their name or when acting as a principal of another entity?

YES NO

If YES, attach as an Attachment details including Project Owner's contact information.

Are there any judgments, claims, disputes or litigation pending or outstanding involving the firm listed in Section 1 or any of its officers (or any of its partners if a partnership or any of the individual entities if a joint venture)?

YES NO

If YES, attach as an Attachment details including Project Owner's contact information.

12. SAFETY PROGRAM:

Name of Contractor's Safety Officer: _____

Include the following as attachments:

Provide as an Attachment Contractor's (and Contractor's proposed Subcontractors and Suppliers furnishing or performing Work having a value in excess of 10 percent of the total amount of the Bid) OSHA No. 500- Log & Summary of Occupational Injuries & Illnesses for the past 5 years.

Provide as an Attachment Contractor's (and Contractor's proposed Subcontractors and Suppliers furnishing or performing Work having a value in excess of 10 percent of the total amount of the Bid) list of all OSHA Citations & Notifications of Penalty (monetary or other) received within the last 5 years (indicate disposition as applicable) - IF NONE SO STATE.

Provide as an Attachment Contractor's (and Contractor's proposed Subcontractors and Suppliers furnishing or performing Work having a value in excess of 10 percent of the total amount of the Bid) list of all safety citations or violations under any state all received within the last 5 years (indicate disposition as applicable) - IF NONE SO STATE.

Provide the following for the firm listed in Section V (and for each proposed Subcontractor furnishing or performing Work having a value in excess of 10 percent of the total amount of the Bid) the following (attach additional sheets as necessary):

Workers' compensation Experience Modification Rate (EMR) for the last 5 years:

YEAR	_____	EMR	_____
YEAR	_____	EMR	_____
YEAR	_____	EMR	_____
YEAR	_____	EMR	_____
YEAR	_____	EMR	_____

Total Recordable Frequency Rate (TRFR) for the last 5 years:

YEAR	_____	TRFR	_____
YEAR	_____	TRFR	_____
YEAR	_____	TRFR	_____
YEAR	_____	TRFR	_____
YEAR	_____	TRFR	_____

13. EQUIPMENT:

MAJOR EQUIPMENT:

List on **Schedule C** all pieces of major equipment available for use on Owner's Project.

I HEREBY CERTIFY THAT THE INFORMATION SUBMITTED HEREWITH, INCLUDING ANY ATTACHMENTS, IS TRUE TO THE BEST OF MY KNOWLEDGE AND BELIEF.

NAME OF ORGANIZATION: _____

BY: _____

TITLE: _____

DATED: _____

NOTARY ATTEST:

SUBSCRIBED AND SWORN TO BEFORE ME

THIS _____ DAY OF _____, 20__

NOTARY PUBLIC - STATE OF _____

MY COMMISSION EXPIRES: _____

REQUIRED ATTACHMENTS

1. Schedule A (Current Experience).
2. Schedule B (Previous Experience).
3. Schedule C (Major Equipment).

SCHEDULE A

CURRENT EXPERIENCE

Project Name	Owner's Contact Person	Design Engineer	Contract Date	Type of Work	Status	Cost of Work
	Name: Address: Telephone:	Name: Company: Telephone:				
	Name: Address: Telephone:	Name: Company: Telephone:				
	Name: Address: Telephone:	Name: Company: Telephone:				
	Name: Address: Telephone:	Name: Company: Telephone:				
	Name: Address: Telephone:	Name: Company: Telephone:				
	Name: Address: Telephone:	Name: Company: Telephone:				
	Name: Address: Telephone:	Name: Company: Telephone:				
	Name: Address: Telephone:	Name: Company: Telephone:				

SCHEDULE B

PREVIOUS EXPERIENCE (Include ALL Projects Completed within last 5 years)

Project Name	Owner's Contact Person	Design Engineer	Contract Date	Type of Work	Status	Cost of Work
	Name: Address: Telephone:	Name: Company: Telephone:				
	Name: Address: Telephone:	Name: Company: Telephone:				
	Name: Address: Telephone:	Name: Company: Telephone:				
	Name: Address: Telephone:	Name: Company: Telephone:				
	Name: Address: Telephone:	Name: Company: Telephone:				
	Name: Address: Telephone:	Name: Company: Telephone:				
	Name: Address: Telephone:	Name: Company: Telephone:				
	Name: Address: Telephone:	Name: Company: Telephone:				

SCHEDULE B

PREVIOUS EXPERIENCE (Include ALL Projects Completed within last 5 years)

Project Name	Owner's Contact Person	Design Engineer	Contract Date	Type of Work	Status	Cost of Work
	Name: Address: Telephone:	Name: Company: Telephone:				
	Name: Address: Telephone:	Name: Company: Telephone:				
	Name: Address: Telephone:	Name: Company: Telephone:				
	Name: Address: Telephone:	Name: Company: Telephone:				
	Name: Address: Telephone:	Name: Company: Telephone:				
	Name: Address: Telephone:	Name: Company: Telephone:				
	Name: Address: Telephone:	Name: Company: Telephone:				
	Name: Address: Telephone:	Name: Company: Telephone:				

SCHEDULE C - LIST OF MAJOR EQUIPMENT AVAILABLE

ITEM	PURCHASE DATE	CONDITION	ACQUIRED VALUE

SECTION C-510

NOTICE OF AWARD (STATE REVOLVING FUND)

Date of Issuance:

Owner: City of Lake City Owner's Contract No.:
Engineer: Constantine Engineering, Inc. Engineer's Project No.: 100392.02
Project: Lake Swamp WWTP Upgrade Contract Name:

Bidder:

Bidder's Address:

TO BIDDER:

You are notified that Owner has accepted your Bid dated [_____] for the above Contract, and that you are the Successful Bidder and are awarded a Contract for:

Lake Swamp WWTP Upgrade

The Contract Price of the awarded Contract is: \$ _____ [note if subject to unit prices, or cost-plus]

[] unexecuted counterparts of the Agreement accompany this Notice of Award, and one copy of the Contract Documents accompanies this Notice of Award, or has been transmitted or made available to Bidder electronically. [revise if multiple copies accompany the Notice of Award]

a set of the Drawings will be delivered separately from the other Contract Documents.

You must comply with the following conditions precedent within 15 days of the date of this Notice of Award:

1. Deliver to Owner [_____] counterparts of the Agreement, fully executed by Bidder.
2. Deliver with the executed Agreement(s) the Contract security [e.g., performance and payment bonds] and insurance documentation as specified in the Instructions to Bidders and General Conditions, Articles 2 and 6.
3. Other conditions precedent (if any):

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 Agreement, together with any additional copies of the Contract Documents as indicated in Paragraph 2.02 of the General Conditions.

Owner:

Authorized Signature

By:

Title:

Copy: Engineer

SECTION C-520

AGREEMENT (RURAL UTILITIES SERVICE) BETWEEN OWNER AND CONTRACTOR FOR CONSTRUCTION CONTRACT (STIPULATED PRICE)

THIS AGREEMENT is by and between City of Lake City (“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:

ARTICLE 2 – THE PROJECT

2.01 The Project, of which the Work under the Contract Documents is a part, is generally described as follows: Lake Swamp WWTP Upgrade.

ARTICLE 3 – ENGINEER

- 3.01 The part of the Project that pertains to the Work has been designed by Constantine Engineering, Inc.
- 3.02 The Owner has retained Constantine Engineering, Inc. (“Engineer”) 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 *Contract Times: Days*

- A. The Work will be substantially completed within 548 days after the date when the Contract Times commence to run as provided in Paragraph 4.01 of the General Conditions, and completed and ready for final payment in accordance with Paragraph 15.06 of the General Conditions within 578 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 and other losses if the Work is not

shown on the punch list of items to be completed or corrected prior to final payment.

6.03 *Final Payment*

- A. Upon final completion and acceptance of the Work in accordance with Paragraph 15.06 of the General Conditions, Owner shall pay the remainder of the Contract Price as recommended by Engineer as provided in said Paragraph 15.06.

ARTICLE 7 – INTEREST

7.01 All amounts not paid when due shall bear interest at the rate of 10 percent per annum.

ARTICLE 8 – CONTRACTOR’S REPRESENTATIONS

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

- A. Contractor has examined and carefully studied the Contract Documents, and any data and reference items identified in the Contract Documents.
- B. Contractor has visited the Site, conducted a thorough, alert visual examination of the Site and adjacent areas, 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 Laws and Regulations that may affect cost, progress, and performance of the Work.
- D. Contractor has carefully studied all: (1) reports of explorations and tests of subsurface conditions at or adjacent to the Site and all drawings of physical conditions relating to existing surface or subsurface structures at the Site that have been identified in the Supplementary Conditions, especially with respect to Technical Data in such reports and drawings.
- E. Contractor has considered the information known to Contractor itself; 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; and (3) Contractor’s safety precautions and programs.
- F. Based on the information and observations referred to in the preceding paragraph, Contractor agrees that no 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.
- 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.

- J. Contractor's entry into this Contract constitutes an incontrovertible representation by Contractor that without exception all prices in the Agreement are premised upon performing and furnishing the Work required by the Contract Documents.

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 (not attached but incorporated by reference) consisting of █ sheets with each sheet bearing the following general title: Industrial Park WTP, Division 1 – Water Treatment Plant.
 8. Addenda (numbers █ to █, inclusive).
 9. Exhibits to this Agreement (enumerated as follows):
 - a. Contractor's Bid (pages █ to █, inclusive).
 10. The following which may be delivered or issued on or after the Effective Date of the Contract and are not attached hereto:
 - a. Notice to Proceed.
 - b. Work Change Directives.
 - c. Change Orders.
 - d. Field 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 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. Unless expressly agreed to elsewhere in the Contract, 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, money that may become due and money that is 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 successors, assigns, and legal representatives to the other party hereto, its 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*

- A. Owner stipulates that if the General Conditions that are made a part of this Contract are based on EJCDC® C-700, Standard General Conditions for the Construction Contract, published by the Engineers Joint Contract Documents Committee®, and if Owner is the party that has furnished said General Conditions, then Owner has plainly shown all modifications to the standard wording of such published document to the Contractor,

through a process such as highlighting or "track changes" (redline/strikeout), or in the Supplementary Conditions.

IN WITNESS WHEREOF, Owner and Contractor have signed this Agreement.

This Agreement will be effective on [REDACTED] (which is the Effective Date of the Contract).

OWNER:

CONTRACTOR:

CITY OF LAKE CITY

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)

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

NOTE TO USER: Use in those states or other jurisdictions where applicable or required.

SECTION C-520

AGREEMENT (STATE REVOLVING FUND) BETWEEN OWNER AND CONTRACTOR FOR CONSTRUCTION CONTRACT (STIPULATED PRICE)

THIS AGREEMENT is by and between City of Lake City (“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:

ARTICLE 2 – THE PROJECT

2.01 The Project, of which the Work under the Contract Documents is a part, is generally described as follows: Lake Swamp WWTP Upgrade.

ARTICLE 3 – ENGINEER

- 3.01 The part of the Project that pertains to the Work has been designed by Constantine Engineering, Inc.
- 3.02 The Owner has retained Constantine Engineering, Inc. (“Engineer”) 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 *Contract Times: Days*

- A. The Work will be substantially completed within 548 days after the date when the Contract Times commence to run as provided in Paragraph 4.01 of the General Conditions, and completed and ready for final payment in accordance with Paragraph 15.06 of the General Conditions within 578 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 and other losses if the Work is not

completed and Milestones not achieved within the times specified in Paragraph 4.02 above, plus any extensions thereof allowed in accordance with the Contract. 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):

1. Substantial Completion: Contractor shall pay Owner \$1,000 for each day that expires after the time (as duly adjusted pursuant to the Contract) specified in Paragraph 4.02.A above for Substantial Completion until the Work is substantially complete.

ARTICLE 5 – CONTRACT PRICE

5.01 Owner shall pay Contractor for completion of the Work in accordance with the Contract Documents the amounts that follow, subject to adjustment under the Contract:

- A. Total of Lump Sum Price \$ _____.

ARTICLE 6 – PAYMENT PROCEDURES

6.01 Submittal and Processing of Payments

- A. Contractor shall submit Applications for Payment in accordance with Article 15 of the General Conditions. Applications for Payment will be processed by Engineer as provided in the General Conditions.

6.02 Progress Payments; Retainage

- A. Owner shall make progress payments on account of the Contract Price on the basis of Contractor's Applications for Payment during performance of the Work as provided in Paragraph 6.02.A.1 below, provided that such Applications for Payment have been submitted in a timely manner and otherwise meet the requirements of the Contract. All such payments will be measured by the Schedule of Values established as provided in 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 elsewhere in the Contract.

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 Owner may withhold, including but not limited to liquidated damages, in accordance with the Contract
 - a. 90 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. 90 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 set off by Owner pursuant to Paragraph 15.01.E of the General Conditions, and less 200 percent of Engineer's estimate of the value of Work to be completed or corrected as

shown on the punch list of items to be completed or corrected prior to final payment.

6.03 *Final Payment*

- A. Upon final completion and acceptance of the Work in accordance with Paragraph 15.06 of the General Conditions, Owner shall pay the remainder of the Contract Price as recommended by Engineer as provided in said Paragraph 15.06.

ARTICLE 7 – INTEREST

7.01 All amounts not paid when due shall bear interest at the rate of 10 percent per annum.

ARTICLE 8 – CONTRACTOR’S REPRESENTATIONS

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

- A. Contractor has examined and carefully studied the Contract Documents, and any data and reference items identified in the Contract Documents.
- B. Contractor has visited the Site, conducted a thorough, alert visual examination of the Site and adjacent areas, 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 Laws and Regulations that may affect cost, progress, and performance of the Work.
- D. Contractor has carefully studied all: (1) reports of explorations and tests of subsurface conditions at or adjacent to the Site and all drawings of physical conditions relating to existing surface or subsurface structures at the Site that have been identified in the Supplementary Conditions, especially with respect to Technical Data in such reports and drawings.
- E. Contractor has considered the information known to Contractor itself; 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; and (3) Contractor’s safety precautions and programs.
- F. Based on the information and observations referred to in the preceding paragraph, Contractor agrees that no 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.
- 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.

- J. Contractor's entry into this Contract constitutes an incontrovertible representation by Contractor that without exception all prices in the Agreement are premised upon performing and furnishing the Work required by the Contract Documents.

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 (not attached but incorporated by reference) consisting of █ sheets with each sheet bearing the following general title: Industrial Park WTP, Division 1 – Water Treatment Plant.
 8. Addenda (numbers █ to █, inclusive).
 9. Exhibits to this Agreement (enumerated as follows):
 - a. Contractor's Bid (pages █ to █, inclusive).
 10. The following which may be delivered or issued on or after the Effective Date of the Contract and are not attached hereto:
 - a. Notice to Proceed.
 - b. Work Change Directives.
 - c. Change Orders.
 - d. Field 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 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. Unless expressly agreed to elsewhere in the Contract, 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, money that may become due and money that is 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 successors, assigns, and legal representatives to the other party hereto, its 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*

- A. Owner stipulates that if the General Conditions that are made a part of this Contract are based on EJCDC® C-700, Standard General Conditions for the Construction Contract, published by the Engineers Joint Contract Documents Committee®, and if Owner is the party that has furnished said General Conditions, then Owner has plainly shown all modifications to the standard wording of such published document to the Contractor,

through a process such as highlighting or "track changes" (redline/strikeout), or in the Supplementary Conditions.

IN WITNESS WHEREOF, Owner and Contractor have signed this Agreement.

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

OWNER:

CONTRACTOR:

CITY OF LAKE CITY

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)

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

NOTE TO USER: Use in those states or other jurisdictions where applicable or required.

SECTION C-550
NOTICE TO PROCEED (RURAL UTILITIES SERVICE)

Owner:	City of Lake City	Owner's Contract No.:	
Contractor:		Contractor's Project No.:	
Engineer:	Constantine Engineering, Inc.	Engineer's Project No.:	100392.02
Project:	Lake Swamp WWTP Upgrade	Contract Name:	
		Effective Date of Contract:	

TO CONTRACTOR:

Owner hereby notifies Contractor that the Contract Times under the above Contract will commence to run on [REDACTED], 20__].

On that date, Contractor shall start performing its obligations under the Contract Documents. No Work shall be done at the Site prior to such date. In accordance with the Agreement, the number of days to achieve Substantial Completion is 548, and the number of days to achieve readiness for final payment is 578.

Owner:

Authorized Signature

By:

Title:

Date Issued:

Copy: Engineer

SECTION C-550
NOTICE TO PROCEED (STATE REVOLVING FUND)

Owner:	City of Lake City	Owner's Contract No.:	
Contractor:		Contractor's Project No.:	
Engineer:	Constantine Engineering, Inc.	Engineer's Project No.:	100392.02
Project:	Lake Swamp WWTP Upgrade	Contract Name:	
		Effective Date of Contract:	

TO CONTRACTOR:

Owner hereby notifies Contractor that the Contract Times under the above Contract will commence to run on [REDACTED], 20__].

On that date, Contractor shall start performing its obligations under the Contract Documents. No Work shall be done at the Site prior to such date. In accordance with the Agreement, the number of days to achieve Substantial Completion is 548, and the number of days to achieve readiness for final payment is 578.

Owner:

Authorized Signature

By:

Title:

Date Issued:

Copy: Engineer

SECTION C-610

PERFORMANCE BOND

CONTRACTOR *(name and address):*

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

OWNER *(name and address):*

City of Lake City
 202 Kelley St.
 Lake City, SC 29560

CONSTRUCTION CONTRACT

Effective Date of the Agreement:
 Amount:
 Description: Lake Swamp WWTP Upgrade

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)
 Contractor's Name and Corporate Seal

(seal)
 Surety's Name and Corporate Seal

By: _____
 Signature

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

 Print Name

 Print Name

 Title

 Title

Attest: _____
 Signature

Attest: _____
 Signature

 Title

 Title

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

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

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

3. 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:

SECTION C-615

PAYMENT BOND

CONTRACTOR *(name and address)*:

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

OWNER: City of Lake City
202 Kelley St.
Lake City, SC 29560

CONSTRUCTION CONTRACT

Effective Date of the Agreement:
Amount:
Description: Lake Swamp WWTP Upgrade

BOND

Bond Number:
Date *(not earlier than the Effective Date of the Agreement of the Construction Contract)*:
Amount:
Modifications to this Bond Form: None See Paragraph 18

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

CONTRACTOR AS PRINCIPAL

SURETY

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

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

By: _____
Signature

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

Print Name

Print Name

Title

Title

Attest: _____
Signature

Attest: _____
Signature

Title

Title

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

1. The Contractor and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors, and assigns to the Owner 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
 - 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.
8. The total amount due and unpaid to the Claimant for labor, materials, or equipment furnished as of the date of the Claim.
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:



SECTION C-620
Contractor's Application for Payment No.

	Application Period:	Application Date:
To (Owner):	From (Contractor):	Via (Engineer):
Project:	Contract:	
Owner's Contract No.:	Contractor's Project No.:	Engineer's Project No.:

Application For Payment
Change Order Summary

Approved Change Orders	Number	Additions	Deductions		
				1. ORIGINAL CONTRACT PRICE.....	\$ _____
				2. Net change by Change Orders.....	\$ _____
				3. Current Contract Price (Line 1 ± 2).....	\$ _____
				4. TOTAL COMPLETED AND STORED TO DATE (Column F total on Progress Estimates).....	\$ _____
				5. RETAINAGE:	
				a. X _____ Work Completed.....	\$ _____
				b. X _____ Stored Material.....	\$ _____
				c. Total Retainage (Line 5.a + Line 5.b).....	\$ _____
				6. AMOUNT ELIGIBLE TO DATE (Line 4 - Line 5.c).....	\$ _____
				7. LESS PREVIOUS PAYMENTS (Line 6 from prior Application).....	\$ _____
				8. AMOUNT DUE THIS APPLICATION.....	\$ _____
				9. BALANCE TO FINISH, PLUS RETAINAGE (Column G total on Progress Estimates + Line 5.c above).....	\$ _____
TOTALS					
NET CHANGE BY					
CHANGE ORDERS					

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

Payment of:	\$ _____	(Line 8 or other - attach explanation of the other amount)
is recommended by:	_____	_____ (Date)
	(Engineer)	
Payment of:	\$ _____	(Line 8 or other - attach explanation of the other amount)
is approved by:	_____	_____ (Date)
	(Owner)	
Approved by:	_____	_____ (Date)
	Funding or Financing Entity (if applicable)	

**SECTION C-625
CERTIFICATE OF SUBSTANTIAL COMPLETION**

Owner:	City of Lake City	Owner's Contract No.:	
Contractor:		Contractor's Project No.:	
Engineer:	Constantine Engineering, Inc.	Engineer's Project No.:	100392.02
Project:	Lake Swamp WWTP Upgrade	Contract Name:	

This [preliminary] [final] Certificate of Substantial Completion applies to:

- All Work 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 Work or portion thereof designated above is hereby established, subject to the provisions of the Contract pertaining to Substantial Completion. The date of Substantial Completion in the final Certificate of Substantial Completion marks the commencement of the contractual correction period and applicable warranties required by the Contract.

A punch list of items to be completed or corrected is attached to this Certificate. 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.

The responsibilities between Owner and Contractor for security, operation, safety, maintenance, heat, utilities, insurance, and warranties upon Owner's use or occupancy of the Work shall be as provided in the Contract, except as amended as follows: *[Note: Amendments of contractual responsibilities recorded in this Certificate should be the product of mutual agreement of Owner and Contractor; see Paragraph 15.03.D of the General Conditions.]*

Amendments to Owner's responsibilities: None
 As follows

Amendments to Contractor's responsibilities: None
 As follows:

The following documents are attached to and made a part of this Certificate: *[punch list; others]*

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.

EXECUTED BY ENGINEER:		RECEIVED:		RECEIVED:	
By: _____	By: _____	By: _____	By: _____	By: _____	By: _____
(Authorized signature)	Owner (Authorized Signature)	Owner (Authorized Signature)	Contractor (Authorized Signature)	Contractor (Authorized Signature)	Contractor (Authorized Signature)
Title: _____	Title: _____	Title: _____	Title: _____	Title: _____	Title: _____
Date: _____	Date: _____	Date: _____	Date: _____	Date: _____	Date: _____

**SECTION C-700
STANDARD GENERAL CONDITIONS OF THE
CONSTRUCTION CONTRACT**

TABLE OF CONTENTS

	Page
Article 1 – Definitions and Terminology	1
1.01 Defined Terms	1
1.02 Terminology	4
Article 2 – Preliminary Matters	6
2.01 Delivery of Bonds and Evidence of Insurance	6
2.02 Copies of Documents	6
2.03 Before Starting Construction	6
2.04 Preconstruction Conference; Designation of Authorized Representatives	6
2.05 Initial Acceptance of Schedules	7
2.06 Electronic Transmittals.....	7
Article 3 – Documents: Intent, Requirements, Reuse	7
3.01 Intent.....	7
3.02 Reference Standards	8
3.03 Reporting and Resolving Discrepancies	8
3.04 Requirements of the Contract Documents	9
3.05 Reuse of Documents	9
Article 4 – Commencement and Progress of the Work	10
4.01 Commencement of Contract Times; Notice to Proceed	10
4.02 Starting the Work.....	10
4.03 Reference Points	10
4.04 Progress Schedule	10
4.05 Delays in Contractor’s Progress	10
Article 5 – Availability of Lands; Subsurface and Physical Conditions; Hazardous Environmental Conditions	11
5.01 Availability of Lands	11
5.02 Use of Site and Other Areas	12
5.03 Subsurface and Physical Conditions.....	12

5.04	Differing Subsurface or Physical Conditions	13
5.05	Underground Facilities	14
5.06	Hazardous Environmental Conditions at Site	16
Article 6 – Bonds and Insurance		18
6.01	Performance, Payment, and Other Bonds	18
6.02	Insurance—General Provisions	18
6.03	Contractor’s Insurance	20
6.04	Owner’s Liability Insurance	22
6.05	Property Insurance.....	22
6.06	Waiver of Rights.....	24
6.07	Receipt and Application of Property Insurance Proceeds	24
Article 7 – Contractor’s Responsibilities		25
7.01	Supervision and Superintendence	25
7.02	Labor; Working Hours	25
7.03	Services, Materials, and Equipment.....	25
7.04	“Or Equals”	26
7.05	Substitutes	27
7.06	Concerning Subcontractors, Suppliers, and Others	28
7.07	Patent Fees and Royalties	29
7.08	Permits	30
7.09	Taxes	30
7.10	Laws and Regulations.....	30
7.11	Record Documents.....	31
7.12	Safety and Protection.....	31
7.13	Safety Representative	32
7.14	Hazard Communication Programs	32
7.15	Emergencies	32
7.16	Shop Drawings, Samples, and Other Submittals.....	32
7.17	Contractor’s General Warranty and Guarantee.....	34
7.18	Indemnification	35
7.19	Delegation of Professional Design Services	36
Article 8 – Other Work at the Site		36
8.01	Other Work	36

8.02	Coordination	37
8.03	Legal Relationships.....	37
Article 9 – Owner’s Responsibilities.....		38
9.01	Communications to Contractor.....	38
9.02	Replacement of Engineer	38
9.03	Furnish Data	38
9.04	Pay When Due.....	38
9.05	Lands and Easements; Reports, Tests, and Drawings	39
9.06	Insurance.....	39
9.07	Change Orders.....	39
9.08	Inspections, Tests, and Approvals.....	39
9.09	Limitations on Owner’s Responsibilities	39
9.10	Undisclosed Hazardous Environmental Condition.....	39
9.11	Evidence of Financial Arrangements.....	39
9.12	Safety Programs	39
Article 10 – Engineer’s Status During Construction.....		39
10.01	Owner’s Representative.....	39
10.02	Visits to Site.....	39
10.03	Project Representative.....	40
10.04	Rejecting Defective Work.....	40
10.05	Shop Drawings, Change Orders and Payments.....	40
10.06	Determinations for Unit Price Work	40
10.07	Decisions on Requirements of Contract Documents and Acceptability of Work	40
10.08	Limitations on Engineer’s Authority and Responsibilities.....	41
10.09	Compliance with Safety Program.....	41
Article 11 – Amending the Contract Documents; Changes in the Work		41
11.01	Amending and Supplementing Contract Documents	41
11.02	Owner-Authorized Changes in the Work	42
11.03	Unauthorized Changes in the Work.....	42
11.04	Change of Contract Price	42
11.05	Change of Contract Times	43
11.06	Change Proposals.....	44
11.07	Execution of Change Orders.....	44

11.08	Notification to Surety.....	45
Article 12 –	Claims.....	45
12.01	Claims.....	45
Article 13 –	Cost of the Work; Allowances; Unit Price Work.....	46
13.01	Cost of the Work.....	46
13.02	Allowances.....	48
13.03	Unit Price Work.....	49
Article 14 –	Tests and Inspections; Correction, Removal or Acceptance of Defective Work.....	50
14.01	Access to Work.....	50
14.02	Tests, Inspections, and Approvals.....	50
14.03	Defective Work.....	51
14.04	Acceptance of Defective Work.....	51
14.05	Uncovering Work.....	51
14.06	Owner May Stop the Work.....	52
14.07	Owner May Correct Defective Work.....	52
Article 15 –	Payments to Contractor; Set-Offs; Completion; Correction Period.....	52
15.01	Progress Payments.....	53
15.02	Contractor’s Warranty of Title.....	55
15.03	Substantial Completion.....	56
15.04	Partial Use or Occupancy.....	56
15.05	Final Inspection.....	57
15.06	Final Payment.....	57
15.07	Waiver of Claims.....	58
15.08	Correction Period.....	58
Article 16 –	Suspension of Work and Termination.....	59
16.01	Owner May Suspend Work.....	59
16.02	Owner May Terminate for Cause.....	59
16.03	Owner May Terminate For Convenience.....	60
16.04	Contractor May Stop Work or Terminate.....	61
Article 17 –	Final Resolution of Disputes.....	61
17.01	Methods and Procedures.....	61
Article 18 –	Miscellaneous.....	62
18.01	Giving Notice.....	62

18.02	Computation of Times.....	62
18.03	Cumulative Remedies	62
18.04	Limitation of Damages	62
18.05	No Waiver	62
18.06	Survival of Obligations	62
18.07	Controlling Law	62
18.08	Headings.....	62

ARTICLE 1 – DEFINITIONS AND TERMINOLOGY

1.01 *Defined Terms*

- A. Wherever used in the Bidding Requirements or Contract Documents, a term printed with initial capital letters, including the term's singular and plural forms, will have the meaning indicated in the definitions below. In addition to terms specifically defined, terms with initial capital letters in the Contract Documents include references to identified articles and paragraphs, and the titles of other documents or forms.
1. *Addenda*—Written or graphic instruments issued prior to the opening of Bids which clarify, correct, or change the Bidding Requirements or the proposed Contract Documents.
 2. *Agreement*—The written instrument, executed by Owner and Contractor, that sets forth the Contract Price and Contract Times, identifies the parties and the Engineer, and designates the specific items that are Contract Documents.
 3. *Application for Payment*—The form acceptable to Engineer which is to be used by Contractor during the course of the Work in requesting progress or final payments and which is to be accompanied by such supporting documentation as is required by the Contract Documents.
 4. *Bid*—The offer of a Bidder submitted on the prescribed form setting forth the prices for the Work to be performed.
 5. *Bidder*—An individual or entity that submits a Bid to Owner.
 6. *Bidding Documents*—The Bidding Requirements, the proposed Contract Documents, and all Addenda.
 7. *Bidding Requirements*—The advertisement or invitation to bid, Instructions to Bidders, Bid Bond or other Bid security, if any, the Bid Form, and the Bid with any attachments.
 8. *Change Order*—A document which is signed by Contractor and Owner and authorizes an addition, deletion, or revision in the Work or an adjustment in the Contract Price or the Contract Times, or other revision to the Contract, issued on or after the Effective Date of the Contract.
 9. *Change Proposal*—A written request by Contractor, duly submitted in compliance with the procedural requirements set forth herein, seeking an adjustment in Contract Price or Contract Times, or both; contesting an initial decision by Engineer concerning the requirements of the Contract Documents or the acceptability of Work under the Contract Documents; challenging a set-off against payments due; or seeking other relief with respect to the terms of the Contract.
 10. *Claim*—(a) A demand or assertion by Owner directly to Contractor, duly submitted in compliance with the procedural requirements set forth herein: seeking an adjustment of Contract Price or Contract Times, or both; contesting an initial decision by Engineer concerning the requirements of the Contract Documents or the acceptability of Work under the Contract Documents; contesting Engineer's decision regarding a Change Proposal; seeking resolution of a contractual issue that Engineer has declined to address; or seeking other relief with respect to the terms of the Contract; or (b) a demand or assertion by Contractor directly to Owner, duly submitted in compliance with the procedural requirements set forth herein, contesting Engineer's decision regarding a Change Proposal; or seeking resolution of a contractual issue that Engineer has declined

to address. A demand for money or services by a third party is not a Claim.

11. *Constituent of Concern*—Asbestos, petroleum, radioactive materials, polychlorinated biphenyls (PCBs), hazardous waste, and any substance, product, waste, or other material of any nature whatsoever that is or becomes listed, regulated, or addressed pursuant to (a) the Comprehensive Environmental Response, Compensation and Liability Act, 42 U.S.C. §§9601 et seq. (“CERCLA”); (b) the Hazardous Materials Transportation Act, 49 U.S.C. §§5101 et seq.; (c) the Resource Conservation and Recovery Act, 42 U.S.C. §§6901 et seq. (“RCRA”); (d) the Toxic Substances Control Act, 15 U.S.C. §§2601 et seq.; (e) the Clean Water Act, 33 U.S.C. §§1251 et seq.; (f) the Clean Air Act, 42 U.S.C. §§7401 et seq.; or (g) any other federal, state, or local statute, law, rule, regulation, ordinance, resolution, code, order, or decree regulating, relating to, or imposing liability or standards of conduct concerning, any hazardous, toxic, or dangerous waste, substance, or material.
12. *Contract*—The entire and integrated written contract between the Owner and Contractor concerning the Work.
13. *Contract Documents*—Those items so designated in the Agreement, and which together comprise the Contract.
14. *Contract Price*—The money that Owner has agreed to pay Contractor for completion of the Work in accordance with the Contract Documents. .
15. *Contract Times*—The number of days or the dates by which Contractor shall: (a) achieve Milestones, if any; (b) achieve Substantial Completion; and (c) complete the Work.
16. *Contractor*—The individual or entity with which Owner has contracted for performance of the Work.
17. *Cost of the Work*—See Paragraph 13.01 for definition.
18. *Drawings*—The part of the Contract that graphically shows the scope, extent, and character of the Work to be performed by Contractor.
19. *Effective Date of the Contract*—The date, indicated in the Agreement, on which the Contract becomes effective.
20. *Engineer*—The individual or entity named as such in the Agreement.
21. *Field Order*—A written order issued by Engineer which requires minor changes in the Work but does not change the Contract Price or the Contract Times.
22. *Hazardous Environmental Condition*—The presence at the Site of Constituents of Concern in such quantities or circumstances that may present a danger to persons or property exposed thereto. The presence at the Site of materials that are necessary for the execution of the Work, or that are to be incorporated in the Work, and that are controlled and contained pursuant to industry practices, Laws and Regulations, and the requirements of the Contract, does not establish a Hazardous Environmental Condition.
23. *Laws and Regulations; Laws or Regulations*—Any and all applicable laws, statutes, rules, regulations, ordinances, codes, and orders of any and all governmental bodies, agencies, authorities, and courts having jurisdiction.
24. *Liens*—Charges, security interests, or encumbrances upon Contract-related funds, real property, or personal property.
25. *Milestone*—A principal event in the performance of the Work that the Contract requires Contractor to achieve by an intermediate completion date or by a time prior to

Substantial Completion of all the Work.

26. *Notice of Award*—The written notice by Owner to a Bidder of Owner’s acceptance of the Bid.
27. *Notice to Proceed*—A written notice by Owner to Contractor fixing the date on which the Contract Times will commence to run and on which Contractor shall start to perform the Work.
28. *Owner*—The individual or entity with which Contractor has contracted regarding the Work, and which has agreed to pay Contractor for the performance of the Work, pursuant to the terms of the Contract.
29. *Progress Schedule*—A schedule, prepared and maintained by Contractor, describing the sequence and duration of the activities comprising the Contractor’s plan to accomplish the Work within the Contract Times.
30. *Project*—The total undertaking to be accomplished for Owner by engineers, contractors, and others, including planning, study, design, construction, testing, commissioning, and start-up, and of which the Work to be performed under the Contract Documents is a part.
31. *Project Manual*—The written documents prepared for, or made available for, procuring and constructing the Work, including but not limited to the Bidding Documents or other construction procurement documents, geotechnical and existing conditions information, the Agreement, bond forms, General Conditions, Supplementary Conditions, and Specifications. The contents of the Project Manual may be bound in one or more volumes.
32. *Resident Project Representative*—The authorized representative of Engineer assigned to assist Engineer at the Site. As used herein, the term Resident Project Representative or “RPR” includes any assistants or field staff of Resident Project Representative.
33. *Samples*—Physical examples of materials, equipment, or workmanship that are representative of some portion of the Work and that establish the standards by which such portion of the Work will be judged.
34. *Schedule of Submittals*—A schedule, prepared and maintained by Contractor, of required submittals and the time requirements for Engineer’s review of the submittals and the performance of related construction activities.
35. *Schedule of Values*—A schedule, prepared and maintained by Contractor, allocating portions of the Contract Price to various portions of the Work and used as the basis for reviewing Contractor’s Applications for Payment.
36. *Shop Drawings*—All drawings, diagrams, illustrations, schedules, and other data or information that are specifically prepared or assembled by or for Contractor and submitted by Contractor to illustrate some portion of the Work. Shop Drawings, whether approved or not, are not Drawings and are not Contract Documents.
37. *Site*—Lands or areas indicated in the Contract Documents as being furnished by Owner upon which the Work is to be performed, including rights-of-way and easements, and such other lands furnished by Owner which are designated for the use of Contractor.
38. *Specifications*—The part of the Contract that consists of written requirements for materials, equipment, systems, standards, and workmanship as applied to the Work, and certain administrative requirements and procedural matters applicable to the Work.
39. *Subcontractor*—An individual or entity having a direct contract with Contractor or with

any other Subcontractor for the performance of a part of the Work.

40. *Substantial Completion*—The time at which the Work (or a specified part thereof) has progressed to the point where, in the opinion of Engineer, the Work (or a specified part thereof) is sufficiently complete, in accordance with the Contract Documents, so that the Work (or a specified part thereof) can be utilized for the purposes for which it is intended. The terms “substantially complete” and “substantially completed” as applied to all or part of the Work refer to Substantial Completion thereof.
41. *Successful Bidder*—The Bidder whose Bid the Owner accepts, and to which the Owner makes an award of contract, subject to stated conditions.
42. *Supplementary Conditions*—The part of the Contract that amends or supplements these General Conditions.
43. *Supplier*—A manufacturer, fabricator, supplier, distributor, materialman, or vendor having a direct contract with Contractor or with any Subcontractor to furnish materials or equipment to be incorporated in the Work by Contractor or a Subcontractor.
44. *Technical Data*—Those items expressly identified as Technical Data in the Supplementary Conditions, with respect to either (a) subsurface conditions at the Site, or physical conditions relating to existing surface or subsurface structures at the Site (except Underground Facilities) or (b) Hazardous Environmental Conditions at the Site. If no such express identifications of Technical Data have been made with respect to conditions at the Site, then the data contained in boring logs, recorded measurements of subsurface water levels, laboratory test results, and other factual, objective information regarding conditions at the Site that are set forth in any geotechnical or environmental report prepared for the Project and made available to Contractor are hereby defined as Technical Data with respect to conditions at the Site under Paragraphs 5.03, 5.04, and 5.06.
45. *Underground Facilities*—All underground pipelines, conduits, ducts, cables, wires, manholes, vaults, tanks, tunnels, or other such facilities or attachments, and any encasements containing such facilities, including but not limited to those that convey electricity, gases, steam, liquid petroleum products, telephone or other communications, fiber optic transmissions, cable television, water, wastewater, storm water, other liquids or chemicals, or traffic or other control systems.
46. *Unit Price Work*—Work to be paid for on the basis of unit prices.
47. *Work*—The entire construction or the various separately identifiable parts thereof required to be provided under the Contract Documents. Work includes and is the result of performing or providing all labor, services, and documentation necessary to produce such construction; furnishing, installing, and incorporating all materials and equipment into such construction; and may include related services such as testing, start-up, and commissioning, all as required by the Contract Documents.
48. *Work Change Directive*—A written directive to Contractor issued on or after the Effective Date of the Contract, signed by Owner and recommended by Engineer, ordering an addition, deletion, or revision in the Work.

1.02 Terminology

- A. The words and terms discussed in the following paragraphs are not defined but, when used in the Bidding Requirements or Contract Documents, have the indicated meaning.

B. *Intent of Certain Terms or Adjectives:*

1. The Contract Documents include the terms “as allowed,” “as approved,” “as ordered,” “as directed” or terms of like effect or import to authorize an exercise of professional judgment by Engineer. In addition, the adjectives “reasonable,” “suitable,” “acceptable,” “proper,” “satisfactory,” or adjectives of like effect or import are used to describe an action or determination of Engineer as to the Work. It is intended that such exercise of professional judgment, action, or determination will be solely to evaluate, in general, the Work for compliance with the information in the Contract Documents and with the design concept of the Project as a functioning whole as shown or indicated in the Contract Documents (unless there is a specific statement indicating otherwise). The use of any such term or adjective is not intended to and shall not be effective to assign to Engineer any duty or authority to supervise or direct the performance of the Work, or any duty or authority to undertake responsibility contrary to the provisions of Article 10 or any other provision of the Contract Documents.

C. *Day:*

1. The word “day” means a calendar day of 24 hours measured from midnight to the next midnight.

D. *Defective:*

1. The word “defective,” when modifying the word “Work,” refers to Work that is unsatisfactory, faulty, or deficient in that it:
 - a. does not conform to the Contract Documents; or
 - b. does not meet the requirements of any applicable inspection, reference standard, test, or approval referred to in the Contract Documents; or
 - c. has been damaged prior to Engineer’s recommendation of final payment (unless responsibility for the protection thereof has been assumed by Owner at Substantial Completion in accordance with Paragraph 15.03 or 15.04).

E. *Furnish, Install, Perform, Provide:*

1. The word “furnish,” when used in connection with services, materials, or equipment, shall mean to supply and deliver said services, materials, or equipment to the Site (or some other specified location) ready for use or installation and in usable or operable condition.
2. The word “install,” when used in connection with services, materials, or equipment, shall mean to put into use or place in final position said services, materials, or equipment complete and ready for intended use.
3. The words “perform” or “provide,” when used in connection with services, materials, or equipment, shall mean to furnish and install said services, materials, or equipment complete and ready for intended use.
4. If the Contract Documents establish an obligation of Contractor with respect to specific services, materials, or equipment, but do not expressly use any of the four words “furnish,” “install,” “perform,” or “provide,” then Contractor shall furnish and install said services, materials, or equipment complete and ready for intended use.

- F. Unless stated otherwise in the Contract Documents, words or phrases that have a well-known technical or construction industry or trade meaning are used in the Contract Documents in accordance with such recognized meaning.

ARTICLE 2 – PRELIMINARY MATTERS

2.01 *Delivery of Bonds and Evidence of Insurance*

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

2.02 *Copies of Documents*

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

2.03 *Before Starting Construction*

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

2.04 *Preconstruction Conference; Designation of Authorized Representatives*

- A. Before any Work at the Site is started, a conference attended by Owner, Contractor, Engineer, and others as appropriate will be held to establish a working understanding among the parties as to the Work and to discuss the schedules referred to in Paragraph 2.03.A, procedures for handling Shop Drawings, Samples, and other submittals, processing Applications for Payment, electronic or digital transmittals, and maintaining required records.

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

2.05 *Initial Acceptance of Schedules*

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

2.06 *Electronic Transmittals*

- A. Except as otherwise stated elsewhere in the Contract, the Owner, Engineer, and Contractor may transmit, and shall accept, Project-related correspondence, text, data, documents, drawings, information, and graphics, including but not limited to Shop Drawings and other submittals, in electronic media or digital format, either directly, or through access to a secure Project website.
- B. If the Contract does not establish protocols for electronic or digital transmittals, then Owner, Engineer, and Contractor shall jointly develop such protocols.
- C. When transmitting items in electronic media or digital format, the transmitting party makes no representations as to long term compatibility, usability, or readability of the items resulting from the recipient's use of software application packages, operating systems, or computer hardware differing from those used in the drafting or transmittal of the items, or from those established in applicable transmittal protocols.

ARTICLE 3 – DOCUMENTS: INTENT, REQUIREMENTS, REUSE

3.01 *Intent*

- A. The Contract Documents are complementary; what is required by one is as binding as if required by all.
- B. It is the intent of the Contract Documents to describe a functionally complete project (or part thereof) to be constructed in accordance with the Contract Documents.
- C. Unless otherwise stated in the Contract Documents, if there is a discrepancy between the electronic or digital versions of the Contract Documents (including any printed copies derived from such electronic or digital versions) and the printed record version, the printed record

version shall govern.

- D. The Contract supersedes prior negotiations, representations, and agreements, whether written or oral.
- E. Engineer will issue clarifications and interpretations of the Contract Documents as provided herein.

3.02 *Reference Standards*

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

3.03 *Reporting and Resolving Discrepancies*

A. *Reporting Discrepancies:*

- 1. *Contractor's Verification of Figures and Field Measurements:* Before undertaking each part of the Work, Contractor shall carefully study the Contract Documents, and check and verify pertinent figures and dimensions therein, particularly with respect to applicable field measurements. Contractor shall promptly report in writing to Engineer any conflict, error, ambiguity, or discrepancy that Contractor discovers, or has actual knowledge of, and shall not proceed with any Work affected thereby until the conflict, error, ambiguity, or discrepancy is resolved, by a clarification or interpretation by Engineer, or by an amendment or supplement to the Contract Documents issued pursuant to Paragraph 11.01.
- 2. *Contractor's Review of Contract Documents:* If, before or during the performance of the Work, Contractor discovers any conflict, error, ambiguity, or discrepancy within the Contract Documents, or between the Contract Documents and (a) any applicable Law or Regulation, (b) actual field conditions, (c) any standard specification, manual, reference standard, or code, or (d) any instruction of any Supplier, then Contractor shall promptly report it to Engineer in writing. Contractor shall not proceed with the Work affected thereby (except in an emergency as required by Paragraph 7.15) until the conflict, error, ambiguity, or discrepancy is resolved, by a clarification or interpretation by Engineer, or by an amendment or supplement to the Contract Documents issued pursuant to Paragraph 11.01.
- 3. Contractor shall not be liable to Owner or Engineer for failure to report any conflict, error, ambiguity, or discrepancy in the Contract Documents unless Contractor had actual

knowledge thereof.

B. *Resolving Discrepancies:*

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

3.04 *Requirements of the Contract Documents*

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

3.05 *Reuse of Documents*

- A. Contractor and its Subcontractors and Suppliers shall not:
 1. have or acquire any title to or ownership rights in any of the Drawings, Specifications, or other documents (or copies of any thereof) prepared by or bearing the seal of Engineer or its consultants, including electronic media editions, or reuse any such Drawings, Specifications, other documents, or copies thereof on extensions of the Project or any other project without written consent of Owner and Engineer and specific written verification or adaptation by Engineer; or
 2. have or acquire any title or ownership rights in any other Contract Documents, reuse any such Contract Documents for any purpose without Owner's express written consent, or violate any copyrights pertaining to such Contract Documents.
- B. The prohibitions of this Paragraph 3.05 will survive final payment, or termination of the Contract. Nothing herein shall preclude Contractor from retaining copies of the Contract

Documents for record purposes.

ARTICLE 4 – COMMENCEMENT AND PROGRESS OF THE WORK

4.01 Commencement of Contract Times; Notice to Proceed

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

4.02 Starting the Work

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

4.03 Reference Points

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

4.04 Progress Schedule

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

4.05 Delays in Contractor's Progress

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

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

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

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

5.01 *Availability of Lands*

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

5.02 *Use of Site and Other Areas*

A. *Limitation on Use of Site and Other Areas:*

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

5.03 *Subsurface and Physical Conditions*

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

1. those reports known to Owner of explorations and tests of subsurface conditions at or adjacent to the Site;

2. those drawings known to Owner of physical conditions relating to existing surface or subsurface structures at the Site (except Underground Facilities); and
 3. Technical Data contained in such reports and drawings.
- B. *Reliance by Contractor on Technical Data Authorized:* Contractor may rely upon the accuracy of the Technical Data expressly identified in the Supplementary Conditions with respect to such reports and drawings, but such reports and drawings are not Contract Documents. If no such express identification has been made, then Contractor may rely upon the accuracy of the Technical Data (as defined in Article 1) contained in any geotechnical or environmental report prepared for the Project and made available to Contractor. Except for such reliance on Technical Data, Contractor may not rely upon or make any claim against Owner or Engineer, or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors, with respect to:
1. the completeness of such reports and drawings for Contractor's purposes, including, but not limited to, any aspects of the means, methods, techniques, sequences, and procedures of construction to be employed by Contractor, and safety precautions and programs incident thereto; or
 2. other data, interpretations, opinions, and information contained in such reports or shown or indicated in such drawings; or
 3. any Contractor interpretation of or conclusion drawn from any Technical Data or any such other data, interpretations, opinions, or information.

5.04 *Differing Subsurface or Physical Conditions*

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

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

- B. *Engineer's Review:* After receipt of written notice as required by the preceding paragraph, Engineer will promptly review the subsurface or physical condition in question; determine the necessity of Owner's obtaining additional exploration or tests with respect to the condition; conclude whether the condition falls within any one or more of the differing site condition categories in Paragraph 5.04.A above; obtain any pertinent cost or schedule information from Contractor; prepare recommendations to Owner regarding the Contractor's resumption of Work in connection with the subsurface or physical condition in question and the need for any change in the Drawings or Specifications; and advise Owner in writing of Engineer's findings,

conclusions, and recommendations.

- C. *Owner's Statement to Contractor Regarding Site Condition:* After receipt of Engineer's written findings, conclusions, and recommendations, Owner shall issue a written statement to Contractor (with a copy to Engineer) regarding the subsurface or physical condition in question, addressing the resumption of Work in connection with such condition, indicating whether any change in the Drawings or Specifications will be made, and adopting or rejecting Engineer's written findings, conclusions, and recommendations, in whole or in part.
- D. *Possible Price and Times Adjustments:*
1. Contractor shall be entitled to an equitable adjustment in Contract Price or Contract Times, or both, to the extent that the existence of a differing subsurface or physical condition, or any related delay, disruption, or interference, causes an increase or decrease in Contractor's cost of, or time required for, performance of the Work; subject, however, to the following:
 - a. such condition must fall within any one or more of the categories described in Paragraph 5.04.A;
 - b. with respect to Work that is paid for on a unit price basis, any adjustment in Contract Price will be subject to the provisions of Paragraph 13.03; and,
 - c. Contractor's entitlement to an adjustment of the Contract Times is conditioned on such adjustment being essential to Contractor's ability to complete the Work within the Contract Times.
 2. Contractor shall not be entitled to any adjustment in the Contract Price or Contract Times with respect to a subsurface or physical condition if:
 - a. Contractor knew of the existence of such condition at the time Contractor made a commitment to Owner with respect to Contract Price and Contract Times by the submission of a Bid or becoming bound under a negotiated contract, or otherwise; or
 - b. the existence of such condition reasonably could have been discovered or revealed as a result of any examination, investigation, exploration, test, or study of the Site and contiguous areas expressly required by the Bidding Requirements or Contract Documents to be conducted by or for Contractor prior to Contractor's making such commitment; or
 - c. Contractor failed to give the written notice as required by Paragraph 5.04.A.
 3. If Owner and Contractor agree regarding Contractor's entitlement to and the amount or extent of any adjustment in the Contract Price or Contract Times, or both, then any such adjustment shall be set forth in a Change Order.
 4. Contractor may submit a Change Proposal regarding its entitlement to or the amount or extent of any adjustment in the Contract Price or Contract Times, or both, no later than 30 days after Owner's issuance of the Owner's written statement to Contractor regarding the subsurface or physical condition in question.

5.05 *Underground Facilities*

- A. *Contractor's Responsibilities:* The information and data shown or indicated in the Contract Documents with respect to existing Underground Facilities at or adjacent to the Site is based on information and data furnished to Owner or Engineer by the owners of such Underground Facilities, including Owner, or by others. Unless it is otherwise expressly provided in the

Supplementary Conditions:

1. Owner and Engineer do not warrant or guarantee the accuracy or completeness of any such information or data provided by others; and
 2. the cost of all of the following will be included in the Contract Price, and Contractor shall have full responsibility for:
 - a. reviewing and checking all information and data regarding existing Underground Facilities at the Site;
 - b. locating all Underground Facilities shown or indicated in the Contract Documents as being at the Site;
 - c. coordination of the Work with the owners (including Owner) of such Underground Facilities, during construction; and
 - d. the safety and protection of all existing Underground Facilities at the Site, and repairing any damage thereto resulting from the Work.
- B. *Notice by Contractor:* If Contractor believes that an Underground Facility that is uncovered or revealed at the Site was not shown or indicated in the Contract Documents, or was not shown or indicated with reasonable accuracy, then Contractor shall, promptly after becoming aware thereof and before further disturbing conditions affected thereby or performing any Work in connection therewith (except in an emergency as required by Paragraph 7.15), identify the owner of such Underground Facility and give written notice to that owner and to Owner and Engineer.
- C. *Engineer's Review:* Engineer will promptly review the Underground Facility and conclude whether such Underground Facility was not shown or indicated in the Contract Documents, or was not shown or indicated with reasonable accuracy; obtain any pertinent cost or schedule information from Contractor; prepare recommendations to Owner regarding the Contractor's resumption of Work in connection with the Underground Facility in question; determine the extent, if any, to which a change is required in the Drawings or Specifications to reflect and document the consequences of the existence or location of the Underground Facility; and advise Owner in writing of Engineer's findings, conclusions, and recommendations. During such time, Contractor shall be responsible for the safety and protection of such Underground Facility.
- D. *Owner's Statement to Contractor Regarding Underground Facility:* After receipt of Engineer's written findings, conclusions, and recommendations, Owner shall issue a written statement to Contractor (with a copy to Engineer) regarding the Underground Facility in question, addressing the resumption of Work in connection with such Underground Facility, indicating whether any change in the Drawings or Specifications will be made, and adopting or rejecting Engineer's written findings, conclusions, and recommendations in whole or in part.
- E. *Possible Price and Times Adjustments:*
1. Contractor shall be entitled to an equitable adjustment in the Contract Price or Contract Times, or both, to the extent that any existing Underground Facility at the Site that was not shown or indicated in the Contract Documents, or was not shown or indicated with reasonable accuracy, or any related delay, disruption, or interference, causes an increase or decrease in Contractor's cost of, or time required for, performance of the Work; subject, however, to the following:
 - a. Contractor did not know of and could not reasonably have been expected to be aware of or to have anticipated the existence or actual location of the Underground

Facility in question;

- b. With respect to Work that is paid for on a unit price basis, any adjustment in Contract Price will be subject to the provisions of Paragraph 13.03;
 - c. Contractor's entitlement to an adjustment of the Contract Times is conditioned on such adjustment being essential to Contractor's ability to complete the Work within the Contract Times; and
 - d. Contractor gave the notice required in Paragraph 5.05.B.
2. If Owner and Contractor agree regarding Contractor's entitlement to and the amount or extent of any adjustment in the Contract Price or Contract Times, or both, then any such adjustment shall be set forth in a Change Order.
 3. Contractor may submit a Change Proposal regarding its entitlement to or the amount or extent of any adjustment in the Contract Price or Contract Times, or both, no later than 30 days after Owner's issuance of the Owner's written statement to Contractor regarding the Underground Facility in question.

5.06 *Hazardous Environmental Conditions at Site*

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

1. ~~those reports and drawings known to Owner relating to Hazardous Environmental Conditions that have been identified at or adjacent to the Site; and~~
2. ~~Technical Data contained in such reports and drawings.~~

B. ~~Reliance by Contractor on Technical Data Authorized: Contractor may rely upon the accuracy of the Technical Data expressly identified in the Supplementary Conditions with respect to such reports and drawings, but such reports and drawings are not Contract Documents. If no such express identification has been made, then Contractor may rely on the accuracy of the Technical Data (as defined in Article 1) contained in any geotechnical or environmental report prepared for the Project and made available to Contractor. Except for such reliance on Technical Data, Contractor may not rely upon or make any claim against Owner or Engineer, or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors with respect to:~~

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

C. ~~Contractor shall not be responsible for removing or remediating any Hazardous Environmental Condition encountered, uncovered, or revealed at the Site unless such removal or remediation is expressly identified in the Contract Documents to be within the scope of the Work.~~

D. ~~Contractor shall be responsible for controlling, containing, and duly removing all Constituents of Concern brought to the Site by Contractor, Subcontractors, Suppliers, or anyone else for whom Contractor is responsible, and for any associated costs; and for the costs of removing and remediating any Hazardous Environmental Condition created by the presence of any such~~

Constituents of Concern.

- E. ~~If Contractor encounters, uncovers, or reveals a Hazardous Environmental Condition whose removal or remediation is not expressly identified in the Contract Documents as being within the scope of the Work, or if Contractor or anyone for whom Contractor is responsible creates a Hazardous Environmental Condition, then Contractor shall immediately: (1) secure or otherwise isolate such condition; (2) stop all Work in connection with such condition and in any area affected thereby (except in an emergency as required by Paragraph 7.15); and (3) notify Owner and Engineer (and promptly thereafter confirm such notice in writing). Owner shall promptly consult with Engineer concerning the necessity for Owner to retain a qualified expert to evaluate such condition or take corrective action, if any. Promptly after consulting with Engineer, Owner shall take such actions as are necessary to permit Owner to timely obtain required permits and provide Contractor the written notice required by Paragraph 5.06.F. If Contractor or anyone for whom Contractor is responsible created the Hazardous Environmental Condition in question, then Owner may remove and remediate the Hazardous Environmental Condition, and impose a set-off against payments to account for the associated costs.~~
- F. ~~Contractor shall not resume Work in connection with such Hazardous Environmental Condition or in any affected area until after Owner has obtained any required permits related thereto, and delivered written notice to Contractor either (1) specifying that such condition and any affected area is or has been rendered safe for the resumption of Work, or (2) specifying any special conditions under which such Work may be resumed safely.~~
- G. ~~If Owner and Contractor cannot agree as to entitlement to or on the amount or extent, if any, of any adjustment in Contract Price or Contract Times, or both, as a result of such Work stoppage or such special conditions under which Work is agreed to be resumed by Contractor, then within 30 days of Owner's written notice regarding the resumption of Work, Contractor may submit a Change Proposal, or Owner may impose a set-off.~~
- H. ~~If after receipt of such written notice Contractor does not agree to resume such Work based on a reasonable belief it is unsafe, or does not agree to resume such Work under such special conditions, then Owner may order the portion of the Work that is in the area affected by such condition to be deleted from the Work, following the contractual change procedures in Article 11. Owner may have such deleted portion of the Work performed by Owner's own forces or others in accordance with Article 8.~~
- I. ~~To the fullest extent permitted by Laws and Regulations, Owner shall indemnify and hold harmless Contractor, Subcontractors, and Engineer, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to a Hazardous Environmental Condition, provided that such Hazardous Environmental Condition (1) was not shown or indicated in the Drawings, Specifications, or other Contract Documents, identified as Technical Data entitled to limited reliance pursuant to Paragraph 5.06.B, or identified in the Contract Documents to be included within the scope of the Work, and (2) was not created by Contractor or by anyone for whom Contractor is responsible. Nothing in this Paragraph 5.06.I shall obligate Owner to indemnify any individual or entity from and against the consequences of that individual's or entity's own negligence.~~
- J. ~~To the fullest extent permitted by Laws and Regulations, Contractor shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees,~~

~~agents, consultants, and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to the failure to control, contain, or remove a Constituent of Concern brought to the Site by Contractor or by anyone for whom Contractor is responsible, or to a Hazardous Environmental Condition created by Contractor or by anyone for whom Contractor is responsible. Nothing in this Paragraph 5.06.J shall obligate Contractor to indemnify any individual or entity from and against the consequences of that individual's or entity's own negligence.~~

- K. ~~The provisions of Paragraphs 5.03, 5.04, and 5.05 do not apply to the presence of Constituents of Concern or to a Hazardous Environmental Condition uncovered or revealed at the Site.~~

ARTICLE 6 – BONDS AND INSURANCE

6.01 *Performance, Payment, and Other Bonds*

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

6.02 *Insurance—General Provisions*

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

6.03 Contractor's Insurance

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

damage arising out of the ownership, maintenance, or use of any motor vehicle. The automobile liability policy shall be written on an occurrence basis.

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

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

- J. The coverage requirements for specific policies of insurance must be met by such policies, and not by reference to excess or umbrella insurance provided in other policies.

6.04 *Owner's Liability Insurance*

- A. In addition to the insurance required to be provided by Contractor under Paragraph 6.03, Owner, at Owner's option, may purchase and maintain at Owner's expense Owner's own liability insurance as will protect Owner against claims which may arise from operations under the Contract Documents.
- B. Owner's liability policies, if any, operate separately and independently from policies required to be provided by Contractor, and Contractor cannot rely upon Owner's liability policies for any of Contractor's obligations to the Owner, Engineer, or third parties.

6.05 *Property Insurance*

- A. *Builder's Risk*: Unless otherwise provided in the Supplementary Conditions, Contractor shall purchase and maintain builder's risk insurance upon the Work on a completed value basis, in the amount of the full insurable replacement cost thereof (subject to such deductible amounts as may be provided in the Supplementary Conditions or required by Laws and Regulations). This insurance shall:
 - 1. include the Owner and Contractor as named insureds, and all Subcontractors, and any individuals or entities required by the Supplementary Conditions to be insured under such builder's risk policy, as insureds or named insureds. For purposes of the remainder of this Paragraph 6.05, Paragraphs 6.06 and 6.07, and any corresponding Supplementary Conditions, the parties required to be insured shall collectively be referred to as "insureds."
 - 2. be written on a builder's risk "all risk" policy form that shall at least include insurance for physical loss or damage to the Work, temporary buildings, falsework, and materials and equipment in transit, and shall insure against at least the following perils or causes of loss: fire; lightning; windstorm; riot; civil commotion; terrorism; vehicle impact; aircraft; smoke; theft; vandalism and malicious mischief; mechanical breakdown, boiler explosion, and artificially generated electric current; earthquake; volcanic activity, and other earth movement; flood; collapse; explosion; debris removal; demolition occasioned by enforcement of Laws and Regulations; water damage (other than that caused by flood); and such other perils or causes of loss as may be specifically required by the Supplementary Conditions. If insurance against mechanical breakdown, boiler explosion, and artificially generated electric current; earthquake; volcanic activity, and other earth movement; or flood, are not commercially available under builder's risk policies, by endorsement or otherwise, such insurance may be provided through other insurance policies acceptable to Owner and Contractor.
 - 3. cover, as insured property, at least the following: (a) the Work and all materials, supplies, machinery, apparatus, equipment, fixtures, and other property of a similar nature that are to be incorporated into or used in the preparation, fabrication, construction, erection, or completion of the Work, including Owner-furnished or assigned property; (b) spare parts inventory required within the scope of the Contract; and (c) temporary works which are not intended to form part of the permanent constructed Work but which are intended to provide working access to the Site, or to the Work under construction, or

- which are intended to provide temporary support for the Work under construction, including scaffolding, form work, fences, shoring, falsework, and temporary structures.
4. cover expenses incurred in the repair or replacement of any insured property (including but not limited to fees and charges of engineers and architects).
 5. extend to cover damage or loss to insured property while in temporary storage at the Site or in a storage location outside the Site (but not including property stored at the premises of a manufacturer or Supplier).
 6. extend to cover damage or loss to insured property while in transit.
 7. allow for partial occupation or use of the Work by Owner, such that those portions of the Work that are not yet occupied or used by Owner shall remain covered by the builder's risk insurance.
 8. allow for the waiver of the insurer's subrogation rights, as set forth below.
 9. provide primary coverage for all losses and damages caused by the perils or causes of loss covered.
 10. not include a co-insurance clause.
 11. include an exception for ensuing losses from physical damage or loss with respect to any defective workmanship, design, or materials exclusions.
 12. include performance/hot testing and start-up.
 13. be maintained in effect, subject to the provisions herein regarding Substantial Completion and partial occupancy or use of the Work by Owner, until the Work is complete.
- B. *Notice of Cancellation or Change:* All the policies of insurance (and the certificates or other evidence thereof) required to be purchased and maintained in accordance with this Paragraph 6.05 will contain a provision or endorsement that the coverage afforded will not be canceled or materially changed or renewal refused until at least 10 days prior written notice has been given to the purchasing policyholder. Within three days of receipt of any such written notice, the purchasing policyholder shall provide a copy of the notice to each other insured.
- C. *Deductibles:* The purchaser of any required builder's risk or property insurance shall pay for costs not covered because of the application of a policy deductible.
- D. *Partial Occupancy or Use by Owner:* If Owner will occupy or use a portion or portions of the Work prior to Substantial Completion of all the Work as provided in Paragraph 15.04, then Owner (directly, if it is the purchaser of the builder's risk policy, or through Contractor) will provide notice of such occupancy or use to the builder's risk insurer. The builder's risk insurance shall not be canceled or permitted to lapse on account of any such partial use or occupancy; rather, those portions of the Work that are occupied or used by Owner may come off the builder's risk policy, while those portions of the Work not yet occupied or used by Owner shall remain covered by the builder's risk insurance.
- E. *Additional Insurance:* If Contractor elects to obtain other special insurance to be included in or supplement the builder's risk or property insurance policies provided under this Paragraph 6.05, it may do so at Contractor's expense.
- F. *Insurance of Other Property:* If the express insurance provisions of the Contract do not require or address the insurance of a property item or interest, such as tools, construction equipment, or other personal property owned by Contractor, a Subcontractor, or an employee of Contractor or a Subcontractor, then the entity or individual owning such property item will be

responsible for deciding whether to insure it, and if so in what amount.

6.06 *Waiver of Rights*

- A. All policies purchased in accordance with Paragraph 6.05, expressly including the builder's risk policy, shall contain provisions to the effect that in the event of payment of any loss or damage the insurers will have no rights of recovery against any insureds thereunder, or against Engineer or its consultants, or their officers, directors, members, partners, employees, agents, consultants, or subcontractors. Owner and Contractor waive all rights against each other and the respective officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, for all losses and damages caused by, arising out of, or resulting from any of the perils or causes of loss covered by such policies and any other property insurance applicable to the Work; and, in addition, waive all such rights against Engineer, its consultants, all Subcontractors, all individuals or entities identified in the Supplementary Conditions as insureds, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, under such policies for losses and damages so caused. None of the above waivers shall extend to the rights that any party making such waiver may have to the proceeds of insurance held by Owner or Contractor as trustee or fiduciary, or otherwise payable under any policy so issued.
- B. Owner waives all rights against Contractor, Subcontractors, and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them, for:
 - 1. loss due to business interruption, loss of use, or other consequential loss extending beyond direct physical loss or damage to Owner's property or the Work caused by, arising out of, or resulting from fire or other perils whether or not insured by Owner; and
 - 2. loss or damage to the completed Project or part thereof caused by, arising out of, or resulting from fire or other insured peril or cause of loss covered by any property insurance maintained on the completed Project or part thereof by Owner during partial occupancy or use pursuant to Paragraph 15.04, after Substantial Completion pursuant to Paragraph 15.03, or after final payment pursuant to Paragraph 15.06.
- C. Any insurance policy maintained by Owner covering any loss, damage or consequential loss referred to in Paragraph 6.06.B shall contain provisions to the effect that in the event of payment of any such loss, damage, or consequential loss, the insurers will have no rights of recovery against Contractor, Subcontractors, or Engineer, or the officers, directors, members, partners, employees, agents, consultants, or subcontractors of each and any of them.
- D. Contractor shall be responsible for assuring that the agreement under which a Subcontractor performs a portion of the Work contains provisions whereby the Subcontractor waives all rights against Owner, Contractor, all individuals or entities identified in the Supplementary Conditions as insureds, the Engineer and its consultants, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, for all losses and damages caused by, arising out of, relating to, or resulting from any of the perils or causes of loss covered by builder's risk insurance and any other property insurance applicable to the Work.

6.07 *Receipt and Application of Property Insurance Proceeds*

- A. Any insured loss under the builder's risk and other policies of insurance required by Paragraph 6.05 will be adjusted and settled with the named insured that purchased the policy. Such named insured shall act as fiduciary for the other insureds, and give notice to such other insureds that adjustment and settlement of a claim is in progress. Any other insured may state

its position regarding a claim for insured loss in writing within 15 days after notice of such claim.

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

ARTICLE 7 – CONTRACTOR'S RESPONSIBILITIES

7.01 *Supervision and Superintendence*

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

7.02 *Labor; Working Hours*

- A. Contractor shall provide competent, suitably qualified personnel to survey and lay out the Work and perform construction as required by the Contract Documents. Contractor shall at all times maintain good discipline and order at the Site.
- B. Except as otherwise required for the safety or protection of persons or the Work or property at the Site or adjacent thereto, and except as otherwise stated in the Contract Documents, all Work at the Site shall be performed during regular working hours, Monday through Friday. Contractor will not perform Work on a Saturday, Sunday, or any legal holiday. Contractor may perform Work outside regular working hours or on Saturdays, Sundays, or legal holidays only with Owner's written consent, which will not be unreasonably withheld.

7.03 *Services, Materials, and Equipment*

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

- C. All materials and equipment shall be stored, applied, installed, connected, erected, protected, used, cleaned, and conditioned in accordance with instructions of the applicable Supplier, except as otherwise may be provided in the Contract Documents.

7.04 "Or Equals"

- A. Whenever an item of material or equipment is specified or described in the Contract Documents by using the name of a proprietary item or the name of a particular Supplier, the Contract Price has been based upon Contractor furnishing such item as specified. The specification or description of such an item is intended to establish the type, function, appearance, and quality required. Unless the specification or description contains or is followed by words reading that no like, equivalent, or "or equal" item is permitted, Contractor may request that Engineer authorize the use of other items of material or equipment, or items from other proposed suppliers under the circumstances described below.
 - 1. If Engineer in its sole discretion determines that an item of material or equipment proposed by Contractor is functionally equal to that named and sufficiently similar so that no change in related Work will be required, Engineer shall deem it an "or equal" item. For the purposes of this paragraph, a proposed item of material or equipment will be considered functionally equal to an item so named if:
 - a. in the exercise of reasonable judgment Engineer determines that:
 - 1) it is at least equal in materials of construction, quality, durability, appearance, strength, and design characteristics;
 - 2) it will reliably perform at least equally well the function and achieve the results imposed by the design concept of the completed Project as a functioning whole;
 - 3) it has a proven record of performance and availability of responsive service; and
 - 4) it is not objectionable to Owner.
 - b. Contractor certifies that, if approved and incorporated into the Work:
 - 1) there will be no increase in cost to the Owner or increase in Contract Times; and
 - 2) it will conform substantially to the detailed requirements of the item named in the Contract Documents.
- B. *Contractor's Expense:* Contractor shall provide all data in support of any proposed "or equal" item at Contractor's expense.
- C. *Engineer's Evaluation and Determination:* Engineer will be allowed a reasonable time to evaluate each "or-equal" request. Engineer may require Contractor to furnish additional data about the proposed "or-equal" item. Engineer will be the sole judge of acceptability. No "or-equal" item will be ordered, furnished, installed, or utilized until Engineer's review is complete and Engineer determines that the proposed item is an "or-equal", which will be evidenced by an approved Shop Drawing or other written communication. Engineer will advise Contractor in writing of any negative determination.
- D. *Effect of Engineer's Determination:* Neither approval nor denial of an "or-equal" request shall result in any change in Contract Price. The Engineer's denial of an "or-equal" request shall be final and binding, and may not be reversed through an appeal under any provision of the Contract Documents.
- E. *Treatment as a Substitution Request:* If Engineer determines that an item of material or equipment proposed by Contractor does not qualify as an "or-equal" item, Contractor may

request that Engineer considered the proposed item as a substitute pursuant to Paragraph 7.05.

7.05 *Substitutes*

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

Engineer may require Contractor to furnish additional data about the proposed substitute item. Engineer will be the sole judge of acceptability. No substitute will be ordered, furnished, installed, or utilized until Engineer's review is complete and Engineer determines that the proposed item is an acceptable substitute. Engineer's determination will be evidenced by a Field Order or a proposed Change Order accounting for the substitution itself and all related impacts, including changes in Contract Price or Contract Times. Engineer will advise Contractor in writing of any negative determination.

- C. *Special Guarantee*: Owner may require Contractor to furnish at Contractor's expense a special performance guarantee or other surety with respect to any substitute.
- D. *Reimbursement of Engineer's Cost*: Engineer will record Engineer's costs in evaluating a substitute proposed or submitted by Contractor. Whether or not Engineer approves a substitute so proposed or submitted by Contractor, Contractor shall reimburse Owner for the reasonable charges of Engineer for evaluating each such proposed substitute. Contractor shall also reimburse Owner for the reasonable charges of Engineer for making changes in the Contract Documents (or in the provisions of any other direct contract with Owner) resulting from the acceptance of each proposed substitute.
- E. *Contractor's Expense*: Contractor shall provide all data in support of any proposed substitute at Contractor's expense.
- F. *Effect of Engineer's Determination*: If Engineer approves the substitution request, Contractor shall execute the proposed Change Order and proceed with the substitution. The Engineer's denial of a substitution request shall be final and binding, and may not be reversed through an appeal under any provision of the Contract Documents. Contractor may challenge the scope of reimbursement costs imposed under Paragraph 7.05.D, by timely submittal of a Change Proposal.

7.06 *Concerning Subcontractors, Suppliers, and Others*

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

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

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

7.07 *Patent Fees and Royalties*

- A. Contractor shall pay all license fees and royalties and assume all costs incident to the use in the performance of the Work or the incorporation in the Work of any invention, design, process, product, or device which is the subject of patent rights or copyrights held by others. If a particular invention, design, process, product, or device is specified in the Contract

Documents for use in the performance of the Work and if, to the actual knowledge of Owner or Engineer, its use is subject to patent rights or copyrights calling for the payment of any license fee or royalty to others, the existence of such rights shall be disclosed by Owner in the Contract Documents.

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

7.08 *Permits*

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

7.09 *Taxes*

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

7.10 *Laws and Regulations*

- A. Contractor shall give all notices required by and shall comply with all Laws and Regulations applicable to the performance of the Work. Except where otherwise expressly required by applicable Laws and Regulations, neither Owner nor Engineer shall be responsible for monitoring Contractor's compliance with any Laws or Regulations.
- B. If Contractor performs any Work or takes any other action knowing or having reason to know that it is contrary to Laws or Regulations, Contractor shall bear all resulting costs and losses, and shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or

arbitration or other dispute resolution costs) arising out of or relating to such Work or other action. It shall not be Contractor's responsibility to make certain that the Work described in the Contract Documents is in accordance with Laws and Regulations, but this shall not relieve Contractor of Contractor's obligations under Paragraph 3.03.

- C. Owner or Contractor may give notice to the other party of any changes after the submission of Contractor's Bid (or after the date when Contractor became bound under a negotiated contract) in Laws or Regulations having an effect on the cost or time of performance of the Work, including but not limited to changes in Laws or Regulations having an effect on procuring permits and on sales, use, value-added, consumption, and other similar taxes. If Owner and Contractor are unable to agree on entitlement to or on the amount or extent, if any, of any adjustment in Contract Price or Contract Times resulting from such changes, then within 30 days of such notice Contractor may submit a Change Proposal, or Owner may initiate a Claim.

7.11 *Record Documents*

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

7.12 *Safety and Protection*

- A. Contractor shall be solely responsible for initiating, maintaining, and supervising all safety precautions and programs in connection with the Work. Such responsibility does not relieve Subcontractors of their responsibility for the safety of persons or property in the performance of their work, nor for compliance with applicable safety Laws and Regulations. Contractor shall take all necessary precautions for the safety of, and shall provide the necessary protection to prevent damage, injury, or loss to:
 - 1. all persons on the Site or who may be affected by the Work;
 - 2. all the Work and materials and equipment to be incorporated therein, whether in storage on or off the Site; and
 - 3. other property at the Site or adjacent thereto, including trees, shrubs, lawns, walks, pavements, roadways, structures, other work in progress, utilities, and Underground Facilities not designated for removal, relocation, or replacement in the course of construction.
- B. Contractor shall comply with all applicable Laws and Regulations relating to the safety of persons or property, or to the protection of persons or property from damage, injury, or loss; and shall erect and maintain all necessary safeguards for such safety and protection. Contractor shall notify Owner; the owners of adjacent property, Underground Facilities, and other utilities; and other contractors and utility owners performing work at or adjacent to the Site, when prosecution of the Work may affect them, and shall cooperate with them in the protection, removal, relocation, and replacement of their property or work in progress.
- C. Contractor shall comply with the applicable requirements of Owner's safety programs, if any. The Supplementary Conditions identify any Owner's safety programs that are applicable to the Work.

- D. Contractor shall inform Owner and Engineer of the specific requirements of Contractor's safety program with which Owner's and Engineer's employees and representatives must comply while at the Site.
- E. All damage, injury, or loss to any property referred to in Paragraph 7.12.A.2 or 7.12.A.3 caused, directly or indirectly, in whole or in part, by Contractor, any Subcontractor, Supplier, or any other individual or entity directly or indirectly employed by any of them to perform any of the Work, or anyone for whose acts any of them may be liable, shall be remedied by Contractor at its expense (except damage or loss attributable to the fault of Drawings or Specifications or to the acts or omissions of Owner or Engineer or anyone employed by any of them, or anyone for whose acts any of them may be liable, and not attributable, directly or indirectly, in whole or in part, to the fault or negligence of Contractor or any Subcontractor, Supplier, or other individual or entity directly or indirectly employed by any of them).
- F. Contractor's duties and responsibilities for safety and protection shall continue until such time as all the Work is completed and Engineer has issued a notice to Owner and Contractor in accordance with Paragraph 15.06.B that the Work is acceptable (except as otherwise expressly provided in connection with Substantial Completion).
- G. Contractor's duties and responsibilities for safety and protection shall resume whenever Contractor or any Subcontractor or Supplier returns to the Site to fulfill warranty or correction obligations, or to conduct other tasks arising from the Contract Documents.

7.13 *Safety Representative*

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

7.14 *Hazard Communication Programs*

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

7.15 *Emergencies*

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

7.16 *Shop Drawings, Samples, and Other Submittals*

A. *Shop Drawing and Sample Submittal Requirements:*

1. Before submitting a Shop Drawing or Sample, Contractor shall have:
 - a. reviewed and coordinated the Shop Drawing or Sample with other Shop Drawings and Samples and with the requirements of the Work and the Contract Documents;
 - b. determined and verified all field measurements, quantities, dimensions, specified performance and design criteria, installation requirements, materials, catalog numbers, and similar information with respect thereto;

- c. determined and verified the suitability of all materials and equipment offered with respect to the indicated application, fabrication, shipping, handling, storage, assembly, and installation pertaining to the performance of the Work; and
 - d. determined and verified all information relative to Contractor's responsibilities for means, methods, techniques, sequences, and procedures of construction, and safety precautions and programs incident thereto.
 2. Each submittal shall bear a stamp or specific written certification that Contractor has satisfied Contractor's obligations under the Contract Documents with respect to Contractor's review of that submittal, and that Contractor approves the submittal.
 3. With each submittal, Contractor shall give Engineer specific written notice of any variations that the Shop Drawing or Sample may have from the requirements of the Contract Documents. This notice shall be set forth in a written communication separate from the Shop Drawings or Sample submittal; and, in addition, in the case of Shop Drawings by a specific notation made on each Shop Drawing submitted to Engineer for review and approval of each such variation.
- B. *Submittal Procedures for Shop Drawings and Samples:* Contractor shall submit Shop Drawings and Samples to Engineer for review and approval in accordance with the accepted Schedule of Submittals. Each submittal will be identified as Engineer may require.
 1. *Shop Drawings:*
 - a. Contractor shall submit the number of copies required in the Specifications.
 - b. Data shown on the Shop Drawings will be complete with respect to quantities, dimensions, specified performance and design criteria, materials, and similar data to show Engineer the services, materials, and equipment Contractor proposes to provide and to enable Engineer to review the information for the limited purposes required by Paragraph 7.16.D.
 2. *Samples:*
 - a. Contractor shall submit the number of Samples required in the Specifications.
 - b. Contractor shall clearly identify each Sample as to material, Supplier, pertinent data such as catalog numbers, the use for which intended and other data as Engineer may require to enable Engineer to review the submittal for the limited purposes required by Paragraph 7.16.D.
 3. Where a Shop Drawing or Sample is required by the Contract Documents or the Schedule of Submittals, any related Work performed prior to Engineer's review and approval of the pertinent submittal will be at the sole expense and responsibility of Contractor.
- C. *Other Submittals:* Contractor shall submit other submittals to Engineer in accordance with the accepted Schedule of Submittals, and pursuant to the applicable terms of the Specifications.
- D. *Engineer's Review:*
 1. Engineer will provide timely review of Shop Drawings and Samples in accordance with the Schedule of Submittals acceptable to Engineer. Engineer's review and approval will be only to determine if the items covered by the submittals will, after installation or incorporation in the Work, conform to the information given in the Contract Documents and be compatible with the design concept of the completed Project as a functioning whole as indicated by the Contract Documents.

2. Engineer's review and approval will not extend to means, methods, techniques, sequences, or procedures of construction or to safety precautions or programs incident thereto.
3. Engineer's review and approval of a separate item as such will not indicate approval of the assembly in which the item functions.
4. Engineer's review and approval of a Shop Drawing or Sample shall not relieve Contractor from responsibility for any variation from the requirements of the Contract Documents unless Contractor has complied with the requirements of Paragraph 7.16.A.3 and Engineer has given written approval of each such variation by specific written notation thereof incorporated in or accompanying the Shop Drawing or Sample. Engineer will document any such approved variation from the requirements of the Contract Documents in a Field Order.
5. Engineer's review and approval of a Shop Drawing or Sample shall not relieve Contractor from responsibility for complying with the requirements of Paragraph 7.16.A and B.
6. Engineer's review and approval of a Shop Drawing or Sample, or of a variation from the requirements of the Contract Documents, shall not, under any circumstances, change the Contract Times or Contract Price, unless such changes are included in a Change Order.
7. Neither Engineer's receipt, review, acceptance or approval of a Shop Drawing, Sample, or other submittal shall result in such item becoming a Contract Document.
8. Contractor shall perform the Work in compliance with the requirements and commitments set forth in approved Shop Drawings and Samples, subject to the provisions of Paragraph 7.16.D.4.

E. *Resubmittal Procedures:*

1. Contractor shall make corrections required by Engineer and shall return the required number of corrected copies of Shop Drawings and submit, as required, new Samples for review and approval. Contractor shall direct specific attention in writing to revisions other than the corrections called for by Engineer on previous submittals.
2. Contractor shall furnish required submittals with sufficient information and accuracy to obtain required approval of an item with no more than three submittals. Engineer will record Engineer's time for reviewing a fourth or subsequent submittal of a Shop Drawings, sample, or other item requiring approval, and Contractor shall be responsible for Engineer's charges to Owner for such time. Owner may impose a set-off against payments due to Contractor to secure reimbursement for such charges.
3. If Contractor requests a change of a previously approved submittal item, Contractor shall be responsible for Engineer's charges to Owner for its review time, and Owner may impose a set-off against payments due to Contractor to secure reimbursement for such charges, unless the need for such change is beyond the control of Contractor.

7.17 *Contractor's General Warranty and Guarantee*

- A. Contractor warrants and guarantees to Owner that all Work will be in accordance with the Contract Documents and will not be defective. Engineer and its officers, directors, members, partners, employees, agents, consultants, and subcontractors shall be entitled to rely on Contractor's warranty and guarantee.
- B. Contractor's warranty and guarantee hereunder excludes defects or damage caused by:
 1. abuse, modification, or improper maintenance or operation by persons other than

- Contractor, Subcontractors, Suppliers, or any other individual or entity for whom Contractor is responsible; or
2. normal wear and tear under normal usage.
- C. Contractor's obligation to perform and complete the Work in accordance with the Contract Documents shall be absolute. None of the following will constitute an acceptance of Work that is not in accordance with the Contract Documents or a release of Contractor's obligation to perform the Work in accordance with the Contract Documents:
1. observations by Engineer;
 2. recommendation by Engineer or payment by Owner of any progress or final payment;
 3. the issuance of a certificate of Substantial Completion by Engineer or any payment related thereto by Owner;
 4. use or occupancy of the Work or any part thereof by Owner;
 5. any review and approval of a Shop Drawing or Sample submittal;
 6. the issuance of a notice of acceptability by Engineer;
 7. any inspection, test, or approval by others; or
 8. any correction of defective Work by Owner.
- D. If the Contract requires the Contractor to accept the assignment of a contract entered into by Owner, then the specific warranties, guarantees, and correction obligations contained in the assigned contract shall govern with respect to Contractor's performance obligations to Owner for the Work described in the assigned contract.

7.18 *Indemnification*

- A. To the fullest extent permitted by Laws and Regulations, and in addition to any other obligations of Contractor under the Contract or otherwise, Contractor shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to the performance of the Work, provided that any such claim, cost, loss, or damage is attributable to bodily injury, sickness, disease, or death, or to injury to or destruction of tangible property (other than the Work itself), including the loss of use resulting therefrom but only to the extent caused by any negligent act or omission of Contractor, any Subcontractor, any Supplier, or any individual or entity directly or indirectly employed by any of them to perform any of the Work or anyone for whose acts any of them may be liable.
- B. In any and all claims against Owner or Engineer or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors by any employee (or the survivor or personal representative of such employee) of Contractor, any Subcontractor, any Supplier, or any individual or entity directly or indirectly employed by any of them to perform any of the Work, or anyone for whose acts any of them may be liable, the indemnification obligation under Paragraph 7.18.A shall not be limited in any way by any limitation on the amount or type of damages, compensation, or benefits payable by or for Contractor or any such Subcontractor, Supplier, or other individual or entity under workers' compensation acts, disability benefit acts, or other employee benefit acts.

- C. The indemnification obligations of Contractor under Paragraph 7.18.A shall not extend to the liability of Engineer and Engineer's officers, directors, members, partners, employees, agents, consultants and subcontractors arising out of:
 - 1. the preparation or approval of, or the failure to prepare or approve maps, Drawings, opinions, reports, surveys, Change Orders, designs, or Specifications; or
 - 2. giving directions or instructions, or failing to give them, if that is the primary cause of the injury or damage.

7.19 *Delegation of Professional Design Services*

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

ARTICLE 8 – OTHER WORK AT THE SITE

8.01 *Other Work*

- A. In addition to and apart from the Work under the Contract Documents, the Owner may perform other work at or adjacent to the Site. Such other work may be performed by Owner's employees, or through contracts between the Owner and third parties. Owner may also arrange to have third-party utility owners perform work on their utilities and facilities at or adjacent to the Site.
- B. If Owner performs other work at or adjacent to the Site with Owner's employees, or through contracts for such other work, then Owner shall give Contractor written notice thereof prior to starting any such other work. If Owner has advance information regarding the start of any

utility work at or adjacent to the Site, Owner shall provide such information to Contractor.

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

8.02 *Coordination*

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

8.03 *Legal Relationships*

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

Times is conditioned on such adjustment being essential to Contractor's ability to complete the Work within the Contract Times.

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

ARTICLE 9 – OWNER'S RESPONSIBILITIES

9.01 *Communications to Contractor*

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

9.02 *Replacement of Engineer*

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

9.03 *Furnish Data*

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

9.04 *Pay When Due*

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

9.05 *Lands and Easements; Reports, Tests, and Drawings*

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

9.06 *Insurance*

- A. Owner's responsibilities, if any, with respect to purchasing and maintaining liability and property insurance are set forth in Article 6.

9.07 *Change Orders*

- A. Owner's responsibilities with respect to Change Orders are set forth in Article 11.

9.08 *Inspections, Tests, and Approvals*

- A. Owner's responsibility with respect to certain inspections, tests, and approvals is set forth in Paragraph 14.02.B.

9.09 *Limitations on Owner's Responsibilities*

- A. The Owner shall not supervise, direct, or have control or authority over, nor be responsible for, Contractor's means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of Contractor to comply with Laws and Regulations applicable to the performance of the Work. Owner will not be responsible for Contractor's failure to perform the Work in accordance with the Contract Documents.

9.10 *Undisclosed Hazardous Environmental Condition*

- A. Owner's responsibility in respect to an undisclosed Hazardous Environmental Condition is set forth in Paragraph 5.06.

9.11 *Evidence of Financial Arrangements*

- A. Upon request of Contractor, Owner shall furnish Contractor reasonable evidence that financial arrangements have been made to satisfy Owner's obligations under the Contract Documents (including obligations under proposed changes in the Work).

9.12 *Safety Programs*

- A. While at the Site, Owner's employees and representatives shall comply with the specific applicable requirements of Contractor's safety programs of which Owner has been informed.
- B. Owner shall furnish copies of any applicable Owner safety programs to Contractor.

ARTICLE 10 – ENGINEER'S STATUS DURING CONSTRUCTION

10.01 *Owner's Representative*

- A. Engineer will be Owner's representative during the construction period. The duties and responsibilities and the limitations of authority of Engineer as Owner's representative during construction are set forth in the Contract.

10.02 *Visits to Site*

- A. Engineer will make visits to the Site at intervals appropriate to the various stages of construction as Engineer deems necessary in order to observe as an experienced and qualified design professional the progress that has been made and the quality of the various aspects of Contractor's executed Work. Based on information obtained during such visits and observations, Engineer, for the benefit of Owner, will determine, in general, if the Work is proceeding in accordance with the Contract Documents. Engineer will not be required to make exhaustive or continuous inspections on the Site to check the quality or quantity of the Work. Engineer's efforts will be directed toward providing for Owner a greater degree of confidence that the completed Work will conform generally to the Contract Documents. On the basis of such visits and observations, Engineer will keep Owner informed of the progress of the Work and will endeavor to guard Owner against defective Work.
- B. Engineer's visits and observations are subject to all the limitations on Engineer's authority and responsibility set forth in Paragraph 10.08. Particularly, but without limitation, during or as a result of Engineer's visits or observations of Contractor's Work, Engineer will not supervise, direct, control, or have authority over or be responsible for Contractor's means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of Contractor to comply with Laws and Regulations applicable to the performance of the Work.

10.03 *Project Representative*

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

10.04 *Rejecting Defective Work*

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

10.05 *Shop Drawings, Change Orders and Payments*

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

10.06 *Determinations for Unit Price Work*

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

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

- A. Engineer will render decisions regarding the requirements of the Contract Documents, and judge the acceptability of the Work, pursuant to the specific procedures set forth herein for initial interpretations, Change Proposals, and acceptance of the Work. In rendering such

decisions and judgments, Engineer will not show partiality to Owner or Contractor, and will not be liable to Owner, Contractor, or others in connection with any proceedings, interpretations, decisions, or judgments conducted or rendered in good faith.

10.08 *Limitations on Engineer's Authority and Responsibilities*

- A. Neither Engineer's authority or responsibility under this Article 10 or under any other provision of the Contract, nor any decision made by Engineer in good faith either to exercise or not exercise such authority or responsibility or the undertaking, exercise, or performance of any authority or responsibility by Engineer, shall create, impose, or give rise to any duty in contract, tort, or otherwise owed by Engineer to Contractor, any Subcontractor, any Supplier, any other individual or entity, or to any surety for or employee or agent of any of them.
- B. Engineer will not supervise, direct, control, or have authority over or be responsible for Contractor's means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of Contractor to comply with Laws and Regulations applicable to the performance of the Work. Engineer will not be responsible for Contractor's failure to perform the Work in accordance with the Contract Documents.
- C. Engineer will not be responsible for the acts or omissions of Contractor or of any Subcontractor, any Supplier, or of any other individual or entity performing any of the Work.
- D. Engineer's review of the final Application for Payment and accompanying documentation and all maintenance and operating instructions, schedules, guarantees, bonds, certificates of inspection, tests and approvals, and other documentation required to be delivered by Paragraph 15.06.A will only be to determine generally that their content complies with the requirements of, and in the case of certificates of inspections, tests, and approvals, that the results certified indicate compliance with the Contract Documents.
- E. The limitations upon authority and responsibility set forth in this Paragraph 10.08 shall also apply to the Resident Project Representative, if any.

10.09 *Compliance with Safety Program*

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

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

11.01 *Amending and Supplementing Contract Documents*

- A. The Contract Documents may be amended or supplemented by a Change Order, a Work Change Directive, or a Field Order.
 - 1. *Change Orders:*
 - a. If an amendment or supplement to the Contract Documents includes a change in the Contract Price or the Contract Times, such amendment or supplement must be set forth in a Change Order. A Change Order also may be used to establish amendments and supplements of the Contract Documents that do not affect the Contract Price or Contract Times.
 - b. Owner and Contractor may amend those terms and conditions of the Contract Documents that do not involve (1) the performance or acceptability of the Work, (2) the design (as set forth in the Drawings, Specifications, or otherwise), or (3) other

engineering or technical matters, without the recommendation of the Engineer. Such an amendment shall be set forth in a Change Order.

2. *Work Change Directives:* A Work Change Directive will not change the Contract Price or the Contract Times but is evidence that the parties expect that the modification ordered or documented by a Work Change Directive will be incorporated in a subsequently issued Change Order, following negotiations by the parties as to the Work Change Directive's effect, if any, on the Contract Price and Contract Times; or, if negotiations are unsuccessful, by a determination under the terms of the Contract Documents governing adjustments, expressly including Paragraph 11.04 regarding change of Contract Price. Contractor must submit any Change Proposal seeking an adjustment of the Contract Price or the Contract Times, or both, no later than 30 days after the completion of the Work set out in the Work Change Directive. Owner must submit any Claim seeking an adjustment of the Contract Price or the Contract Times, or both, no later than 60 days after issuance of the Work Change Directive.
3. *Field Orders:* Engineer may authorize minor changes in the Work if the changes do not involve an adjustment in the Contract Price or the Contract Times and are compatible with the design concept of the completed Project as a functioning whole as indicated by the Contract Documents. Such changes will be accomplished by a Field Order and will be binding on Owner and also on Contractor, which shall perform the Work involved promptly. If Contractor believes that a Field Order justifies an adjustment in the Contract Price or Contract Times, or both, then before proceeding with the Work at issue, Contractor shall submit a Change Proposal as provided herein.

11.02 *Owner-Authorized Changes in the Work*

- A. Without invalidating the Contract and without notice to any surety, Owner may, at any time or from time to time, order additions, deletions, or revisions in the Work. Such changes shall be supported by Engineer's recommendation, to the extent the change involves the design (as set forth in the Drawings, Specifications, or otherwise), or other engineering or technical matters. Such changes may be accomplished by a Change Order, if Owner and Contractor have agreed as to the effect, if any, of the changes on Contract Times or Contract Price; or by a Work Change Directive. Upon receipt of any such document, Contractor shall promptly proceed with the Work involved; or, in the case of a deletion in the Work, promptly cease construction activities with respect to such deleted Work. Added or revised Work shall be performed under the applicable conditions of the Contract Documents. Nothing in this paragraph shall obligate Contractor to undertake work that Contractor reasonably concludes cannot be performed in a manner consistent with Contractor's safety obligations under the Contract Documents or Laws and Regulations.

11.03 *Unauthorized Changes in the Work*

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

11.04 *Change of Contract Price*

- A. The Contract Price may only be changed by a Change Order. Any Change Proposal for an adjustment in the Contract Price shall comply with the provisions of Paragraph 11.06. Any Claim for an adjustment of Contract Price shall comply with the provisions of Article 12.
- B. An adjustment in the Contract Price will be determined as follows:

1. where the Work involved is covered by unit prices contained in the Contract Documents, then by application of such unit prices to the quantities of the items involved (subject to the provisions of Paragraph 13.03); or
 2. where the Work involved is not covered by unit prices contained in the Contract Documents, then by a mutually agreed lump sum (which may include an allowance for overhead and profit not necessarily in accordance with Paragraph 11.04.C.2); or
 3. where the Work involved is not covered by unit prices contained in the Contract Documents and the parties do not reach mutual agreement to a lump sum, then on the basis of the Cost of the Work (determined as provided in Paragraph 13.01) plus a Contractor's fee for overhead and profit (determined as provided in Paragraph 11.04.C).
- C. *Contractor's Fee:* When applicable, the Contractor's fee for overhead and profit shall be determined as follows:
1. a mutually acceptable fixed fee; or
 2. if a fixed fee is not agreed upon, then a fee based on the following percentages of the various portions of the Cost of the Work:
 - a. for costs incurred under Paragraphs 13.01.B.1 and 13.01.B.2, the Contractor's fee shall be 15 percent;
 - b. for costs incurred under Paragraph 13.01.B.3, the Contractor's fee shall be five percent;
 - c. where one or more tiers of subcontracts are on the basis of Cost of the Work plus a fee and no fixed fee is agreed upon, the intent of Paragraphs 11.04.C.2.a and 11.04.C.2.b is that the Contractor's fee shall be based on: (1) a fee of 15 percent of the costs incurred under Paragraphs 13.01.A.1 and 13.01.A.2 by the Subcontractor that actually performs the Work, at whatever tier, and (2) with respect to Contractor itself and to any Subcontractors of a tier higher than that of the Subcontractor that actually performs the Work, a fee of five percent of the amount (fee plus underlying costs incurred) attributable to the next lower tier Subcontractor; provided, however, that for any such subcontracted work the maximum total fee to be paid by Owner shall be no greater than 27 percent of the costs incurred by the Subcontractor that actually performs the work;
 - d. no fee shall be payable on the basis of costs itemized under Paragraphs 13.01.B.4, 13.01.B.5, and 13.01.C;
 - e. the amount of credit to be allowed by Contractor to Owner for any change which results in a net decrease in cost will be the amount of the actual net decrease in cost plus a deduction in Contractor's fee by an amount equal to five percent of such net decrease; and
 - f. when both additions and credits are involved in any one change, the adjustment in Contractor's fee shall be computed on the basis of the net change in accordance with Paragraphs 11.04.C.2.a through 11.04.C.2.e, inclusive.

11.05 *Change of Contract Times*

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

4.05, concerning delays in Contractor's progress.

11.06 *Change Proposals*

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

11.07 *Execution of Change Orders*

- A. Owner and Contractor shall execute appropriate Change Orders covering:
1. changes in the Contract Price or Contract Times which are agreed to by the parties, including any undisputed sum or amount of time for Work actually performed in accordance with a Work Change Directive;
 2. changes in Contract Price resulting from an Owner set-off, unless Contractor has duly contested such set-off;
 3. changes in the Work which are: (a) ordered by Owner pursuant to Paragraph 11.02, (b) required because of Owner's acceptance of defective Work under Paragraph 14.04 or

Owner's correction of defective Work under Paragraph 14.07, or (c) agreed to by the parties, subject to the need for Engineer's recommendation if the change in the Work involves the design (as set forth in the Drawings, Specifications, or otherwise), or other engineering or technical matters; and

4. changes in the Contract Price or Contract Times, or other changes, which embody the substance of any final and binding results under Paragraph 11.06, or Article 12.

B. If Owner or Contractor refuses to execute a Change Order that is required to be executed under the terms of this Paragraph 11.07, it shall be deemed to be of full force and effect, as if fully executed.

11.08 *Notification to Surety*

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

ARTICLE 12 – CLAIMS

12.01 *Claims*

A. *Claims Process:* The following disputes between Owner and Contractor shall be submitted to the Claims process set forth in this Article:

1. Appeals by Owner or Contractor of Engineer's decisions regarding Change Proposals;
2. Owner demands for adjustments in the Contract Price or Contract Times, or other relief under the Contract Documents; and
3. Disputes that Engineer has been unable to address because they do not involve the design (as set forth in the Drawings, Specifications, or otherwise), the acceptability of the Work, or other engineering or technical matters.

B. *Submittal of Claim:* The party submitting a Claim shall deliver it directly to the other party to the Contract promptly (but in no event later than 30 days) after the start of the event giving rise thereto; in the case of appeals regarding Change Proposals within 30 days of the decision under appeal. The party submitting the Claim shall also furnish a copy to the Engineer, for its information only. The responsibility to substantiate a Claim shall rest with the party making the Claim. In the case of a Claim by Contractor seeking an increase in the Contract Times or Contract Price, or both, Contractor shall certify that the Claim is made in good faith, that the supporting data are accurate and complete, and that to the best of Contractor's knowledge and belief the amount of time or money requested accurately reflects the full amount to which Contractor is entitled.

C. *Review and Resolution:* The party receiving a Claim shall review it thoroughly, giving full consideration to its merits. The two parties shall seek to resolve the Claim through the exchange of information and direct negotiations. The parties may extend the time for resolving the Claim by mutual agreement. All actions taken on a Claim shall be stated in writing and submitted to the other party, with a copy to Engineer.

D. *Mediation:*

1. At any time after initiation of a Claim, Owner and Contractor may mutually agree to mediation of the underlying dispute. The agreement to mediate shall stay the Claim

submittal and response process.

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

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

13.01 *Cost of the Work*

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

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

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

the performance of the Work (except losses and damages within the deductible amounts of property insurance established in accordance with Paragraph 6.05), provided such losses and damages have resulted from causes other than the negligence of Contractor, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable. Such losses shall include settlements made with the written consent and approval of Owner. No such losses, damages, and expenses shall be included in the Cost of the Work for the purpose of determining Contractor's fee.

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

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

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

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

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

13.02 Allowances

A. It is understood that Contractor has included in the Contract Price all allowances so named in

the Contract Documents and shall cause the Work so covered to be performed for such sums and by such persons or entities as may be acceptable to Owner and Engineer.

- B. *Cash Allowances*: Contractor agrees that:
 - 1. the cash allowances include the cost to Contractor (less any applicable trade discounts) of materials and equipment required by the allowances to be delivered at the Site, and all applicable taxes; and
 - 2. Contractor's costs for unloading and handling on the Site, labor, installation, overhead, profit, and other expenses contemplated for the cash allowances have been included in the Contract Price and not in the allowances, and no demand for additional payment on account of any of the foregoing will be valid.
- C. *Contingency Allowance*: Contractor agrees that a contingency allowance, if any, is for the sole use of Owner to cover unanticipated costs.
- D. Prior to final payment, an appropriate Change Order will be issued as recommended by Engineer to reflect actual amounts due Contractor on account of Work covered by allowances, and the Contract Price shall be correspondingly adjusted.

13.03 *Unit Price Work*

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

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

14.01 *Access to Work*

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

14.02 *Tests, Inspections, and Approvals*

- A. Contractor shall give Engineer timely notice of readiness of the Work (or specific parts thereof) for all required inspections and tests, and shall cooperate with inspection and testing personnel to facilitate required inspections and tests.
- B. Owner shall retain and pay for the services of an independent inspector, testing laboratory, or other qualified individual or entity to perform all inspections and tests expressly required by the Contract Documents to be furnished and paid for by Owner, except that costs incurred in connection with tests or inspections of covered Work shall be governed by the provisions of Paragraph 14.05.
- C. If Laws or Regulations of any public body having jurisdiction require any Work (or part thereof) specifically to be inspected, tested, or approved by an employee or other representative of such public body, Contractor shall assume full responsibility for arranging and obtaining such inspections, tests, or approvals, pay all costs in connection therewith, and furnish Engineer the required certificates of inspection or approval.
- D. Contractor shall be responsible for arranging, obtaining, and paying for all inspections and tests required:
 - 1. by the Contract Documents, unless the Contract Documents expressly allocate responsibility for a specific inspection or test to Owner;
 - 2. to attain Owner's and Engineer's acceptance of materials or equipment to be incorporated in the Work;
 - 3. by manufacturers of equipment furnished under the Contract Documents;
 - 4. for testing, adjusting, and balancing of mechanical, electrical, and other equipment to be incorporated into the Work; and
 - 5. for acceptance of materials, mix designs, or equipment submitted for approval prior to Contractor's purchase thereof for incorporation in the Work.

Such inspections and tests shall be performed by independent inspectors, testing laboratories, or other qualified individuals or entities acceptable to Owner and Engineer.

- E. If the Contract Documents require the Work (or part thereof) to be approved by Owner, Engineer, or another designated individual or entity, then Contractor shall assume full responsibility for arranging and obtaining such approvals.
- F. If any Work (or the work of others) that is to be inspected, tested, or approved is covered by Contractor without written concurrence of Engineer, Contractor shall, if requested by Engineer, uncover such Work for observation. Such uncovering shall be at Contractor's expense unless Contractor had given Engineer timely notice of Contractor's intention to cover the same and Engineer had not acted with reasonable promptness in response to such notice.

14.03 *Defective Work*

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

14.04 *Acceptance of Defective Work*

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

14.05 *Uncovering Work*

- A. Engineer has the authority to require additional inspection or testing of the Work, whether or not the Work is fabricated, installed, or completed.
- B. If any Work is covered contrary to the written request of Engineer, then Contractor shall, if requested by Engineer, uncover such Work for Engineer's observation, and then replace the covering, all at Contractor's expense.
- C. If Engineer considers it necessary or advisable that covered Work be observed by Engineer or inspected or tested by others, then Contractor, at Engineer's request, shall uncover, expose, or otherwise make available for observation, inspection, or testing as Engineer may require, that

portion of the Work in question, and provide all necessary labor, material, and equipment.

1. If it is found that the uncovered Work is defective, Contractor shall be responsible for all claims, costs, losses, and damages arising out of or relating to such uncovering, exposure, observation, inspection, and testing, and of satisfactory replacement or reconstruction (including but not limited to all costs of repair or replacement of work of others); and pending Contractor's full discharge of this responsibility the Owner shall be entitled to impose a reasonable set-off against payments due under Article 15.
2. If the uncovered Work is not found to be defective, Contractor shall be allowed an increase in the Contract Price or an extension of the Contract Times, or both, directly attributable to such uncovering, exposure, observation, inspection, testing, replacement, and reconstruction. If the parties are unable to agree as to the amount or extent thereof, then Contractor may submit a Change Proposal within 30 days of the determination that the Work is not defective.

14.06 *Owner May Stop the Work*

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

14.07 *Owner May Correct Defective Work*

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

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

15.01 *Progress Payments*

- A. *Basis for Progress Payments:* The Schedule of Values established as provided in Article 2 will serve as the basis for progress payments and will be incorporated into a form of Application for Payment acceptable to Engineer. Progress payments on account of Unit Price Work will be based on the number of units completed during the pay period, as determined under the provisions of Paragraph 13.03. Progress payments for cost-based Work will be based on Cost of the Work completed by Contractor during the pay period.
- B. *Applications for Payments:*
1. At least 20 days before the date established in the Agreement for each progress payment (but not more often than once a month), Contractor shall submit to Engineer for review an Application for Payment filled out and signed by Contractor covering the Work completed as of the date of the Application and accompanied by such supporting documentation as is required by the Contract Documents. If payment is requested on the basis of materials and equipment not incorporated in the Work but delivered and suitably stored at the Site or at another location agreed to in writing, the Application for Payment shall also be accompanied by a bill of sale, invoice, or other documentation warranting that Owner has received the materials and equipment free and clear of all Liens, and evidence that the materials and equipment are covered by appropriate property insurance, a warehouse bond, or other arrangements to protect Owner's interest therein, all of which must be satisfactory to Owner.
 2. Beginning with the second Application for Payment, each Application shall include an affidavit of Contractor stating that all previous progress payments received on account of the Work have been applied on account to discharge Contractor's legitimate obligations associated with prior Applications for Payment.
 3. The amount of retainage with respect to progress payments will be as stipulated in the Agreement.
- C. *Review of Applications:*
1. Engineer will, within 10 days after receipt of each Application for Payment, including each resubmittal, either indicate in writing a recommendation of payment and present the Application to Owner, or return the Application to Contractor indicating in writing Engineer's reasons for refusing to recommend payment. In the latter case, Contractor may make the necessary corrections and resubmit the Application.
 2. Engineer's recommendation of any payment requested in an Application for Payment will constitute a representation by Engineer to Owner, based on Engineer's observations of the executed Work as an experienced and qualified design professional, and on Engineer's review of the Application for Payment and the accompanying data and schedules, that to the best of Engineer's knowledge, information and belief:
 - a. the Work has progressed to the point indicated;
 - b. the quality of the Work is generally in accordance with the Contract Documents (subject to an evaluation of the Work as a functioning whole prior to or upon Substantial Completion, the results of any subsequent tests called for in the Contract Documents, a final determination of quantities and classifications for Unit Price Work under Paragraph 13.03, and any other qualifications stated in the recommendation); and
 - c. the conditions precedent to Contractor's being entitled to such payment appear to

have been fulfilled in so far as it is Engineer's responsibility to observe the Work.

3. By recommending any such payment Engineer will not thereby be deemed to have represented that:
 - a. inspections made to check the quality or the quantity of the Work as it has been performed have been exhaustive, extended to every aspect of the Work in progress, or involved detailed inspections of the Work beyond the responsibilities specifically assigned to Engineer in the Contract; or
 - b. there may not be other matters or issues between the parties that might entitle Contractor to be paid additionally by Owner or entitle Owner to withhold payment to Contractor.
4. Neither Engineer's review of Contractor's Work for the purposes of recommending payments nor Engineer's recommendation of any payment, including final payment, will impose responsibility on Engineer:
 - a. to supervise, direct, or control the Work, or
 - b. for the means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or
 - c. for Contractor's failure to comply with Laws and Regulations applicable to Contractor's performance of the Work, or
 - d. to make any examination to ascertain how or for what purposes Contractor has used the money paid on account of the Contract Price, or
 - e. to determine that title to any of the Work, materials, or equipment has passed to Owner free and clear of any Liens.
5. Engineer may refuse to recommend the whole or any part of any payment if, in Engineer's opinion, it would be incorrect to make the representations to Owner stated in Paragraph 15.01.C.2.
6. Engineer will recommend reductions in payment (set-offs) necessary in Engineer's opinion to protect Owner from loss because:
 - a. the Work is defective, requiring correction or replacement;
 - b. the Contract Price has been reduced by Change Orders;
 - c. Owner has been required to correct defective Work in accordance with Paragraph 14.07, or has accepted defective Work pursuant to Paragraph 14.04;
 - d. Owner has been required to remove or remediate a Hazardous Environmental Condition for which Contractor is responsible; or
 - e. Engineer has actual knowledge of the occurrence of any of the events that would constitute a default by Contractor and therefore justify termination for cause under the Contract Documents.

D. *Payment Becomes Due:*

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

E. *Reductions in Payment by Owner:*

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

15.02 *Contractor's Warranty of Title*

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

time of payment by Owner.

15.03 *Substantial Completion*

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

15.04 *Partial Use or Occupancy*

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

to the following conditions:

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

15.05 *Final Inspection*

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

15.06 *Final Payment*

A. *Application for Payment:*

1. After Contractor has, in the opinion of Engineer, satisfactorily completed all corrections identified during the final inspection and has delivered, in accordance with the Contract Documents, all maintenance and operating instructions, schedules, guarantees, bonds, certificates or other evidence of insurance, certificates of inspection, annotated record documents (as provided in Paragraph 7.11), and other documents, Contractor may make application for final payment.
2. The final Application for Payment shall be accompanied (except as previously delivered) by:
 - a. all documentation called for in the Contract Documents;
 - b. consent of the surety, if any, to final payment;
 - c. satisfactory evidence that all title issues have been resolved such that title to all Work, materials, and equipment has passed to Owner free and clear of any Liens or other title defects, or will so pass upon final payment.
 - d. a list of all disputes that Contractor believes are unsettled; and
 - e. complete and legally effective releases or waivers (satisfactory to Owner) of all Lien rights arising out of the Work, and of Liens filed in connection with the Work.

3. In lieu of the releases or waivers of Liens specified in Paragraph 15.06.A.2 and as approved by Owner, Contractor may furnish receipts or releases in full and an affidavit of Contractor that: (a) the releases and receipts include all labor, services, material, and equipment for which a Lien could be filed; and (b) all payrolls, material and equipment bills, and other indebtedness connected with the Work for which Owner might in any way be responsible, or which might in any way result in liens or other burdens on Owner's property, have been paid or otherwise satisfied. If any Subcontractor or Supplier fails to furnish such a release or receipt in full, Contractor may furnish a bond or other collateral satisfactory to Owner to indemnify Owner against any Lien, or Owner at its option may issue joint checks payable to Contractor and specified Subcontractors and Suppliers.

B. *Engineer's Review of Application and Acceptance:*

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

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

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

15.07 *Waiver of Claims*

- A. The making of final payment will not constitute a waiver by Owner of claims or rights against Contractor. Owner expressly reserves claims and rights arising from unsettled Liens, from defective Work appearing after final inspection pursuant to Paragraph 15.05, from Contractor's failure to comply with the Contract Documents or the terms of any special guarantees specified therein, from outstanding Claims by Owner, or from Contractor's continuing obligations under the Contract Documents.
- B. The acceptance of final payment by Contractor will constitute a waiver by Contractor of all claims and rights against Owner other than those pending matters that have been duly submitted or appealed under the provisions of Article 17.

15.08 *Correction Period*

- A. If within one year after the date of Substantial Completion (or such longer period of time as may be prescribed by the terms of any applicable special guarantee required by the Contract Documents, or by any specific provision of the Contract Documents), any Work is found to be

defective, or if the repair of any damages to the Site, adjacent areas that Contractor has arranged to use through construction easements or otherwise, and other adjacent areas used by Contractor as permitted by Laws and Regulations, is found to be defective, then Contractor shall promptly, without cost to Owner and in accordance with Owner's written instructions:

1. correct the defective repairs to the Site or such other adjacent areas;
 2. correct such defective Work;
 3. if the defective Work has been rejected by Owner, remove it from the Project and replace it with Work that is not defective, and
 4. satisfactorily correct or repair or remove and replace any damage to other Work, to the work of others, or to other land or areas resulting therefrom.
- B. If Contractor does not promptly comply with the terms of Owner's written instructions, or in an emergency where delay would cause serious risk of loss or damage, Owner may have the defective Work corrected or repaired or may have the rejected Work removed and replaced. Contractor shall pay all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such correction or repair or such removal and replacement (including but not limited to all costs of repair or replacement of work of others).
- C. In special circumstances where a particular item of equipment is placed in continuous service before Substantial Completion of all the Work, the correction period for that item may start to run from an earlier date if so provided in the Specifications.
- D. Where defective Work (and damage to other Work resulting therefrom) has been corrected or removed and replaced under this paragraph, the correction period hereunder with respect to such Work will be extended for an additional period of one year after such correction or removal and replacement has been satisfactorily completed.
- E. Contractor's obligations under this paragraph are in addition to all other obligations and warranties. The provisions of this paragraph shall not be construed as a substitute for, or a waiver of, the provisions of any applicable statute of limitation or repose.

ARTICLE 16 – SUSPENSION OF WORK AND TERMINATION

16.01 *Owner May Suspend Work*

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

16.02 *Owner May Terminate for Cause*

- A. The occurrence of any one or more of the following events will constitute a default by Contractor and justify termination for cause:
1. Contractor's persistent failure to perform the Work in accordance with the Contract Documents (including, but not limited to, failure to supply sufficient skilled workers or

- suitable materials or equipment or failure to adhere to the Progress Schedule);
2. Failure of Contractor to perform or otherwise to comply with a material term of the Contract Documents;
 3. Contractor's disregard of Laws or Regulations of any public body having jurisdiction; or
 4. Contractor's repeated disregard of the authority of Owner or Engineer.
- B. If one or more of the events identified in Paragraph 16.02.A occurs, then after giving Contractor (and any surety) ten days written notice that Owner is considering a declaration that Contractor is in default and termination of the contract, Owner may proceed to:
1. declare Contractor to be in default, and give Contractor (and any surety) notice that the Contract is terminated; and
 2. enforce the rights available to Owner under any applicable performance bond.
- C. Subject to the terms and operation of any applicable performance bond, if Owner has terminated the Contract for cause, Owner may exclude Contractor from the Site, take possession of the Work, incorporate in the Work all materials and equipment stored at the Site or for which Owner has paid Contractor but which are stored elsewhere, and complete the Work as Owner may deem expedient.
- D. Owner may not proceed with termination of the Contract under Paragraph 16.02.B if Contractor within seven days of receipt of notice of intent to terminate begins to correct its failure to perform and proceeds diligently to cure such failure.
- E. If Owner proceeds as provided in Paragraph 16.02.B, Contractor shall not be entitled to receive any further payment until the Work is completed. If the unpaid balance of the Contract Price exceeds the cost to complete the Work, including all related claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals) sustained by Owner, such excess will be paid to Contractor. If the cost to complete the Work including such related claims, costs, losses, and damages exceeds such unpaid balance, Contractor shall pay the difference to Owner. Such claims, costs, losses, and damages incurred by Owner will be reviewed by Engineer as to their reasonableness and, when so approved by Engineer, incorporated in a Change Order. When exercising any rights or remedies under this paragraph, Owner shall not be required to obtain the lowest price for the Work performed.
- F. Where Contractor's services have been so terminated by Owner, the termination will not affect any rights or remedies of Owner against Contractor then existing or which may thereafter accrue, or any rights or remedies of Owner against Contractor or any surety under any payment bond or performance bond. Any retention or payment of money due Contractor by Owner will not release Contractor from liability.
- G. If and to the extent that Contractor has provided a performance bond under the provisions of Paragraph 6.01.A, the provisions of that bond shall govern over any inconsistent provisions of Paragraphs 16.02.B and 16.02.D.

16.03 *Owner May Terminate For Convenience*

- A. Upon seven days written notice to Contractor and Engineer, Owner may, without cause and without prejudice to any other right or remedy of Owner, terminate the Contract. In such case, Contractor shall be paid for (without duplication of any items):
1. completed and acceptable Work executed in accordance with the Contract Documents prior to the effective date of termination, including fair and reasonable sums for overhead

- and profit on such Work;
 - 2. expenses sustained prior to the effective date of termination in performing services and furnishing labor, materials, or equipment as required by the Contract Documents in connection with uncompleted Work, plus fair and reasonable sums for overhead and profit on such expenses; and
 - 3. other reasonable expenses directly attributable to termination, including costs incurred to prepare a termination for convenience cost proposal.
- B. Contractor shall not be paid on account of loss of anticipated overhead, profits, or revenue, or other economic loss arising out of or resulting from such termination.

16.04 *Contractor May Stop Work or Terminate*

- A. If, through no act or fault of Contractor, (1) the Work is suspended for more than 90 consecutive days by Owner or under an order of court or other public authority, or (2) Engineer fails to act on any Application for Payment within 30 days after it is submitted, or (3) 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 16.03.
- B. In lieu of terminating the Contract and without prejudice to any other right or remedy, if Engineer has failed to act on an Application for Payment within 30 days after it is submitted, or Owner has failed for 30 days to pay Contractor any sum finally determined to be due, Contractor may, seven days after written notice to Owner and Engineer, stop the Work until payment is made of all such amounts due Contractor, including interest thereon. The provisions of this paragraph are not intended to preclude Contractor from submitting a Change Proposal for an adjustment in Contract Price or Contract Times or otherwise for expenses or damage directly attributable to Contractor's stopping the Work as permitted by this paragraph.

ARTICLE 17 – FINAL RESOLUTION OF DISPUTES

17.01 *Methods and Procedures*

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

ARTICLE 18 – MISCELLANEOUS

18.01 *Giving Notice*

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

18.02 *Computation of Times*

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

18.03 *Cumulative Remedies*

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

18.04 *Limitation of Damages*

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

18.05 *No Waiver*

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

18.06 *Survival of Obligations*

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

18.07 *Controlling Law*

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

18.08 *Headings*

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

SECTION C-800

SUPPLEMENTARY CONDITIONS

These Supplementary Conditions amend or supplement the Standard General Conditions of the Construction Contract, EJCDC® C-700 (2013 Edition). All provisions that are not so amended or supplemented remain in full force and effect.

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

The address system used in these Supplementary Conditions is the same as the address system used in the General Conditions, with the prefix "SC" added thereto.

TABLE OF CONTENTS

		Page
SC-1.01.A.8	Change Order	1
SC-1.01.A.48	Work Change Directive	1
SC-1.01.A.10	Change Order	1
SC-1.01.A.49	Abnormal Weather Conditions	1
SC-1.01.A.50	Agency	2
SC-2.02.A	Copies of Documents	2
SC-4.01.A	Contract Times & Notice to Proceed	2
SC-4.05.C.2	Delays in Contractor's Progress	2
SC-5.03	Subsurface and Physical Conditions	3
SC-5.06	Hazardous Environmental Conditions	3
SC-6.03	Contractor's Insurance	4
SC-7.04.A	Or-Equal	5
SC-7.04.A.1	Or-Equal	5
SC-7.06.A	Concerning Subcontractors, Suppliers, and Others	5
SC-7.06.B	Concerning Subcontractors, Suppliers, and Others	5
SC-7.06.E	Concerning Subcontractors, Suppliers, and Others	5
SC-10.03	Project Representative	5
SC-11.07.C	Execution of Change Orders	8
SC-13.02.C	Contingency Allowance	8
SC-15.01.B	Applications for Payments	8
SC-15-01.B.3	Applications for Payments	8
SC 15.01.B.4	Applications for Payments	8
SC 15.01.D.1	Payment Due	8
SC 15.02.A	Contractor's Warranty of Title	8
SC 18.09	Tribal Sovereignty	8
SC 19	Federal Requirements	9
SC 19.01	Agency Not a Party	9
SC 19.02	Contract Approval	9
SC 19.03	Conflict of Interest & Gratuities	9

SC 19.04	Gratuities	10
SC 19.05	Small, Minority and Women’s Businesses	10
SC 19.06	Anti-Kickback	11
SC 19.07	Clean Air and Pollution Control Acts	11
SC 19.08	Equal Employment Opportunity	11
SC 19.09	Byrd Anti-Lobbying Amendment	11
SC 19.10	Environmental Requirements	12
SC 19.11	Contract Work Hours and Safety Standards Act	12
SC 19.12	Debarment and Suspension	13
SC 19.13	Procurement of Recovered Materials	13
SC 19.14	AIS	16
SC 19.15	Definitions	17

SC 1.01.A.8 Add the following language at the end of last sentence of Paragraph 1.01.A.8:

The Change Order form to be used on this Project is EJCDC C-941. Agency approval is required before Change Orders are effective.

SC 1.01.A.48 Add the following language at the end of the last sentence of Paragraph 1.01.A.48:

A Work Change Directive cannot change Contract Price or Contract Times without a subsequent Change Order.

SC 1.01.A.49 Add the following new Paragraph after Paragraph 1.01.A.48:

Abnormal Weather Conditions – Conditions of extreme or unusual weather for a given region, elevation, or season as determined by Engineer. Extreme or unusual weather that is typical for a given region, elevation, or season should not be considered Abnormal Weather Conditions.

SC 1.01.A.50 Add the following new Paragraph after Paragraph 1.01.A.49:

Agency - The Project is financed in whole or in part by USDA Rural Utilities Service pursuant to the Consolidated Farm and Rural Development Act (7 USC Section 1921 et seq.). The Rural Utilities Service programs are administered through the USDA Rural Development offices; therefore, the Agency for these documents is USDA Rural Development.

SC 2.02.A Amend the first sentence of Paragraph 2.02.A. to read as follows:

Owner shall furnish to Contractor five copies of the Contract Documents (including one fully executed counterpart of the Agreement), and one copy in electronic portable document format (PDF).

SC-2.06.B Add the following language to the end of 2.06.B:

Special requirements for electronic data apply to this Project. See attached Exhibit entitled “Electronic Communications Protocol Addendum,” Consensus DOCS form 200.2.

SC 4.01.A Amend the last sentence of Paragraph 4.01.A by striking out the following words:

In no event will the Contract Times commence to run later than the sixtieth day after the day of Bid opening or the thirtieth day after the Effective Date of the Contract, whichever date is earlier.

SC 4.05.C.2 Amend Paragraph 4.05.C.2 by striking out the following text: “abnormal weather conditions;” and inserting the following text:

Abnormal Weather Conditions;

SC-5.03 Delete Paragraphs 5.03.A and 5.03.B in their entirety and insert the following:

- A. No reports of explorations or tests of subsurface conditions at or adjacent to the Site, or drawings of physical conditions relating to existing surface or subsurface structures at the Site, are known to Owner.

SC 5.06 Delete Paragraphs 5.06.A and 5.06.B in their entirety and insert the following:

- A. No reports or drawings related to Hazardous Environmental Conditions at the Site are known to Owner.
- B. Not Used.

SC 6.03 Add the following new paragraph immediately after Paragraph 6.03.J:

K. The limits of liability for the insurance required by Paragraph 6.03 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 6.03.A.1 and A.2 of the General Conditions:

State:	<u>Statutory</u>
Federal, if applicable (e.g., Longshoreman’s):	<u>Statutory</u>

Employer’s Liability:

Bodily injury, each accident	\$ 500,000
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- 2. Contractor’s Commercial General Liability under Paragraphs 6.03.B and 6.03.C of the General Conditions:

General Aggregate	\$ <u>2,000,000</u>
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Products - Completed Operations Aggregate	\$ <u>1,000,000</u>
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Personal and Advertising Injury \$ 1,000,000

Each Occurrence (Bodily Injury and Property Damage) \$ 1,000,000

3. **Automobile Liability under Paragraph 6.03.D. of the General Conditions:**

Bodily Injury:

Each person \$ 1,000,000

Each accident \$ 1,000,000

Property Damage:

Each accident \$ 1,000,000

Combined Single Limit of \$ 1,000,000

4. **Excess or Umbrella Liability:**

Per Occurrence \$ 2,000,000

General Aggregate \$ 2,000,000

If box is checked, Contractor is not required to provide Contractor's Pollution Liability insurance under this Contract

6. **Additional Insureds:** In addition to Owner and Engineer, include as additional insureds the following: *Constantine Engineering and the City of Lake City shall be included as additional insureds.*

SC 7.03 Add sentence 7.03.d:

All iron and steel products must meet American Iron and Steel requirements.

SC 7.04.A Amend the third sentence of Paragraph 7.04.A by striking out the following words:

Unless the specification or description contains or is followed by words reading that no like, equivalent, or 'or-equal' item is permitted.

SC 7.04.A.1 Amend the last sentence of Paragraph a.3 by striking out "and;" and adding a period at the end of Paragraph a.3.

SC 7.04.A.1 Delete paragraph 7.04.A.1.a.4 in its entirety and insert the following in its place:

[Deleted]

SC 7.04.B.1 Add 7.04.B.1:

Contractor shall include a Manufacturer's Certification letter for compliance with American Iron and Steel requirements in support data, if applicable. Refer to Manufacturer's Certification Letter provided in these Contract Documents. In addition, for the Deminimis Waiver, Contractor shall maintain an itemized list of incidental components and ensure that the cost is less than 5% of total materials cost for project; for the Minor Components Waiver, the Contractor shall maintain a list of products to which the minor components waiver applies and the cost of the non- domestically produced component is less than 5% of total materials cost of that product.

SC 7.05.A.3.a.4 Add 7.05.A.3.a.4:

4) comply with American Iron and Steel by providing Manufacturer's Certification letter of American Iron and Steel compliance, if applicable. Refer to Manufacturer's Certification Letter provided in these Contract Documents.

SC 7.06.A Amend Paragraph 7.06.A by adding the following text to the end of the Paragraph:

The Contractor shall not award work valued at more than fifty percent of the Contract Price to Subcontractor(s), without prior written approval of the Owner.

SC 7.06.B Delete paragraph 7.06.B in its entirety and insert the following in its place:

[Deleted]

SC 7.06.E Amend the second sentence of Paragraph 7.06.E by striking out "Owner may also require Contractor to retain specific replacements; provided, however, that".

SC 7.11.A Modify 7.11.A by inserting the following after “written interpretations and clarifications,”:

Manufacturers’ Certification letter is documentation provided by the manufacturer, supplier, distributor, vendor, fabricator, etc. to various entities stating that the iron and steel products to be used in the project are produced in the United States in accordance with American Iron and Steel Requirements. Refer to Manufacturer’s Certification Letter provided in these Contract Documents.

SC 7.16.A.1.e Add 7.16.A.1.e:

e. obtained Manufacturer’s Certification letter for any item in the submittal subject to American Iron and Steel requirements and include the Certificate in the submittal. Refer to Manufacturer’s Certification Letter provided in these Contract Documents.

SC 7.16.D.9 Add 7.16.D.9:

Engineer’s review and approval of Shop Drawing or Sample shall include review of compliance with American Iron and Steel requirements, as applicable.

SC 7.17.E Add 7.17.E:

Contractor shall certify upon Substantial Completion that all Work and Materials has complied with American Iron and Steel requirements as mandated by Section 746 of Title VII of the Consolidated Appropriations Act of 2017 (Division A - Agriculture, Rural Development, Food and Drug Administration, and Related Agencies Appropriations Act, 2017) and subsequent statutes mandating domestic preference. Contractor shall provide said Certification to Owner. Refer to General Contractor’s Certification Letter provided in these Contract Documents.

SC-10.03 Add the following new paragraphs immediately after Paragraph 10.03.A:

- B. The Resident Project Representative (RPR) will be Engineer’s representative at the Site, will act as directed by and under the supervision of Engineer, and will confer with Engineer regarding RPR’s actions.**
 - 1. General: RPR’s dealings in matters pertaining to the Work in general shall be with Engineer and Contractor. RPR’s dealings with Subcontractors shall only be through or with the full knowledge and approval of Contractor. RPR shall generally communicate with Owner only with the knowledge of and under the direction of Engineer.**
 - 2. Schedules: Review the progress schedule, schedule of Shop Drawing and Sample submittals, and Schedule of Values prepared by Contractor and consult with Engineer concerning acceptability.**
 - 3. Conferences and Meetings: Attend meetings with Contractor, such as preconstruction conferences, progress meetings, job conferences, and other Project-related meetings, and prepare and circulate copies of minutes thereof.**

4. **Liaison:**
 - a. **Serve as Engineer's liaison with Contractor. Working principally through Contractor's authorized representative or designee, assist in providing information regarding the provisions and intent of the Contract Documents.**
 - b. **Assist Engineer in serving as Owner's liaison with Contractor when Contractor's operations affect Owner's on-Site operations.**
 - c. **Assist in obtaining from Owner additional details or information, when required for proper execution of the Work.**
5. **Interpretation of Contract Documents: Report to Engineer when clarifications and interpretations of the Contract Documents are needed and transmit to Contractor clarifications and interpretations as issued by Engineer.**
6. **Shop Drawings and Samples:**
 - a. **Record date of receipt of Samples and Contractor-approved Shop Drawings.**
 - b. **Receive Samples which are furnished at the Site by Contractor, and notify Engineer of availability of Samples for examination.**
 - c. **Advise Engineer and Contractor of the commencement of any portion of the Work requiring a Shop Drawing or Sample submittal for which RPR believes that the submittal has not been approved by Engineer.**
7. **Modifications: Consider and evaluate Contractor's suggestions for modifications in Drawings or Specifications and report such suggestions, together with RPR's recommendations, if any, to Engineer. Transmit to Contractor in writing decisions as issued by Engineer.**
8. **Review of Work and Rejection of Defective Work:**
 - a. **Conduct on-Site observations of Contractor's work in progress to assist Engineer in determining if the Work is in general proceeding in accordance with the Contract Documents.**
 - b. **Report to Engineer whenever RPR believes that any part of Contractor's work in progress is defective, will not produce a completed Project that conforms generally to the Contract Documents, or will imperil the integrity of the design concept of the completed Project as a functioning whole as indicated in the Contract Documents, or has been damaged, or does not meet the requirements of any inspection, test or approval required to be made; and advise Engineer of that part of work in progress that RPR believes should be corrected or rejected or should be uncovered for observation, or requires special testing, inspection or approval.**

9. **Inspections, Tests, and System Start-ups:**
 - a. Verify that tests, equipment, and systems start-ups and operating and maintenance training are conducted in the presence of appropriate Owner's personnel, and that Contractor maintains adequate records thereof.
 - b. Observe, record, and report to Engineer appropriate details relative to the test procedures and systems start-ups.
10. **Records:**
 - a. Prepare a daily report or keep a diary or log book, recording Contractor's hours on the Site, Subcontractors present at the Site, weather conditions, data relative to questions of Change Orders, Field Orders, Work Change Directives, or changed conditions, Site visitors, deliveries of equipment or materials, daily activities, decisions, observations in general, and specific observations in more detail as in the case of observing test procedures; and send copies to Engineer.
 - b. Record names, addresses, fax numbers, e-mail addresses, web site locations, and telephone numbers of all Contractors, Subcontractors, and major Suppliers of materials and equipment.
 - c. Maintain records for use in preparing Project documentation.
11. **Reports:**
 - a. Furnish to Engineer periodic reports as required of progress of the Work and of Contractor's compliance with the Progress Schedule and schedule of Shop Drawing and Sample submittals.
 - b. Draft and recommend to Engineer proposed Change Orders, Work Change Directives, and Field Orders. Obtain backup material from Contractor.
 - c. Immediately notify Engineer of the occurrence of any Site accidents, emergencies, acts of God endangering the Work, force majeure or delay events, damage to property by fire or other causes, or the discovery of any Constituent of Concern or Hazardous Environmental Condition.
12. **Payment Requests:** Review applications for payment with Contractor for compliance with the established procedure for their submission and forward with recommendations to Engineer, noting particularly the relationship of the payment requested to the Schedule of Values, Work completed, and materials and equipment delivered at the Site but not incorporated in the Work.
13. **Certificates, Operation and Maintenance Manuals:** During the course of the Work, verify that materials and equipment certificates, operation and maintenance manuals and other data required by the Contract Documents to be assembled and furnished by Contractor are applicable to the items actually installed and in accordance with the Contract Documents, and have

these documents delivered to Engineer for review and forwarding to Owner prior to payment for that part of the Work.

14. Completion:

- a. Participate in Engineer's visits to the Site to determine Substantial Completion, assist in the determination of Substantial Completion and the preparation of a punch list of items to be completed or corrected.
- b. Participate in Engineer's final visit to the Site to determine completion of the Work, in the company of Owner and Contractor, and prepare a final punch list of items to be completed and deficiencies to be remedied.
- c. Observe whether all items on the final list have been completed or corrected and make recommendations to Engineer concerning acceptance and issuance of the notice of acceptability of the work.

C. The RPR shall not:

1. Authorize any deviation from the Contract Documents or substitution of materials or equipment (including "or-equal" items).
2. Exceed limitations of Engineer's authority as set forth in the Contract Documents.
3. Undertake any of the responsibilities of Contractor, Subcontractors, or Suppliers.
4. Advise on, issue directions relative to, or assume control over any aspect of the means, methods, techniques, sequences or procedures of Contractor's work.
5. Advise on, issue directions regarding, or assume control over security or safety practices, precautions, and programs in connection with the activities or operations of Owner or Contractor.
6. Participate in specialized field or laboratory tests or inspections conducted off-site by others except as specifically authorized by Engineer.
7. Accept Shop Drawing or Sample submittals from anyone other than Contractor.
8. Authorize Owner to occupy the Project in whole or in part.

SC 10.10.A Add 10.10.A American Iron & Steel:

A. Services required to determine and certify that to the best of the Engineer's knowledge and belief all iron and steel products referenced in engineering analysis, the Plans, Specifications, Bidding Documents, and associated Bid Addenda requiring design revisions are either produced in the United States or are the subject of an approved waiver and services required to determine to the best of the engineer's knowledge and belief that approved substitutes, equals, and all iron and steel products proposed in the shop drawings, Change Orders and Partial Payment Estimates are either produced in the United States or are the subject of an approved waiver under Section 746 of Title VII of the

Consolidated Appropriations Act of 2017 (Division A - Agriculture, Rural Development, Food and Drug Administration, and Related Agencies Appropriations Act, 2017)

SC 11.06.A.1 Modify 11.06.A.1 by inserting the following sentence after “within 15 days after the submittal of the Change Proposal.”:

Include supporting data (name of manufacturer, city and state where the product was manufactured, description of product, signature of authorized manufacturer’s representative) in the Manufacturer’s Certification Letter, as applicable.

SC 11.07.C Add the following new Paragraph after Paragraph 11.07.B:

All Contract Change Orders must be concurred in by Agency before they are effective.

SC 13.02.C Delete Paragraph 13.02.C in its entirety and insert the following in its place:

[Deleted]

SC 14.03.G Add 14.03.G:

G. Installation of Materials that are non-compliant with American Iron and Steel requirements shall be considered defective work.

SC 15.01.B Amend the second sentence of Paragraph 15.01.B.1 by striking out the following text: “a bill of sale, invoice, or other.”

SC 15.01.B.3 Add the following language at the end of paragraph 15.01.B.3:

No payments will be made that would deplete the retainage, place in escrow any funds that are required for retainage, or invest the retainage for the benefit of the Contractor.

SC 15.01.B.4 Add the following new Paragraph after Paragraph 15.01.B.3:

The Application for Payment form to be used on this Project is EJCDC C-620. The Agency must approve all Applications for Payment before payment is made.

SC 15.01.B.4 Add 15.01.B.4:

4. By submitting Materials for payment, Contractor is certifying that the submitted Materials are compliant with American Iron and Steel requirements. Manufacturer’s Certification letter for Materials satisfy this certification. Refer to Manufacturer’s Certification Letter provided in these Contract Documents.

SC 15.01.C.2.d Add 15.01.C.2.d:

d. the Materials presented for payment comply with American Iron and Steel.

SC 15.01.D.1 Delete Paragraph 15.01.D.1 in its entirety and insert the following in its place:

The Application for Payment with Engineer’s recommendations will be presented to the Owner and Agency for consideration. If both the Owner and Agency find the Application for Payment acceptable, the recommended amount less any reduction under the provisions of Paragraph 15.01.E will become due twenty (20) days after the Application for Payment is presented to the Owner, and the Owner will make payment to the Contractor.

SC 15.02.A Amend Paragraph 15.02.A by striking out the following text:

no later than seven days after the time of payment by Owner” and insert “no later than the time of payment by Owner.”

SC 15.03.A Modify 15.03.A by adding the following after the last sentence:

Services required to determine and certify that to the best of the Contractor’s knowledge and belief all substitutes, equals, and all iron and steel products proposed in the shop drawings, Change Orders and Partial Payment Estimates, and those installed for the project are either produced in the United States or are the subject of an approved waiver under Section 746 of Title VII of the Consolidated Appropriations Act of 2017 (Division A -Agriculture, Rural Development, Food and Drug Administration, and Related Agencies Appropriations Act, 2017) and subsequent statutes mandating domestic preference.

SC 18.09 Add the following new paragraph after Paragraph 18.08:

Tribal Sovereignty. No provision of this Agreement will be construed by any of the signatories as abridging or debilitating any sovereign powers of the {insert name of Tribe} Tribe; affecting the trust-beneficiary relationship between the Secretary of the Interior, Tribe, and Indian landowner(s); or interfering with the government-to-government relationship between the United States and the Tribe.

SC 19 Add Article 19 titled “FEDERAL REQUIREMENTS”

19.01 Add the following language as Paragraph 19.01 with the title “Agency Not a Party”:

- A. This Contract is expected to be funded in part with funds provided by Agency. Neither Agency, nor any of its departments, entities, or employees is a party to this Contract.**

SC 19.02 Add the following sections after Article 19.01 with the title “Contract Approval”:

- A. Owner and Contractor will furnish Owner’s attorney such evidence as required so that Owner’s attorney can complete and execute the following “Certificate of Owner’s Attorney” (Exhibit I of RUS Bulletin 1780-26) before Owner submits the executed Contract Documents to Agency for approval.**
- B. Concurrence by Agency in the award of the Contract is required before the Contract is effective.**

SC 19.03 Add the following language after Article 19.02.B with the title **“Conflict of Interest & Gratuities”**:

- A. Contractor may not knowingly contract with a supplier or manufacturer if the individual or entity who prepared the plans and specifications has a corporate or financial affiliation with the supplier or manufacturer. Owner’s officers, employees, or agents shall not engage in the award or administration of this Contract if a conflict of interest, real or apparent, would be involved. Such a conflict would arise when: (i) the employee, officer or agent; (ii) any member of their immediate family; (iii) their partner or (iv) an organization that employs, or is about to employ, any of the above, has a financial interest in Contractor. Owner’s officers, employees, or agents shall neither solicit nor accept gratuities, favors or anything of monetary value from Contractor or subcontractors.**

SC 19.04 Add the following language after Article 19.03.A with the title **“Gratuities”**:

- A. If Owner finds after a notice and hearing that Contractor, or any of Contractor’s agents or representatives, offered or gave gratuities (in the form of entertainment, gifts, or otherwise) to any official, employee, or agent of Owner or Agency in an attempt to secure this Contract or favorable treatment in awarding, amending, or making any determinations related to the performance of this Contract, Owner may, by written notice to Contractor, terminate this Contract. Owner may also pursue other rights and remedies that the law or this Contract provides. However, the existence of the facts on which Owner bases such findings shall be an issue and may be reviewed in proceedings under the dispute resolution provisions of this Contract.**
- B. In the event this Contract is terminated as provided in paragraph 19.04.A, Owner may pursue the same remedies against Contractor as it could pursue in the event of a breach of this Contract by Contractor. As a penalty, in addition to any other damages to which it may be entitled by law, Owner may pursue exemplary damages in an amount (as determined by Owner) which shall not be less than three nor more than ten times the costs Contractor incurs in providing any such gratuities to any such officer or employee.**

SC 19.05 Add the following language after Article 19.05.A with the title **“Small, Minority and Women’s Businesses”**:

- A. Contracting with small and minority businesses, women's business enterprises, and labor surplus area firms. If Contractor intends to let any subcontracts for a portion of the work, Contractor must take all necessary affirmative steps to assure that minority businesses, women's business enterprises, and labor surplus area firms are used when possible. Affirmative steps must include:
 - (1) Placing qualified small and minority businesses and women's business enterprises on solicitation lists;**
 - (2) Assuring that small and minority businesses, and women's business enterprises are solicited whenever they are potential sources;****

- (3) Dividing total requirements, when economically feasible, into smaller tasks or quantities to permit maximum participation by small and minority businesses and women's business enterprises;
- (4) Establishing delivery schedules, where the requirement permits, which encourage participation by small and minority businesses, and women's business enterprises; and
- (5) Using the services and assistance, as appropriate, of such organizations as the Small Business Administration and the Minority Business Development Agency of the Department of Commerce.

SC 19.06 Add the following after Article 19.06.A with the title "Anti-Kickback":

- A. Contractor shall comply with the Copeland Anti-Kickback Act (40 U.S.C 3145) as supplemented by Department of Labor regulations (29 CFR Part 3, "Contractors and Subcontractors on Public Buildings or Public Work Financed in Whole or in Part by Loans or Grants from the United States"). The Act provides that Contractor or subcontractor must be prohibited from inducing, by any means, any person employed in the construction, completion, or repair of public work, to give up any part of the compensation to which he or she is otherwise entitled. Owner shall report all suspected or reported violations to Agency.

SC 19.07 Add the following after Article 19.07.A with the title "Clean Air Act (42 U.S.C. 7401-7671q) and the Federal Water Pollution Control Act (33 U.S.C. 1251-1387), as amended":

- A. Contractor to agree to comply with all applicable standards, orders or regulations issued pursuant to the Clean Air Act (42 U.S.C. 7401-7671q) and the Federal Water Pollution Control Act as amended (33 U.S.C. 1251-1387). Violations must be reported to the Federal awarding agency and the Regional Office of the Environmental Protection Agency (EPA).

SC 19.08 Add the following after Article 19.09 with the title "Equal Employment Opportunity":

- A. The Contract is considered a federally assisted construction contract. Except as otherwise provided under 41 CFR Part 60, all contracts that meet the definition of "federally assisted construction contract" in 41 CFR Part 60-1.3 must include the equal opportunity clause provided under 41 CFR 60-1.4(b), in accordance with Executive Order 11246, "Equal Employment Opportunity" (30 FR 12319, 12935, 3 CFR Part, 1964-1965 Comp., p. 339), as amended by Executive Order 11375, "Amending Executive Order 11246 Relating to Equal Employment Opportunity," and implementing regulations at 41 CFR part 60, "Office of Federal Contract Compliance Programs, Equal Employment Opportunity, Department of Labor."

SC 19.09 Add the following after Article 19.10.C with the title "Byrd Anti-Lobbying Amendment (31 U.S.C. 1352)":

- A. Contractors that apply or bid for an award exceeding \$100,000 must file the required certification (RD Instruction 1940-Q, Exhibit A-1). The Contractor certifies to the

Owner and every subcontractor certifies to the Contractor that it will not and has not used Federal appropriated funds to pay any person or organization for influencing or attempting to influence an officer or employee of any agency, a member of Congress, officer or employee of Congress, or an employee of a member of Congress in connection with obtaining the Contract if it is covered by 31 U.S.C. 1352. The Contractor and every subcontractor must also disclose any lobbying with non-Federal funds that takes place in connection with obtaining any Federal award. Such disclosures are forwarded from tier to tier up to the Owner. Necessary certification and disclosure forms shall be provided by Owner

19.10 Add the following after Article 19.11.A with the title “**Environmental Requirements**”:

When constructing a Project involving trenching and/or other related earth excavations, Contractor shall comply with the following environmental conditions:

- A. Wetlands – When disposing of excess, spoil, or other construction materials on public or private property, Contractor shall not fill in or otherwise convert wetlands.**
- B. Floodplains – When disposing of excess, spoil, or other construction materials on public or private property, Contractor shall not fill in or otherwise convert 100-year floodplain areas (Standard Flood Hazard Area) delineated on the latest Federal Emergency Management Agency Floodplain Maps, or other appropriate maps, e.g., alluvial soils on NRCS Soil Survey Maps.**
- C. Historic Preservation – Any excavation by Contractor that uncovers an historical or archaeological artifact or human remains shall be immediately reported to Owner and a representative of Agency. Construction shall be temporarily halted pending the notification process and further directions issued by Agency after consultation with the State Historic Preservation Officer (SHPO).**
- D. Endangered Species – Contractor shall comply with the Endangered Species Act, which provides for the protection of endangered and/or threatened species and critical habitat. Should any evidence of the presence of endangered and/or threatened species or their critical habitat be brought to the attention of Contractor, Contractor will immediately report this evidence to Owner and a representative of Agency. Construction shall be temporarily halted pending the notification process and further directions issued by Agency after consultation with the U.S. Fish and Wildlife Service.**
- E. Mitigation Measures – The following environmental mitigation measures are required on this Project: {Insert mitigation measures here}.**

SC19.11 Add the following after Article 19. with the title “**Contract Work Hours and Safety Standards Act (40 U.S.C. 3701-3708)**”:

- A. Where applicable, for contracts awarded by the Owner in excess of \$100,000 that involve the employment of mechanics or laborers, the Contractor must comply with 40 U.S.C. 3702 and 3704, as supplemented by Department of Labor regulations (29**

CFR Part 5). Under 40 U.S.C. 3702 of the Act, the Contractor must compute the wages of every mechanic and laborer on the basis of a standard work week of 40 hours. Work in excess of the standard work week is permissible provided that the worker is compensated at a rate of not less than one and a half times the basic rate of pay for all hours worked in excess of 40 hours in the work week. The requirements of 40 U.S.C. 3704 are applicable to construction work and provide that no laborer or mechanic must be required to work in surroundings or under working conditions which are unsanitary, hazardous or dangerous. These requirements do not apply to the purchases of supplies or materials or articles ordinarily available on the open market, or contracts for transportation or transmission of intelligence.

SC19.12 Add the following after Article 19. with the title “**Debarment and Suspension (Executive Orders 12549 and 12689)**”:

- A. A contract award (see 2 CFR 180.220) must not be made to parties listed on the governmentwide exclusions in the System for Award Management (SAM), in accordance with the OMB guidelines at 2 CFR 180 that implement Executive Orders 12549 (3 CFR part 1986 Comp., p. 189) and 12689 (3 CFR part 1989 Comp., p. 235), “Debarment and Suspension.” SAM Exclusions contains the names of parties debarred, suspended, or otherwise excluded by agencies, as well as parties declared ineligible under statutory or regulatory authority other than Executive Order 12549.

SC19.13 Add the following after Article 19. with the title “**Procurement of recovered materials**”:

- A. The Contractor must comply with 2 CFR Part 200.322, “Procurement of recovered materials.”

SC 19.14 Add the following:

Section 746 of Title VII of the Consolidated Appropriations Act of 2017 (Division A - Agriculture, Rural Development, Food and Drug Administration, and Related Agencies Appropriations Act, 2017) and subsequent statutes mandating domestic preference applies an American Iron and Steel requirement to this project. All iron and steel products used in this project must be produced in the United States. The term “iron and steel products” means the following products made primarily of iron or steel: lined or unlined pipes and fittings, manhole covers and other municipal castings, hydrants, tanks, flanges, pipe clamps and restraints, valves, structural steel, reinforced precast concrete, and construction materials. The de minimis and minor components waiver {add project specific waivers as applicable} apply to this contract.

SC 19.15 Add SC 19.15 Definitions:

“Assistance recipient” is the entity that receives funding assistance from programs required to comply with Section 746 Division A Title VII of the Consolidated Appropriations Act of 2017 (Agriculture, Rural Development, Food and Drug Administration, and Related Agencies Appropriations Act, 2017) and subsequent statutes mandating domestic preference. This term includes owner and/or applicant.

“Certifications” means the following:

- **Manufacturers’ certification** is documentation provided by the manufacturer or fabricator to various entities stating that the iron and steel products to be used in the project are produced in the United States in accordance with American Iron and Steel (AIS) Requirements. If items are purchased via a supplier, distributor, vendor, etc. vs. from the manufacturer or fabricator directly, then the supplier, distributor, vendor, etc. will be responsible for obtaining and providing these certification letters to the parties purchasing the products.
- **Engineers’ certification** is documentation that plans, specifications, and bidding documents comply with AIS.
- **Contractors’ certification** is documentation submitted upon substantial completion of the project that all iron and steel products installed were produced in the United States.

“Coating” means a covering that is applied to the surface of an object. If a coating is applied to the external surface of a domestic iron or steel component, and the application takes place outside of the United States, said product would be considered a compliant product under the AIS requirements. Any coating processes that are applied to the external surface of iron and steel components that would otherwise be AIS compliant would not disqualify the product from meeting the AIS requirements regardless of where the coating processes occur, provided that final assembly of the product occurs in the United States. This exemption only applies to coatings on the external surface of iron and steel components. It does not apply to coatings or linings on internal surfaces of iron and steel products, such as the lining of lined pipes. All manufacturing processes for lined pipes, including the application of pipe lining, must occur in the United States for the product to be compliant with AIS requirements.

“Construction materials” are those articles, materials, or supplies made primarily of iron and steel, that are permanently incorporated into the project, not including mechanical and/or electrical components, equipment and systems. Some of these products may overlap with what is also considered “structural steel”.

Note: Mechanical and electrical components, equipment and systems are not considered construction materials. See definition of mechanical and electrical equipment.

“Consulting engineer” is an individual or entity with which the owner has contracted to perform engineering/architectural services for water and waste projects funded by the programs subject to AIS requirements).

“De minimis incidental components” are various miscellaneous low-cost components that are essential for, but incidental to, the construction and are incorporated into the physical structure of the project. Examples of incidental components could include small washers, screws, fasteners (such as “off the shelf” nuts and bolts), miscellaneous wire, corner bead, ancillary tube, signage, trash bins, door hardware etc.

Costs for such de minimis incidental components cumulatively may comprise no more than a total of five percent of the total cost of the materials used in and incorporated into a project; the cost of an individual item may not exceed one percent of the total cost of the materials used in and incorporated into a project.

“General contractor” is the individual or entity with which the applicant has contracted (or is expected to) to perform construction services (or for water and waste projects funded by the programs subject to AIS requirements). This includes bidders, contractors that have received an award from the applicant and any party having a direct contractual relationship with the owner/applicant. A general contractor is often referred to as the prime contractor.

“Iron and steel products” are defined as the following products made primarily of iron or steel: lined or unlined pipes and fittings, manhole covers and other municipal castings, hydrants, tanks, flanges, pipe clamps and restraints, valves, structural steel, reinforced precast concrete, and construction materials. Only items on the above list made primarily of iron or steel, permanently incorporated into the project must be produced in the United States. For example trench boxes, scaffolding or equipment, which are removed from the project site upon completion of the project, are not required to be made of U.S. Iron or Steel.

“Manufacturers” meaning a supplier, fabricator, distributor, materialman, or vendor is an entity with which the applicant, general contractor or with any subcontractor has contracted to furnish materials or equipment to be incorporated in the project by the applicant, contractor or a subcontractor.

“Manufacturing processes” are processes such as melting, refining, forming, rolling, drawing, finishing, and fabricating. Further, if a domestic iron and steel product is taken out of the United States for any part of the manufacturing process, it becomes foreign source material. However, raw materials such as iron ore, limestone and iron and steel scrap are not covered by the AIS requirement, and the material(s), if any, being applied as a coating are similarly not covered. Non-iron or steel components of an iron and steel product may come from non-US sources. For example, for products such as valves and hydrants, the individual non-iron and steel components do not have to be of domestic origin. Raw materials, such as iron ore, limestone, scrap iron, and scrap steel, can come from non-U.S. sources.

“Mechanical equipment” is typically that which has motorized parts and/or is powered by a motor. **“Electrical equipment”** is typically any machine powered by electricity and includes components that are part of the electrical distribution system. AIS does apply to mechanical equipment.

“Minor components” are components within an iron and/or steel product otherwise compliant with the American Iron and Steel requirements. This is different from the de minimis definition where de minimis pertains to the entire project and the minor component definition pertains to a single product. This waiver, would allow non-domestically produced miscellaneous minor components comprising up to five percent of the total material cost of an otherwise domestically produced iron and steel product to be used. However, unless a separate waiver for a product has been approved, all other iron and steel components in said product must still meet the AIS requirements. This waiver does not exempt the whole product from the AIS requirements only minor components within said product and the iron or steel components of the product must be produced domestically. Valves and hydrants are also subject to the cost ceiling requirements described here. Examples of minor components could include items such pins and springs in valves/hydrants, bands/straps in couplings, and other low cost items such as small fasteners etc.

“Municipal castings” are cast iron or steel infrastructure products that are melted and cast. They typically provide access, protection, or housing for components incorporated into utility owned drinking water, storm water, wastewater, and solid waste infrastructure.

“National Office” refers to the office responsible for the oversight and administration of the program nationally. The National Office sets policy, develops program regulations, and provides training and technical assistance to help the state offices administer the program. The National Office is located in Washington, D.C.

“Owner” is the individual or entity with which the general contractor has contracted regarding the work, and which has agreed to pay the general contractor for the performance of the work, pursuant to the terms of the contract for water and waste projects funded by the programs subject to AIS requirements. For the purpose of this Bulletin, this term is synonymous with the term “applicant” as defined in 7 CFR 1780.7 (a) (1), (2) and (3) and is an entity receiving financial assistance from the programs subject to the AIS requirements.

“Pass through Entities” is an entity that provides a subaward to a loan and/or grant recipient to carry out part of a Federal program. Examples are grantees utilizing the Revolving Loan Program and Household Water Well Program and Alaska Native Tribal Health Consortium (ANTHC) or the State of Alaska from the RAVG Program.

“Primarily iron or steel” is defined as a product made of greater than 50 percent iron or steel, measured by cost. The cost should be based on the material costs. An exception to this definition is reinforced precast concrete (see Definitions). All technical specifications and applicable industry standards (e.g. NIST, NSF, AWWA) must be met. If a product is determined to be less than 50 percent iron and steel, the AIS requirements do not apply.

For example, the cost of a fire hydrant includes:

- (1) The cost of materials used for the iron portion of a fire hydrant (e.g. bonnet, body and shoe); and
- (2) The cost to pour and cast to create those components (e.g. labor and energy).

Not included in the cost are:

- (1) The additional material costs for the non-iron and steel internal workings of the hydrant (e.g. stem, coupling, valve, seals, etc.); and
- (2) The cost to assemble the internal workings into the hydrant body.

“Produced in the United States” means that the production in the United States of the iron or steel products used in the project requires that all manufacturing processes must take place in the United States, with the exception of metallurgical processes involving refinement of steel additives.

“Project” is the total undertaking to be accomplished for the applicant by consulting engineers, general contractors, and others, including the planning, study, design, construction, testing, commissioning, and start-up, and of which the work to be performed under the contract is a part. A project includes all activity that an applicant is undertaking to be financed in whole or part by programs subject to AIS requirements. The intentional splitting of projects into separate and smaller contracts or obligations to avoid AIS requirements is prohibited.

“Reinforced Precast Concrete” may not consist of at least 50 percent iron or steel, but the reinforcing bar and wire must be produced in the United States and meet the same standards as for any other iron or steel product. Additionally, the casting of the concrete product must take place in the United States. The cement and other raw materials used in concrete production are not required to be of domestic origin. If the reinforced concrete is cast at the construction site, the reinforcing bar and wire are considered to be a construction material and must be produced in the United States.

“Steel” means an alloy that includes at least 50 percent iron, between 0.02 and 2 percent carbon, and may include other elements. Metallic elements such as chromium, nickel, molybdenum, manganese, and silicon may be added during the melting of steel for the purpose of enhancing properties such as corrosion resistance, hardness, or strength. The definition of steel covers carbon steel, alloy steel, stainless steel, tool steel, and other specialty steels.

“Structural steel” is rolled flanged shapes, having at least one dimension of their cross-section three inches or greater, which are used in the construction of bridges, buildings, ships, railroad rolling stock, and for numerous other constructional purposes. Such shapes are designated as wide-flange shapes, standard I-beams, channels, angles, tees, and zees. Other shapes include but are not limited to, H-piles, sheet piling, tie plates, cross ties, and those for other special purposes.

“Ultimate recipient” is a loan or grant recipient receiving funds from a pass-through entity. Examples include: (1) a loan recipient from the Revolving Loan Fund; (2) a loan recipient from the Household Water Well Program; and (3) a grant recipient from ANTHC or the State of Alaska from the RAVG Program.

“United States” means each of the several states, the District of Columbia, and each Federally Recognized Indian Tribe.

**SECTION C-941
CHANGE ORDER**

Change Order No. _____

Date of Issuance:

Effective Date:

Owner:

Owner's Contract No.:

Contractor:

Contractor's Project No.:

Engineer:

Engineer's Project No.:

Project:

Contract Name:

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

Description:

Attachments: *[List documents supporting change]*

CHANGE IN CONTRACT PRICE	CHANGE IN CONTRACT TIMES <i>[note changes in Milestones if applicable]</i>
Original Contract Price: \$ _____	Original Contract Times: Substantial Completion: _____ Ready for Final Payment: _____ days or dates
[Increase] [Decrease] from previously approved Change Orders No. ___ to No. ___: \$ _____	[Increase] [Decrease] from previously approved Change Orders No. ___ to No. ___: Substantial Completion: _____ Ready for Final Payment: _____ days
Contract Price prior to this Change Order: \$ _____	Contract Times prior to this Change Order: Substantial Completion: _____ Ready for Final Payment: _____ days or dates
[Increase] [Decrease] of this Change Order: \$ _____	[Increase] [Decrease] of this Change Order: Substantial Completion: _____ Ready for Final Payment: _____ days or dates
Contract Price incorporating this Change Order: \$ _____	Contract Times with all approved Change Orders: Substantial Completion: _____ Ready for Final Payment: _____ days or dates

RECOMMENDED:

ACCEPTED:

ACCEPTED:

By: _____ Engineer (if required)	By: _____ Owner (Authorized Signature)	By: _____ Contractor (Authorized Signature)
Title: _____	Title: _____	Title: _____
Date: _____	Date: _____	Date: _____

Approved by Funding Agency (if applicable)

By: _____ Date: _____
Title: _____

COMPLIANCE STATEMENT

This statement relates to a proposed contract with _____

(Name of borrower or grantee)

who expects to finance the contract with assistance from either the Rural Housing Service (RHS), Rural Business-Cooperative Service (RBS), or the Rural Utilities Service (RUS) or their successor agencies, United States Department of Agriculture (whether by a loan, grant, loan insurance, guarantee, or other form of financial assistance). I am the undersigned bidder or prospective contractor, I represent that:

1. I have, have not, participated in a previous contract or subcontract subject to Executive Order 11246 (regarding equal employment opportunity) or a preceding similar Executive Order.
2. If I have participated in such a contract or subcontract, I have, have not, filed all compliance reports that have been required to file in connection with the contract or subcontract.
 If the proposed contract is for \$50,000 or more: or If the proposed nonconstruction contract is for \$50,000 or more and I have 50 or more employees, I also represent that:
3. I have, have not previously had contracts subject to the written affirmative action programs requirements of the Secretary of Labor.
4. If I have participated in such a contract or subcontract, I have, have not developed and placed on file at each establishment affirmative action programs as required by the rules and regulations of the Secretary of Labor.

I understand that if I have failed to file any compliance reports that have been required of me, I am not eligible and will not be eligible to have my bid considered or to enter into the proposed contract unless and until I make an arrangement regarding such reports that is satisfactory to either the RHS, RBS or RUS, or to the office where the reports are required to be filed.

I also certify that I do not maintain or provide for my employees any segregated facilities at any of my establishments, and that I do not permit my employees to perform their services at any location, under my control, where segregated facilities are maintained. I certify further that I will not maintain or provide for my employees any segregated facilities at any of my establishments, and that I will not permit my employees to perform their services at any location, under my control, where segregated facilities are maintained. I agree that a breach of this certification is a violation of the Equal Opportunity clause in my contract. As used in this certification, the term "segregated facilities" means any waiting rooms, work areas, restrooms and wash rooms, restaurants and other eating areas time clocks, locker rooms and other storage or dressing areas, parking lots, drinking fountains, recreation or entertainment areas, transportation, and housing facilities provided for employees which are segregated by explicit directive or are in fact segregated on the basis of race, creed, color, or national origin, because of habit, local custom, or otherwise. I further agree that (except where I have obtained identical certifications for proposed subcontractors for specific time periods) I will obtain identical certifications from proposed subcontractors prior to the award of subcontracts exceeding \$10,000 which are not exempt from the provisions of the Equal Opportunity clause; that I will retain such certifications in my files; and that I will forward the following notice to such proposed subcontractors (except where the proposed subcontractors have submitted identical certifications for specific time periods):

According to the Paperwork Reduction Act of 1995, an agency may not conduct or sponsor, and a person is not required to respond to a collection of information unless it displays the valid OMB control number. The valid OMB control number for this information collection is 0575-0018. The time required to complete this information collection is estimated to average 10 minutes per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information.

**NOTICE TO PROSPECTIVE SUBCONTRACTORS OF REQUIREMENTS FOR
CERTIFICATIONS OF NON-SEGREGATED FACILITIES**

A certification of Nonsegregated Facilities, as required by the May 9, 1967, order (32F.R. 7439, may 19, 1967) on Elimination of Segregated Facilities, by the Secretary of Labor, must be submitted prior to the award of a subcontract exceeding \$ 10,000 which is not exempt from the provisions of the Equal Opportunity clause. The certification may be submitted either for each subcontract or for all subcontracts during a period (i.e., quarterly, semiannually, or annually).

NOTE: The penalty for making false statements in offers is prescribed in 18 U.S.C. 1001.

DATE _____

(Signature of Bidder or Prospective Contractor)

Address (including Zip Code)

U.S. DEPARTMENT OF AGRICULTURE

Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion - Lower Tier Covered Transactions

This certification is required by the regulations implementing Executive Order 12549, Debarment and Suspension, 7 CFR Part 3017, Section 3017.510, Participants' responsibilities. The regulations were published as Part IV of the January 30, 1989, **Federal Register** (pages 4722-4733). Copies of the regulations may be obtained by contacting the Department of Agriculture agency with which this transaction originated.

(BEFORE COMPLETING CERTIFICATION, READ INSTRUCTIONS ON REVERSE)

- (1) The prospective lower tier participant certifies, by submission of this proposal, that neither it nor its principals is presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from participation in this transaction by any Federal department or agency.
- (2) Where the prospective lower tier participant is unable to certify to any of the statements in this certification, such prospective participant shall attach an explanation to this proposal.

Organization Name

PR/Award Number or Project Name

Name(s) and Title(s) of Authorized Representative(s)

Signature(s)

Date

Instructions for Certification

1. By signing and submitting this form, the prospective lower tier participant is providing the certification set out on the reverse side in accordance with these instructions.
2. The certification in this clause is a material representation of fact upon which reliance was placed when this transaction was entered into. If it is later determined that the prospective lower tier participant knowingly rendered an erroneous certification, in addition to other remedies available to the Federal Government, the department or agency with which this transaction originated may pursue available remedies, including suspension and/or debarment.
3. The prospective lower tier participant shall provide immediate written notice to the person to which this proposal is submitted if at any time the prospective lower tier participant learns that its certification was erroneous when submitted or has become erroneous by reason of changed circumstances.
4. The terms "covered transaction," "debarred," "suspended," "ineligible," "lower tier covered transaction," "participant," "person," "primary covered transaction," "principal," "proposal," and "voluntarily excluded," as used in this clause, have the meanings set out in the Definitions and Coverage sections of rules implementing Executive Order 12549. You may contact the person to which this proposal is submitted for assistance in obtaining a copy of those regulations.
5. The prospective lower tier participant agrees by submitting this form that, should the proposed covered transaction be entered into, it shall not knowingly enter into any lower tier covered transaction with a person who is debarred, suspended, declared ineligible, or voluntarily excluded from participation in this covered transaction, unless authorized by the department or agency with which this transaction originated.
6. The prospective lower tier participant further agrees by submitting this form that it will include this clause titled "Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion - Lower Tier Covered Transactions," without modification, in all lower tier covered transactions and in all solicitations for lower tier covered transactions.
7. A participant in a covered transaction may rely upon a certification of a prospective participant in a lower tier covered transaction that it is not debarred, suspended, ineligible, or voluntarily excluded from the covered transaction, unless it knows that the certification is erroneous. A participant may decide the method and frequency by which it determines the eligibility of its principals. Each participant may, but is not required to, check the Nonprocurement List.
8. Nothing contained in the foregoing shall be construed to require establishment of a system of records in order to render in good faith the certification required by this clause. The knowledge and information of a participant is not required to exceed that which is normally possessed by a prudent person in the ordinary course of business dealings.
9. Except for transactions authorized under paragraph 5 of these instructions, if a participant in a covered transaction knowingly enters into a lower tier covered transaction with a person who is suspended, debarred, ineligible, or voluntarily excluded from participation in this transaction, in addition to other remedies available to the Federal Government, the department or agency with which this transaction originated may pursue available remedies, including suspension and/or debarment.

CERTIFICATE OF OWNER'S ATTORNEY AND AGENCY CONCURRENCE

CERTIFICATE OF OWNER'S ATTORNEY

PROJECT NAME:

CONTRACTOR NAME:

I, the undersigned, _____, the duly authorized and acting legal representative of _____, do hereby certify as follows: I have examined the attached Contract(s) and performance and payment bond(s) and the manner of execution thereof, and I am of the opinion that each of the aforesaid agreements is adequate and has been duly executed by the proper parties thereto acting through their duly authorized representatives; that said representatives have full power and authority to execute said agreements on behalf of the respective parties named thereon; and that the foregoing agreements constitute valid and legally binding obligations upon the parties executing the same in accordance with the terms, conditions, and provisions thereof.

Name

Date

AGENCY CONCURRENCE

As lender or insurer of funds to defray the costs of this Contract, and without liability for any payments thereunder, the Agency hereby concurs in the form, content, and execution of this Agreement.

Agency Representative

Date

Name

ENGINEER'S CERTIFICATION OF FINAL PLANS AND SPECIFICATIONS

PROJECT NAME: _____

The final Drawings and Specifications, other assembled Construction Contract Documents, bidding-related documents (or requests for proposals or other construction procurement documents), and any other Final Design Phase deliverables, comply with all requirements of the U.S. Department of Agriculture, Rural Utilities Service, to the best of my knowledge and professional judgment.

If the Engineers Joint Contract Documents Committee (EJCDC) documents have been used, all modifications required by RUS Bulletin 1780-26 have been made in accordance with the terms of the license agreement, which states in part that the Engineer "must plainly show all changes to the Standard EJCDC Text, using 'Track Changes' (redline/strikeout), highlighting, or other means of clearly indicating additions and deletions." Such other means may include attachments indicating changes (e.g. Supplementary Conditions modifying the General Conditions).

Engineer

Date

Name and Title

CERTIFICATION FOR CONTRACTS, GRANTS AND LOANS

The undersigned certifies, to the best of his or her knowledge and belief, that:

1. 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 awarding of any Federal contract, the making of any Federal grant or Federal loan, and the extension, continuation, renewal, amendment, or modification of any Federal contract, grant or loan.

2. 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 contract, grant or loan, the undersigned shall complete and submit Standard Form - LLL, "Disclosure of Lobbying Activities," in accordance with its instructions.

3. The undersigned shall require that the language of this certification be included in the award documents for all subawards at all tiers (including contracts, subcontracts, and subgrants under grants and loans) and that all subrecipients shall certify and disclose accordingly.

This certification is a material representation of fact upon which reliance was placed when this transaction was made or entered into. Submission of this certification is a prerequisite for making or entering into this transaction imposed by section 1352, title 31, U.S. Code. Any person who fails to file the required certification shall be subject to a civil penalty of not less than \$10,000 and not more than \$100,000 for each such failure.

(name)

(date)

(title)

oOo

APPENDIX A – Federal Funds

Mandatory Supplemental General Conditions

For The

South Carolina State Revolving Fund Program

Federally-funded Projects

July 2020

Following is the standard language that must be incorporated into all solicitations for offers and bids for (1) construction contracts, (2) subcontracts, (3) equipment, and (4) material to be funded by the Federally-assisted State Revolving Fund Program.

The requirements in these Supplemental General Conditions shall not relieve the participants in this project of responsibility to meet any requirements of other portions of this contract or of other agencies, whether any other requirements are more or less stringent. The requirements in these Supplemental General Conditions must be satisfied in order for work to be funded in the State Revolving Fund Program.

APPENDIX A
TABLE OF CONTENTS

	<u>Page</u>
General Instructions	3
The Disadvantaged Business Enterprise (DBE) Program	5
Special Notice to Bidders.....	10
Davis-Bacon and Related Acts, Labor Standards Provisions	12
Davis-Bacon Wage Rate Determination.....	20
Notice of Requirement for Affirmative Action	21
Attachment A – Contacts for Procurement of DBEs	29
Attachment B – Forms	30
EPA Form 5700-52A MBE/WBE Utilization Under Federal Grants, Cooperative Agreements, and Interagency Agreements	
EPA Form 6100-2 DBE Subcontractor Positioning Form	
EPA Form 6100-3 DBE Subcontractor Utilization Form	
EPA Form 6100-4 DBE Procurement Subcontractor Utilization Form	
DHEC 2323 EEO Documentation Form	
DHEC 2556 Bidder’s “American Iron and Steel” Certification	
DHEC 3590 Certification Regarding Debarment, Suspension and Other Responsibility Matters	
DHEC 3591 Prime Contractor’s Subagreement Certification	
DHEC 3592 Certification by Proposed Prime or Subcontractor Regarding Equal Employment Opportunity	

EPA 6100 forms are
suspended as of 3/2016

General Instructions

Submittal and Approval of DBE and EEO Documentation

It is the policy of the State Revolving Loan Fund (SRF) to assure that:

- (a) Disadvantaged business enterprises (DBEs) have the opportunity to participate in a fair share of the funds awarded for contracts and subcontracts for supplies, construction, equipment or services; and
- (b) Discrimination in employment practices on the basis of race, color, religion, national origin, sex, age or handicap (referred to as Equal Employment Opportunity) is prohibited.

Compliance with these provisions IS REQUIRED in order for project costs to be eligible for SRF funding. Failure on the part of the tentatively selected bidder to submit required information may be grounds for rejecting the bid.

The Contractor must submit the following items to the Project Sponsor (Owner):

1. **DBE Compliance Documentation** listed on page 7 to include a “Bidder’s List” showing all bidders for any subcontracting opportunities. Documentation of DBE solicitation and results of such efforts must be submitted along with the following forms (See Attachment B) as part of the DBE package:

- **“Prime Contractor’s Subagreement Certification” (DHEC 3591)** - This form provides a list of all proposed subcontractors, both DBE firms and non-DBE firms. Each prime contractor must submit this form.
- **“DBE Program Subcontractor Utilization Form” (EPA Form 6100-4)** - This form captures the prime contractor’s intended use of an identified DBE subcontractor, and the estimated dollar amount of the subcontract.
- **“DBE Subcontractor Performance Form” (EPA Form 6100-3)** - Each DBE subcontractor must submit this form which captures an intended DBE subcontractor’s description of the work to be performed for the prime contractor and the price of the work submitted to the prime contractor.

EPA 6100 forms are
suspended as of 3/2016

The South Carolina Department of Health and Environmental Control (DHEC) cannot authorize the Project Sponsor (Owner) to award the construction contract(s) until the project’s “good faith efforts” (See page 6) are approved.

2. **“EEO Documentation Form” (DHEC Form 2323)** and all required attachments (See Attachment B). Each prime contractor and any subcontractor whose contract amount exceeds \$10,000 must submit this information. *DHEC cannot authorize the Project Sponsor to award the construction contract(s) until the EEO documentation is approved.*

3. **“Certification by Proposed Prime or Subcontractor Regarding Equal Employment Opportunity” (DHEC 3592)** (See Attachment B). Each prime contractor and any subcontractor whose contract amount is expected to exceed \$10,000 must submit this form.
4. **“Certification Regarding Debarment, Suspension and Other Responsibility Matters” (DHEC Form 3590)** (See Attachment B). Each prime contractor and any subcontractor whose contract amount is expected to equal or exceed \$25,000 must submit this form.

The tentatively selected bidder is required to submit the above information in duplicate to the Project Sponsor after bid opening. As part of the bid package, the Project Sponsor must forward one copy of the information to DHEC at the address listed below.

During Construction, the Prime Contractor must submit the following items:

1. **A copy of each DBE subcontract.**
2. **“MBE/WBE Utilization under Federal Grants, Cooperative Agreements, and Interagency Agreements” (EPA Form 5700-52A)** (See Attachment B). This report must be submitted semi-annually by April 15th and October 15th until the final draw has been processed for the project.
3. **Weekly Certified Payrolls** for each prime contractor and all subcontractors. **Payrolls should be submitted weekly with little lag time to the Project Sponsor.** Project Sponsors must retain payroll records for three years from the completion of the project.
4. Notice of **changes, substitutions or additions to the approved list of subcontractors. Any changes must be reported immediately to DHEC’s SRF Section and a revised DHEC Form 3591, and EPA 6100-4** must be submitted to the project’s SRF Project Manager as soon as practical. (See also “Reporting Requirements During Construction” on page 8.) **Use of any unapproved subcontractor on the project may delay payment or result in costs associated with that subcontract declared ineligible for SRF assistance.**

The Project Sponsor must forward one copy of the above items (**except for item number 3, payroll records**) to the project’s SRF Project Manager:

**[Project Manager Name Here], SRF Project Manager
SRF Section, Water Facilities Permitting Division
South Carolina Department of Health and Environmental Control
2600 Bull Street
Columbia, South Carolina 29201**

THE DISADVANTAGED BUSINESS ENTERPRISE (DBE) PROGRAM IN THE STATE REVOLVING FUND PROGRAM

Objective

The objective of the State Revolving Fund (SRF) Program's DBE program is to ensure Project Sponsors and their prime contractors utilize certified DBEs as subcontractors to the fullest extent possible. Compliance with these provisions is required in order for the project costs to be eligible for SRF funding. Failure on the part of the prime contractor to submit required documentation and obtain DBE approval may be grounds for rejecting the bid or result in subcontractor costs declared ineligible for SRF assistance.

Policy

It is SRF policy to require the Project Sponsor to implement procedures to ensure DBE firms are given opportunities for meaningful participation if subcontracts are awarded. A fair share goal of

2.6% MBE and 2.6% WBE

of the funds awarded for prime contracts or subcontracts for construction must be made available to organizations owned and controlled by socially and economically disadvantaged individuals, women, disabled Americans, historically black colleges and universities, and minority institutions. Prime contractors must include the fair share goal in their bid documents for subcontracts.

NOTE: The fair share goal is subject to change each fiscal year. Therefore, prior to bidding, it is the Project Sponsor's responsibility to check with the SRF Project Manager for the current fair share percentage to be included in bid documents.

DBE Definitions

A Disadvantaged Business Enterprise (DBE) is defined as a business that meets the criteria cited below:

Owned by socially disadvantaged individuals who have been subjected to racial or ethnic prejudice or cultural bias because of their identity as a member of a group without regard to their individual qualities;

Owned by economically disadvantaged individuals whose ability to compete in the free enterprise system has been impaired due to diminished capital and credit opportunities, as compared to others in the same line of business who are not socially disadvantaged. An individual claiming disadvantaged status must have an initial and continued personal net worth of less than \$750,000.

For purposes of this definition, disadvantaged individuals include the following:

Black Americans
Women
Disabled Americans
Minority Institutions

Asian Americans
Hispanic Americans
Native Americans
Historically Black Colleges and Universities

To qualify as a DBE firm, at least 51 percent of an independent business must be owned and controlled by a socially and economically disadvantaged individual whose personal net worth is less than \$750,000. The minority or woman owner's interest must be real, substantial and continuing. The control determination will revolve around the minority or woman owner's involvement in the day-to-day management of the business enterprise.

DBE Certification

DHEC does not determine the DBE status of businesses. Instead, the SRF Program accepts certification of DBE status from other sources already established to make this determination, such as:

- ▶ South Carolina Department of Transportation
- ▶ South Carolina Governor's Office of Small & Minority Business Assistance
- ▶ South Carolina Minority Business Development Agency (MBDA) Business Center
- ▶ South Carolina Chamber of Commerce
- ▶ Other agencies or organizations that provide procurement assistance to DBEs if their definition of a DBE matches the criteria established above.

Note: See Attachment A for a listing of the addresses, telephone numbers and web addresses for the above referenced agencies.

DBE Requirements – "Six Good Faith Efforts"

Project Sponsors and their prime contractors must comply with the following "Six Good Faith Efforts" before a contract is awarded:

- (1) Ensure DBEs are made aware of contracting opportunities to the fullest extent practicable through outreach and recruitment activities. This will include placing DBEs on solicitation lists and soliciting them whenever they are potential sources.
- (2) Make information on forthcoming opportunities available to DBEs and arrange time frames for contracts and establish delivery schedules, where the requirements permit, in a way that encourages and facilitates participation by DBEs in the competitive process. This includes, whenever possible, **posting solicitations for bids or proposals for a minimum of 30 calendar days before the bid or proposal closing date.**
- (3) Consider in the contracting process whether firms competing for large contracts could subcontract with DBEs. This will involve dividing total requirements, when economically feasible, into smaller tasks or quantities to permit maximum participation by DBEs in the competitive process.
- (4) Encourage contracting with a consortium of DBEs when a contract is too large for one of these firms to handle individually.
- (5) Use the services and assistance of the Small Business Administration (SBA) and the Minority Business Development Agency (MBDA) of the U.S. Department of Commerce.
- (6) If the prime contractor awards subcontracts, require the prime contractor to take the steps in paragraphs (1) through (5) of this section.

The prime contractor must employ the “Six Good Faith Efforts” to subcontract with DBEs, even if the prime contractor has achieved his or her fair share objectives.

Solicitation of DBE Firms

Solicitation should allow adequate time for price analysis; as stated above, whenever possible, **contact should be made not later than 30 days before bid opening.** Efforts taken to comply with these requirements must be documented in detail.

Prime contractors must create and maintain a **Bidders List**. This list must include **all firms that bid or quote subcontracts including both MBE/WBEs and non-MBE/WBEs.** The Bidders List must be kept until the project period has ended. The following information must be obtained from all subcontractors:

- Subcontractor’s name with point of contact,
- Subcontractor’s mailing address, telephone number and e-mail address;
- The procurement (scope of work) on which the subcontractor bid or quoted and when; and
- The subcontractor’s status as a certified MBE, WBE, or non-MBE/WBE.

The prime contractor is **required** to use the services of the Minority Business Development Agency (MBDA). MBDA Business Centers are funded by the U.S. Department of Commerce to provide technical, financial and contracting assistance to minority and women’s business enterprises. These Centers are located in a number of Regional cities. Use of the services provided by these Centers does not absolve the prime contractors from pursuing additional efforts to comply with this requirement. See Attachment A for a listing of the address, telephone number and web address for the MBDA Business Center – Columbia SC as well as other resource agencies.

DBE Compliance Documentation

If subcontracts are awarded, prime contractors *must submit the following items* as documentation of their good faith efforts, **even if the prime contractor has achieved its fair share objectives:**

- (1) A copy of the prime contractor’s Bidder’s List.
- (2) Evidence of solicitation to *certified* prospective DBE firms, such as copies of solicitation letters/emails listing **specific scope/volume of work**, phone logs, fax confirmation sheets, printouts of online searches with results of said searches, etc. The prime contractor is strongly encouraged to follow-up each written, faxed or emailed solicitation with at least one logged phone call.
- (3) Copies of letters or e-mails asking for assistance from the MBDA Business Center – Columbia, SC, the South Carolina Governor’s Office of Small & Minority Business Assistance, or other agencies or organizations that provide procurement assistance to DBEs. **Note: As outlined in the “Good Faith Effort” Number 5 above, it is mandatory that prime contractors contact the SBA and the MBDA Business Center.**

- (4) List by trade the names of *certified* DBE subcontractors solicited but not selected, including name, address, telephone number, contact person, date of contact, and outcome of contact, including dollar amount of quote.
- (5) List any job-specific criteria that disqualified a certified DBE firm that submitted a low bid for a subcontract. Attach a copy of the disqualified bid or quote along with the bid or quote from the selected subcontractor for comparison.
- (6) Proof of **DBE certification** from an acceptable source for each subcontractor listed as a MBE or WBE.
- (7) DHEC form entitled “Prime Contractor’s Subagreement Certification” (DHEC Form 3591) (See Attachment B) listing **all** proposed subcontractors, both DBE firms and non-DBE firms.
- (8) EPA Form 6100-4 “DBE Subcontractor Utilization Form” (See Attachment B) listing all proposed DBE subcontractors.
- (9) Require all DBE subcontractors to complete EPA Form 6100-3, “DBE Subcontractor Performance Form” (See Attachment B) This form captures an intended DBE subcontractor’s description of work to be performed for the prime contractor and the price of the work submitted to the prime contractor.

Reporting Requirements for Prime Contractors During Construction

- ▶ Forward a copy of each DBE subcontract as soon as possible after contract award.
- ▶ Pay subcontractors for satisfactory performance no more than **30 days** from the prime contractor’s receipt of payment.
- ▶ Report any proposed changes/additions from the approved subcontractor list to the Project Sponsor and DHEC **prior to initiation of the action** along with the following actions:
 - Submit a **revised/updated** “Prime Contractor’s Subagreement Certification” (DHEC Form 3591) and EPA Form 6100-4 (See Attachment B).
 - Document the reason for the proposed deviation
 - Submit evidence of the prime contractor’s continued good faith efforts to secure a DBE firm for the new and/or replacement subcontract work.
 - Provide any new subcontractors with the “DBE Subcontractor Performance Form” (EPA Form 6100-3) (See Attachment B) **if** work is subcontracted to a **new** DBE firm.
 - Submit a “EEO Documentation Form” (DHEC Form 2323) (See Attachment B) from the **new** subcontractor **if** the subcontract amount exceeds \$10,000.
 - Submit a “Certification by Proposed Prime or Subcontractor Regarding Equal Employment Opportunity” (DHEC 3592) (See Attachment) from the **new** subcontractor **if** the subcontract amount exceeds \$10,000.
 - Submit a “Certification Regarding Debarment, Suspension and Other Responsibility Matters” (DHEC 3590) (See Attachment B) from the **new** subcontractor **if** the subcontract amount equals or exceeds \$25,000.

Use of any unapproved subcontractor on the project may delay loan draw requests or result in costs associated with that subcontract declared ineligible for SRF assistance.

- ▶ Submittal of the data for “MBE/WBE Utilization under Federal Grants, Cooperative Agreements, and Interagency Agreements” (EPA Form 5700-52A) to the Project Sponsor. The reporting period is semiannual, with reporting periods ending March 31st and September 30th. Submission of this report is required even if there is no MBE/WBE activity to report; this is called a Negative Report.
- ▶ Provide EPA Form 6100-2, “DBE Subcontractor Participation Form”, to all DBE subcontractors. This form gives a DBE subcontractor the opportunity to describe the work the DBE subcontractor received from the prime contractor, how much the DBE subcontractor was paid and other concerns the DBE subcontractor might have. DBE subcontractors may send completed copies of EPA Form 6100-2 directly to: EPA DBE Coordinator, EPA Region 4, 61 Forsyth Street SW, Atlanta, Georgia, 30303.

SPECIAL NOTICE TO BIDDERS

Number 1: The State Revolving Fund Program requires the Equal Employment Opportunity (EEO) commitment of the prime contractor and all subcontractors with a contract in excess of \$10,000 to the requirements of Executive Order 11246. EEO Affirmative Action is mandated throughout the duration of the contract.

The tentatively selected bidder is required to submit the EEO documentation as outlined in the “General Instructions” of these Supplemental General Conditions.

Failure to submit the EEO documentation may subject the contractor to sanctions under Executive Order 11246.

Number 2: By the submission of this bid, each bidder acknowledges that he understands and agrees to be bound by the equal opportunity requirements of EPA regulations (40 CFR Part 8, particularly Section 8.4(b)), which shall be applicable throughout the performance of work under any contract awarded pursuant to this solicitation. Each bidder agrees that if awarded a contract, it will similarly bind contractually each subcontractor. In implementation of the foregoing policies, each bidder further understands and agrees that if awarded a contract, it must engage in affirmative action directed at promoting and ensuring equal employment opportunity in the workforce used under the contract. The bidder understands and agrees that “affirmative action” as used herein shall constitute a good faith effort to achieve and maintain minority employment in each trade in the on-site workforce used on the project.

Number 3: The successful bidder is required to certify that they are not presently debarred, suspended, proposed for debarment, declared ineligible or voluntarily excluded from participating in a contract using federal funds. In turn, prime contractors will require subcontractors whose contract amount is expected to equal or exceed \$25,000 to also submit such certification using the “Certification Regarding Debarment, Suspension and Other Responsibility Matters” (DHEC Form 3590) (See Attachment B).

Number 4: Bonding requirements are as follows:

- (a) Bid guarantee equivalent to five percent of the bid price. The bid guarantee shall be in the form of a certified check or bid bond.
- (b) Performance bond equal to 100 percent of the contract price; and
- (c) Payment bond equal to 100 percent of the contract price.

Bonds must be obtained from companies holding Certificates of Authority as acceptable sureties, issued by the U.S. Treasury.

Number 5: The Project Sponsor and contractors must follow the flood hazard area requirements of the Flood Disaster Protection Act of 1973 contained in 40 CRF Part 30.

Number 6: Fire and Extended Coverage Insurance (Builder’s Risk):

- (a) The Contractor shall maintain, as applicable, in an Insurance Company or Insurance Companies acceptable to the Project Sponsor, Fire, Extended Coverage and Vandalism and Malicious Mischief Insurance on buildings and structures, while in the course of construction, including foundations, additions, attachments and all permanent fixtures belonging to and constituting a part of said buildings or structures. The policy or policies shall also cover machinery if the cost of machinery is included in the contract. The amount of insurance must at all times be at least equal to the actual cash value of the insured property. The policy shall be in the name of the Project Sponsor and the Contractor, as their interests may appear, and shall also cover the interests of all subcontractors performing work.
- (b) The Contractor shall provide the Project Sponsor with satisfactory evidence certifying that the foregoing insurance is in force; and such evidence shall include provisions that the insurance shall not be cancelled, allowed to expire or be materially changed without giving the Project Sponsor advance notice by registered mail.
- (c) Cancellation and Re-Insurance: If any insurance should be cancelled or changed by the insurance company or should any insurance expire during the period of this Contract, the Contractor shall be responsible for securing other acceptable insurance to provide the coverage specified in this section to maintain continuous coverage during the life of this Contract.

Number 7: Use of American Iron and Steel

The Contractor acknowledges to and for the benefit of the Project Sponsor and the State Revolving Fund (SRF) Program that it understands the goods and services under this Agreement are being funded with monies made available by the Clean Water State Revolving Fund and/or Drinking Water State Revolving Fund that have statutory requirements commonly known as “American Iron and Steel;” that requires all of the iron and steel products used in the project to be produced in the United States (“American Iron and Steel Requirement”) including iron and steel products provided by the Contractor pursuant to this Agreement. The Contractor hereby represents and warrants to and for the benefit of the Project Sponsor and the SRF Program that (a) the Contractor has reviewed and understands the American Iron and Steel Requirement, (b) all of the iron and steel products used in the project will be and/or have been produced in the United States in a manner that complies with the American Iron and Steel Requirement, unless a waiver of the requirement is approved, and (c) the Contractor will provide any further verified information, certification or assurance of compliance with this paragraph, or information necessary to support a waiver of the American Iron and Steel Requirement, as may be requested by the Project Sponsor or the SRF Program. Notwithstanding any other provision of this Agreement, any failure to comply with this paragraph by the Contractor shall permit the Project Sponsor or the SRF Program to recover as damages against the Contractor any loss, expense, or cost (including without limitation attorney’s fees) incurred by the Project Sponsor or the SRF Program resulting from any such failure (including without limitation any impairment or loss of funding, whether in whole or in part, from the SRF Program or any damages owed to the SRF Program by the Project Sponsor). While the Contractor has no direct contractual privity with the SRF Program, as a lender to the Project Sponsor for the funding of its project, the Project Sponsor and the Contractor agree that the SRF Program is a third-party beneficiary and neither this paragraph (nor any other provision of this Agreement necessary to give this paragraph force or effect) shall be amended or waived without the prior written consent of the SRF Program.

The proposed prime contractor(s) must certify American Iron and Steel compliance using DHEC Form 2556.

DAVIS-BACON AND RELATED ACTS

WAGE RATE REQUIREMENTS FOR FEDERAL AND FEDERALLY ASSISTED CONTRACTS

Wage Rate Requirements

Preamble

With respect to the Clean Water and Safe Drinking Water State Revolving Funds, EPA provides capitalization grants to each State which in turn provides subgrants or loans to eligible entities within the State. Typically, the subrecipients are municipal or other local governmental entities that manage the funds. For these types of recipients, the provisions set forth under Roman Numeral I, below, shall apply. Although EPA and the State remain responsible for ensuring subrecipients' compliance with the wage rate requirements set forth herein, those subrecipients shall have the primary responsibility to maintain payroll records as described in Section 3(ii)(A), below and for compliance as described in Section I-5.

Occasionally, the subrecipient may be a private for profit or not for profit entity. For these types of recipients, the provisions set forth in Roman Numeral II, ~~below~~ [available upon request], shall apply. Although EPA and the State remain responsible for ensuring subrecipients' compliance with the wage rate requirements set forth herein, those subrecipients shall have the primary responsibility to maintain payroll records as described in Section II-3(ii)(A), ~~below~~ and for compliance as described in Section II-5.

I. Requirements Under The Water Resources Reform and Development Act of 2014 (WRRDA) and Under the Safe Drinking Water Act, Section 1452(a)(5) For Subrecipients That Are Governmental Entities:

The following terms and conditions specify how recipients will assist EPA in meeting its Davis-Bacon (DB) responsibilities when DB applies to EPA awards of financial assistance with respect to State recipients and sub recipients that are governmental entities. If a sub recipient has questions regarding when DB applies, obtaining the correct DB wage determinations, DB provisions, or compliance monitoring, it may contact the State recipient. If a State recipient needs guidance, the recipient may contact Sheryl Parsons, parsons.sheryl@epa.gov, 404-562-9337 of EPA, Region 4 for guidance. The recipient or sub recipient may also obtain additional guidance from DOL's web site at <http://www.dol.gov/whd/>

1. Applicability of the Davis- Bacon (DB) prevailing wage requirements.

DB prevailing wage requirements apply to the construction, alteration, and repair of treatment works carried out in whole or in part with assistance made available by a State water pollution control revolving fund and to any construction project carried out in whole or in part by assistance made available by a drinking water treatment revolving loan fund. If a sub recipient encounters a unique situation at a site that presents uncertainties regarding DB applicability, the sub recipient must discuss the situation with the recipient State before authorizing work on that site.

2. Obtaining Wage Determinations.

(a) Sub recipients shall obtain the wage determination for the locality in which a covered activity subject to DB will take place prior to issuing requests for bids, proposals, quotes or other methods for soliciting contracts (solicitation) for activities subject to DB. These wage determinations shall be incorporated into solicitations and any subsequent contracts. Prime contracts must contain a provision requiring that subcontractors follow the wage determination incorporated into the prime contract.

(i) While the solicitation remains open, the sub recipient shall monitor <http://beta.sam.gov/> weekly to ensure that the wage determination contained in the solicitation remains current. The sub recipients shall

amend the solicitation if DOL issues a modification more than 10 days prior to the closing date (i.e. bid opening) for the solicitation. If DOL modifies or supersedes the applicable wage determination less than 10 days prior to the closing date, the sub recipients may request a finding from the State recipient that there is not a reasonable time to notify interested contractors of the modification of the wage determination. The State recipient will provide a report of its findings to the sub recipient.

(ii) If the sub recipient does not award the contract within 90 days of the closure of the solicitation, any modifications or supersedes DOL makes to the wage determination contained in the solicitation shall be effective unless the State recipient, at the request of the sub recipient, obtains an extension of the 90 day period from DOL pursuant to 29 CFR 1.6(c)(3)(iv). The sub recipient shall monitor <http://beta.sam.gov/> on a weekly basis if it does not award the contract within 90 days of closure of the solicitation to ensure that wage determinations contained in the solicitation remain current.

(b) If the sub recipient carries out activity subject to DB by issuing a task order, work assignment or similar instrument to an existing contractor (ordering instrument) rather than by publishing a solicitation, the sub recipient shall insert the appropriate DOL wage determination from <http://beta.sam.gov/> into the ordering instrument.

(c) Sub recipients shall review all subcontracts subject to DB entered into by prime contractors to verify that the prime contractor has required its subcontractors to include the applicable wage determinations.

(d) As provided in 29 CFR 1.6(f), DOL may issue a revised wage determination applicable to a sub recipient's contract after the award of a contract or the issuance of an ordering instrument if DOL determines that the sub recipient has failed to incorporate a wage determination or has used a wage determination that clearly does not apply to the contract or ordering instrument. If this occurs, the sub recipient shall either terminate the contract or ordering instrument and issue a revised solicitation or ordering instrument or incorporate DOL's wage determination retroactive to the beginning of the contract or ordering instrument by change order. The sub recipient's contractor must be compensated for any increases in wages resulting from the use of DOL's revised wage determination.

3. Contract and Subcontract provisions.

(a) The Recipient shall insure that the sub recipient(s) shall insert in full in any contract in excess of \$2,000 which is entered into for the actual construction, alteration and/or repair, including painting and decorating, of a treatment work under the CWSRF or a construction project under the DWSRF financed in whole or in part from Federal funds or in accordance with guarantees of a Federal agency or financed from funds obtained by pledge of any contract of a Federal agency to make a loan, grant or annual contribution (except where a different meaning is expressly indicated), and which is subject to the labor standards provisions of any of the acts listed in § 5.1 or the Safe Drinking Water Act, Section 1452(a)(5), or WRRDA, the following clauses:

(1) Minimum wages.

(i) All laborers and mechanics employed or working upon the site of the work will be paid unconditionally and not less often than once a week, and without subsequent deduction or rebate on any account (except such payroll deductions as are permitted by regulations issued by the Secretary of Labor under the Copeland Act (29 CFR part 3)), the full amount of wages and bona fide fringe benefits (or cash equivalents thereof) due at time of payment computed at rates not less than those contained in the wage determination of the Secretary of Labor which is attached hereto and made a part hereof, regardless of any contractual relationship which may be alleged to exist between the contractor and such laborers and mechanics.

Contributions made or costs reasonably anticipated for bona fide fringe benefits under section 1(b)(2) of the Davis-Bacon Act on behalf of laborers or mechanics are considered wages paid to such laborers or mechanics, subject to the provisions of paragraph (a)(1)(iv) of this section; also, regular contributions made or costs incurred for more than a weekly period (but not less often than quarterly) under plans,

funds, or programs which cover the particular weekly period, are deemed to be constructively made or incurred during such weekly period. Such laborers and mechanics shall be paid the appropriate wage rate and fringe benefits on the wage determination for the classification of work actually performed, without regard to skill, except as provided in § 5.5(a)(4). Laborers or mechanics performing work in more than one classification may be compensated at the rate specified for each classification for the time actually worked therein: Provided that the employer's payroll records accurately set forth the time spent in each classification in which work is performed. The wage determination (including any additional classification and wage rates conformed under paragraph (a)(1)(ii) of this section) and the Davis-Bacon poster (WH-1321) shall be posted at all times by the contractor and its subcontractors at the site of the work in a prominent and accessible place where it can be easily seen by the workers. Sub recipients may obtain wage determinations from the U.S. Department of Labor's web site, www.dol.gov.

(ii)(A) The sub recipient(s), on behalf of EPA, shall require that any class of laborers or mechanics, including helpers, which is not listed in the wage determination and which is to be employed under the contract shall be classified in conformance with the wage determination. The State award official shall approve a request for an additional classification and wage rate and fringe benefits therefore only when the following criteria have been met:

- (1) The work to be performed by the classification requested is not performed by a classification in the wage determination; and
- (2) The classification is utilized in the area by the construction industry; and
- (3) The proposed wage rate, including any bona fide fringe benefits, bears a reasonable relationship to the wage rates contained in the wage determination.

(B) If the contractor and the laborers and mechanics to be employed in the classification (if known), or their representatives, and the sub recipient(s) agree on the classification and wage rate (including the amount designated for fringe benefits where appropriate), documentation of the action taken and the request, including the local wage determination shall be sent by the sub recipient (s) to the State award official. The State award official will transmit the request, to the Administrator of the Wage and Hour Division, Employment Standards Administration, U.S. Department of Labor, Washington, DC 20210 and to the EPA DB Regional Coordinator concurrently. The Administrator, or an authorized representative, will approve, modify, or disapprove every additional classification request within 30 days of receipt and so advise the State award official or will notify the State award official within the 30-day period that additional time is necessary.

(C) In the event the contractor, the laborers or mechanics to be employed in the classification or their representatives, and the sub recipient(s) do not agree on the proposed classification and wage rate (including the amount designated for fringe benefits, where appropriate), the award official shall refer the request and the local wage determination, including the views of all interested parties and the recommendation of the State award official, to the Administrator for determination. The request shall be sent to the EPA DB Regional Coordinator concurrently. The Administrator, or an authorized representative, will issue a determination within 30 days of receipt of the request and so advise the contracting officer or will notify the contracting officer within the 30-day period that additional time is necessary.

(D) The wage rate (including fringe benefits where appropriate) determined pursuant to paragraphs (a)(1)(ii)(B) or (C) of this section, shall be paid to all workers performing work in the classification under this contract from the first day on which work is performed in the classification.

(iii) Whenever the minimum wage rate prescribed in the contract for a class of laborers or mechanics includes a fringe benefit which is not expressed as an hourly rate, the contractor shall either pay the benefit as stated in the wage determination or shall pay another bona fide fringe benefit or an hourly cash equivalent thereof.

(iv) If the contractor does not make payments to a trustee or other third person, the contractor may consider as part of the wages of any laborer or mechanic the amount of any costs reasonably anticipated in providing bona fide fringe benefits under a plan or program, Provided, That the Secretary of Labor has found, upon the written request of the contractor, that the applicable standards of the Davis-Bacon Act have been met. The Secretary of Labor may require the contractor to set aside in a separate account assets for the meeting of obligations under the plan or program.

(2) Withholding.

The sub recipient(s), shall upon written request of the EPA Award Official or an authorized representative of the Department of Labor, withhold or cause to be withheld from the contractor under this contract or any other Federal contract with the same prime contractor, or any other federally-assisted contract subject to Davis-Bacon prevailing wage requirements, which is held by the same prime contractor, so much of the accrued payments or advances as may be considered necessary to pay laborers and mechanics, including apprentices, trainees, and helpers, employed by the contractor or any subcontractor the full amount of wages required by the contract. In the event of failure to pay any laborer or mechanic, including any apprentice, trainee, or helper, employed or working on the site of the work, all or part of the wages required by the contract, the (Agency) may, after written notice to the contractor, sponsor, applicant, or owner, take such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds until such violations have ceased.

(3) Payrolls and basic records.

(i) Payrolls and basic records relating thereto shall be maintained by the contractor during the course of the work and preserved for a period of three years thereafter for all laborers and mechanics working at the site of the work. Such records shall contain the name, address, and social security number of each such worker, his or her correct classification, hourly rates of wages paid (including rates of contributions or costs anticipated for bona fide fringe benefits or cash equivalents thereof of the types described in section 1(b)(2)(B) of the Davis-Bacon Act), daily and weekly number of hours worked, deductions made and actual wages paid. Whenever the Secretary of Labor has found under 29 CFR 5.5(a)(1)(iv) that the wages of any laborer or mechanic include the amount of any costs reasonably anticipated in providing benefits under a plan or program described in section 1(b)(2)(B) of the Davis-Bacon Act, the contractor shall maintain records which show that the commitment to provide such benefits is enforceable, that the plan or program is financially responsible, and that the plan or program has been communicated in writing to the laborers or mechanics affected, and records which show the costs anticipated or the actual cost incurred in providing such benefits. Contractors employing apprentices or trainees under approved programs shall maintain written evidence of the registration of apprenticeship programs and certification of trainee programs, the registration of the apprentices and trainees, and the ratios and wage rates prescribed in the applicable programs.

(ii)(A) The contractor shall submit weekly, for each week in which any contract work is performed, a copy of all payrolls to the sub recipient, that is, the entity that receives the sub-grant or loan from the State capitalization grant recipient. Such documentation shall be available on request of the State recipient or EPA. As to each payroll copy received, the sub recipient shall provide written confirmation in a form satisfactory to the State indicating whether or not the project is in compliance with the requirements of 29 CFR 5.5(a)(1) based on the most recent payroll copies for the specified week. The payrolls shall set out accurately and completely all of the information required to be maintained under 29 CFR 5.5(a)(3)(i), except that full social security numbers and home addresses shall not be included on the weekly payrolls. Instead the payrolls shall only need to include an individually identifying number for each employee (e.g., the last four digits of the employee's social security number). The required weekly payroll information may be submitted in any form desired. Optional Form WH-347 is available for this purpose from the Wage and Hour Division Web site at <http://www.dol.gov/whd/forms/wh347instr.htm> or its successor site. The prime contractor is responsible for the submission of copies of payrolls by all subcontractors. Contractors and subcontractors shall maintain the full social security number and current address of each

covered worker, and shall provide them upon request to the sub recipient(s) for transmission to the State or EPA if requested by EPA, the State, the contractor, or the Wage and Hour Division of the Department of Labor for purposes of an investigation or audit of compliance with prevailing wage requirements. It is not a violation of this section for a prime contractor to require a subcontractor to provide addresses and social security numbers to the prime contractor for its own records, without weekly submission to the sub recipient(s).

(B) Each payroll submitted shall be accompanied by a "Statement of Compliance," signed by the contractor or subcontractor or his or her agent who pays or supervises the payment of the persons employed under the contract and shall certify the following:

(1) That the payroll for the payroll period contains the information required to be provided under § 5.5 (a)(3)(ii) of Regulations, 29 CFR part 5, the appropriate information is being maintained under § 5.5 (a)(3)(i) of Regulations, 29 CFR part 5, and that such information is correct and complete;

(2) That each laborer or mechanic (including each helper, apprentice, and trainee) employed on the contract during the payroll period has been paid the full weekly wages earned, without rebate, either directly or indirectly, and that no deductions have been made either directly or indirectly from the full wages earned, other than permissible deductions as set forth in Regulations, 29 CFR part 3;

(3) That each laborer or mechanic has been paid not less than the applicable wage rates and fringe benefits or cash equivalents for the classification of work performed, as specified in the applicable wage determination incorporated into the contract.

(C) The weekly submission of a properly executed certification set forth on the reverse side of Optional Form WH-347 shall satisfy the requirement for submission of the "Statement of Compliance" required by paragraph (a)(3)(ii)(B) of this section.

(D) The falsification of any of the above certifications may subject the contractor or subcontractor to civil or criminal prosecution under section 1001 of title 18 and section 231 of title 31 of the United States Code.

(iii) The contractor or subcontractor shall make the records required under paragraph (a)(3)(i) of this section available for inspection, copying, or transcription by authorized representatives of the State, EPA or the Department of Labor, and shall permit such representatives to interview employees during working hours on the job. If the contractor or subcontractor fails to submit the required records or to make them available, the Federal agency or State may, after written notice to the contractor, sponsor, applicant, or owner, take such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds. Furthermore, failure to submit the required records upon request or to make such records available may be grounds for debarment action pursuant to 29 CFR 5.12.

(4) Apprentices and trainees

(i) Apprentices. Apprentices will be permitted to work at less than the predetermined rate for the work they performed when they are employed pursuant to and individually registered in a bona fide apprenticeship program registered with the U.S. Department of Labor, Employment and Training Administration, Office of Apprenticeship Training, Employer and Labor Services, or with a State Apprenticeship Agency recognized by the Office, or if a person is employed in his or her first 90 days of probationary employment as an apprentice in such an apprenticeship program, who is not individually registered in the program, but who has been certified by the Office of Apprenticeship Training, Employer and Labor Services or a State Apprenticeship Agency (where appropriate) to be eligible for probationary employment as an apprentice. The allowable ratio of apprentices to journeymen on the job site in any craft classification shall not be greater than the ratio permitted to the contractor as to the entire work force under the registered program. Any worker listed on a payroll at an apprentice wage rate, who is not registered or otherwise employed as stated above, shall be paid not less than the applicable wage rate on the wage determination for the classification of work actually performed. In addition, any apprentice

performing work on the job site in excess of the ratio permitted under the registered program shall be paid not less than the applicable wage rate on the wage determination for the work actually performed. Where a contractor is performing construction on a project in a locality other than that in which its program is registered, the ratios and wage rates (expressed in percentages of the journeyman's hourly rate) specified in the contractor's or subcontractor's registered program shall be observed. Every apprentice must be paid at not less than the rate specified in the registered program for the apprentice's level of progress, expressed as a percentage of the journeymen hourly rate specified in the applicable wage determination. Apprentices shall be paid fringe benefits in accordance with the provisions of the apprenticeship program. If the apprenticeship program does not specify fringe benefits, apprentices must be paid the full amount of fringe benefits listed on the wage determination for the applicable classification. If the Administrator determines that a different practice prevails for the applicable apprentice classification, fringes shall be paid in accordance with that determination. In the event the Office of Apprenticeship Training, Employer and Labor Services, or a State Apprenticeship Agency recognized by the Office, withdraws approval of an apprenticeship program, the contractor will no longer be permitted to utilize apprentices at less than the applicable predetermined rate for the work performed until an acceptable program is approved.

(ii) Trainees. Except as provided in 29 CFR 5.16, trainees will not be permitted to work at less than the predetermined rate for the work performed unless they are employed pursuant to and individually registered in a program which has received prior approval, evidenced by formal certification by the U.S. Department of Labor, Employment and Training Administration. The ratio of trainees to journeymen on the job site shall not be greater than permitted under the plan approved by the Employment and Training Administration. Every trainee must be paid at not less than the rate specified in the approved program for the trainee's level of progress, expressed as a percentage of the journeyman hourly rate specified in the applicable wage determination. Trainees shall be paid fringe benefits in accordance with the provisions of the trainee program. If the trainee program does not mention fringe benefits, trainees shall be paid the full amount of fringe benefits listed on the wage determination unless the Administrator of the Wage and Hour Division determines that there is an apprenticeship program associated with the corresponding journeyman wage rate on the wage determination which provides for less than full fringe benefits for apprentices. Any employee listed on the payroll at a trainee rate who is not registered and participating in a training plan approved by the Employment and Training Administration shall be paid not less than the applicable wage rate on the wage determination for the classification of work actually performed. In addition, any trainee performing work on the job site in excess of the ratio permitted under the registered program shall be paid not less than the applicable wage rate on the wage determination for the work actually performed. In the event the Employment and Training Administration withdraws approval of a training program, the contractor will no longer be permitted to utilize trainees at less than the applicable predetermined rate for the work performed until an acceptable program is approved.

(iii) Equal employment opportunity. The utilization of apprentices, trainees and journeymen under this part shall be in conformity with the equal employment opportunity requirements of Executive Order 11246, as amended and 29 CFR part 30.

(5) Compliance with Copeland Act requirements. The contractor shall comply with the requirements of 29 CFR part 3, which are incorporated by reference in this contract.

(6) Subcontracts. The contractor or subcontractor shall insert in any subcontracts the clauses contained in 29 CFR 5.5(a)(1) through (10) and such other clauses as the EPA determines may be appropriate, and also a clause requiring the subcontractors to include these clauses in any lower tier subcontracts. The prime contractor shall be responsible for the compliance by any subcontractor or lower tier subcontractor with all the contract clauses in 29 CFR 5.5.

(7) Contract termination; debarment. A breach of the contract clauses in 29 CFR 5.5 may be grounds for termination of the contract, and for debarment as a contractor and a subcontractor as provided in 29 CFR 5.12.

(8) Compliance with Davis-Bacon and Related Act requirements. All rulings and interpretations of the Davis-Bacon and Related Acts contained in 29 CFR parts 1, 3, and 5 are herein incorporated by reference in this contract.

(9) Disputes concerning labor standards. Disputes arising out of the labor standards provisions of this contract shall not be subject to the general disputes clause of this contract. Such disputes shall be resolved in accordance with the procedures of the Department of Labor set forth in 29 CFR parts 5, 6, and 7. Disputes within the meaning of this clause include disputes between the contractor (or any of its subcontractors) and sub recipient(s), State, EPA, the U.S. Department of Labor, or the employees or their representatives.

(10) Certification of eligibility.

(i) By entering into this contract, the contractor certifies that neither it (nor he or she) nor any person or firm who has an interest in the contractor's firm is a person or firm ineligible to be awarded Government contracts by virtue of section 3(a) of the Davis-Bacon Act or 29 CFR 5.12(a)(1).

(ii) No part of this contract shall be subcontracted to any person or firm ineligible for award of a Government contract by virtue of section 3(a) of the Davis-Bacon Act or 29 CFR 5.12(a)(1).

(iii) The penalty for making false statements is prescribed in the U.S. Criminal Code, 18 U.S.C. 1001.

4. Contract Provision for Contracts in Excess of \$100,000.

(a) Contract Work Hours and Safety Standards Act. The sub recipient shall insert the following clauses set forth in paragraphs (a)(1), (2), (3), and (4) of this section in full in any contract in an amount in excess of \$100,000 and subject to the overtime provisions of the Contract Work Hours and Safety Standards Act. These clauses shall be inserted in addition to the clauses required by Item 3, above or 29 CFR 4.6. As used in this paragraph, the terms laborers and mechanics include watchmen and guards.

(1) Overtime requirements. No contractor or subcontractor contracting for any part of the contract work which may require or involve the employment of laborers or mechanics shall require or permit any such laborer or mechanic in any workweek in which he or she is employed on such work to work in excess of forty hours in such workweek unless such laborer or mechanic receives compensation at a rate not less than one and one-half times the basic rate of pay for all hours worked in excess of forty hours in such workweek.

(2) Violation; liability for unpaid wages; liquidated damages. In the event of any violation of the clause set forth in paragraph (a)(1) of this section the contractor and any subcontractor responsible therefore shall be liable for the unpaid wages. In addition, such contractor and subcontractor shall be liable to the United States (in the case of work done under contract for the District of Columbia or a territory, to such District or to such territory), for liquidated damages. Such liquidated damages shall be computed with respect to each individual laborer or mechanic, including watchmen and guards, employed in violation of the clause set forth in paragraph (a)(1) of this section, in the sum of \$10 for each calendar day on which such individual was required or permitted to work in excess of the standard workweek of forty hours without payment of the overtime wages required by the clause set forth in paragraph (a)(1) of this section.

(3) Withholding for unpaid wages and liquidated damages. The sub recipient, upon written request of the EPA Award Official or an authorized representative of the Department of Labor, shall withhold or cause to be withheld, from any moneys payable on account of work performed by the contractor or subcontractor under any such contract or any other Federal contract with the same prime contractor, or any other federally-assisted contract subject to the Contract Work Hours and Safety Standards Act, which is held by the same prime contractor, such sums as may be determined to be necessary to satisfy any liabilities of such contractor or subcontractor for unpaid wages and liquidated damages as provided in the clause set forth in paragraph (b)(2) of this section.

(4) Subcontracts. The contractor or subcontractor shall insert in any subcontracts the clauses set forth in paragraph (a)(1) through (4) of this section and also a clause requiring the subcontractors to include these

clauses in any lower tier subcontracts. The prime contractor shall be responsible for compliance by any subcontractor or lower tier subcontractor with the clauses set forth in paragraphs (a)(1) through (4) of this section.

(b) In addition to the clauses contained in Item 3, above, in any contract subject only to the Contract Work Hours and Safety Standards Act and not to any of the other statutes cited in 29 CFR 5.1, the Sub recipient shall insert a clause requiring that the contractor or subcontractor shall maintain payrolls and basic payroll records during the course of the work and shall preserve them for a period of three years from the completion of the contract for all laborers and mechanics, including guards and watchmen, working on the contract. Such records shall contain the name and address of each such employee, social security number, correct classifications, hourly rates of wages paid, daily and weekly number of hours worked, deductions made, and actual wages paid. Further, the Sub recipient shall insert in any such contract a clause providing that the records to be maintained under this paragraph shall be made available by the contractor or subcontractor for inspection, copying, or transcription by authorized representatives of the (write the name of agency) and the Department of Labor, and the contractor or subcontractor will permit such representatives to interview employees during working hours on the job.

5. Compliance Verification

(a) The sub recipient shall periodically interview a sufficient number of employees entitled to DB prevailing wages (covered employees) to verify that contractors or subcontractors are paying the appropriate wage rates. As provided in 29 CFR 5.6(a)(6), all interviews must be conducted in confidence. The sub recipient must use Standard Form 1445 (SF 1445) or equivalent documentation to memorialize the interviews. Copies of the SF 1445 are available from EPA on request.

(b) The sub recipient shall establish and follow an interview schedule based on its assessment of the risks of noncompliance with DB posed by contractors or subcontractors and the duration of the contract or subcontract. Sub recipients must conduct more frequent interviews if the initial interviews or other information indicated that there is a risk that the contractor or subcontractor is not complying with DB. Sub recipients shall immediately conduct interviews in response to an alleged violation of the prevailing wage requirements. All interviews shall be conducted in confidence."

(c) The sub recipient shall periodically conduct spot checks of a representative sample of weekly payroll data to verify that contractors or subcontractors are paying the appropriate wage rates. The sub recipient shall establish and follow a spot check schedule based on its assessment of the risks of noncompliance with DB posed by contractors or subcontractors and the duration of the contract or subcontract. At a minimum, if practicable, the sub recipient should spot check payroll data within two weeks of each contractor or subcontractor's submission of its initial payroll data and two weeks prior to the completion date the contract or subcontract. Sub recipients must conduct more frequent spot checks if the initial spot check or other information indicates that there is a risk that the contractor or subcontractor is not complying with DB. In addition, during the examinations the sub recipient shall verify evidence of fringe benefit plans and payments there under by contractors and subcontractors who claim credit for fringe benefit contributions.

(d) The sub recipient shall periodically review contractors and subcontractor's use of apprentices and trainees to verify registration and certification with respect to apprenticeship and training programs approved by either the U.S Department of Labor or a state, as appropriate, and that contractors and subcontractors are not using disproportionate numbers of, laborers, trainees and apprentices. These reviews shall be conducted in accordance with the schedules for spot checks and interviews described in Item 5(b) and (c) above.

(e) Sub recipients must immediately report potential violations of the DB prevailing wage requirements to the EPA DB contact listed above and to the appropriate DOL Wage and Hour District Office listed at <http://www.dol.gov/whd/america2.htm>.

"General Decision Number: SC20210047 01/01/2021

Superseded General Decision Number: SC20200047

State: South Carolina

Construction Type: Heavy

Counties: Aiken, Florence and Sumter Counties in South Carolina.

Aiken County (Excludes Savannah River Site)

HEAVY CONSTRUCTION PROJECTS

Note: Under Executive Order (EO) 13658, an hourly minimum wage of \$10.95 for calendar year 2021 applies to all contracts subject to the Davis-Bacon Act for which the contract is awarded (and any solicitation was issued) on or after January 1, 2015. If this contract is covered by the EO, the contractor must pay all workers in any classification listed on this wage determination at least \$10.95 per hour (or the applicable wage rate listed on this wage determination, if it is higher) for all hours spent performing on the contract in calendar year 2021. If this contract is covered by the EO and a classification considered necessary for performance of work on the contract does not appear on this wage determination, the contractor must pay workers in that classification at least the wage rate determined through the conformance process set forth in 29 CFR 5.5(a)(1)(ii) (or the EO minimum wage rate, if it is higher than the conformed wage rate). The EO minimum wage rate will be adjusted annually. Please note that this EO applies to the above-mentioned types of contracts entered into by the federal government that are subject to the Davis-Bacon Act itself, but it does not apply to contracts subject only to the Davis-Bacon Related Acts, including those set forth at 29 CFR 5.1(a)(2)-(60). Additional information on contractor requirements and worker protections under the EO is available at www.dol.gov/whd/govcontracts.

Modification Number	Publication Date
0	01/01/2021

* IRON0848-001 07/01/2020

	Rates	Fringes
IRONWORKER, STRUCTURAL.....	\$ 26.00	15.80

SUSC2011-045 11/02/2011

	Rates	Fringes
CARPENTER, Includes Form Work....	\$ 14.85	0.00
LABORER: Common or General.....	\$ 10.69	0.00
LABORER: Pipelayer.....	\$ 12.84	0.00
OPERATOR: Backhoe/Excavator/Trackhoe.....	\$ 12.50	0.00

OPERATOR: Grader/Blade.....	\$ 20.11	1.39
OPERATOR: Loader.....	\$ 10.50	1.98
TRUCK DRIVER.....	\$ 14.15	2.32

WELDERS - Receive rate prescribed for craft performing operation to which welding is incidental.

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Note: Executive Order (EO) 13706, Establishing Paid Sick Leave for Federal Contractors applies to all contracts subject to the Davis-Bacon Act for which the contract is awarded (and any solicitation was issued) on or after January 1, 2017. If this contract is covered by the EO, the contractor must provide employees with 1 hour of paid sick leave for every 30 hours they work, up to 56 hours of paid sick leave each year. Employees must be permitted to use paid sick leave for their own illness, injury or other health-related needs, including preventive care; to assist a family member (or person who is like family to the employee) who is ill, injured, or has other health-related needs, including preventive care; or for reasons resulting from, or to assist a family member (or person who is like family to the employee) who is a victim of, domestic violence, sexual assault, or stalking. Additional information on contractor requirements and worker protections under the EO is available at www.dol.gov/whd/govcontracts.

Unlisted classifications needed for work not included within the scope of the classifications listed may be added after award only as provided in the labor standards contract clauses (29CFR 5.5 (a) (1) (ii)).

The body of each wage determination lists the classification and wage rates that have been found to be prevailing for the cited type(s) of construction in the area covered by the wage determination. The classifications are listed in alphabetical order of "identifiers" that indicate whether the particular rate is a union rate (current union negotiated rate for local), a survey rate (weighted average rate) or a union average rate (weighted union average rate).

Union Rate Identifiers

A four letter classification abbreviation identifier enclosed in dotted lines beginning with characters other than "SU" or "UAVG" denotes that the union classification and rate were prevailing for that classification in the survey. Example: PLUM0198-005 07/01/2014. PLUM is an abbreviation identifier of the union which prevailed in the survey for this classification, which in this example would be Plumbers. 0198 indicates the local union number or district council number where applicable, i.e., Plumbers Local 0198. The next number, 005 in the example, is an internal number used in processing the wage determination. 07/01/2014 is the effective date of the most current negotiated rate, which in this example is July 1, 2014.

Union prevailing wage rates are updated to reflect all rate changes in the collective bargaining agreement (CBA) governing this classification and rate.

Survey Rate Identifiers

Classifications listed under the ""SU"" identifier indicate that no one rate prevailed for this classification in the survey and the published rate is derived by computing a weighted average rate based on all the rates reported in the survey for that classification. As this weighted average rate includes all rates reported in the survey, it may include both union and non-union rates. Example: SULA2012-007 5/13/2014. SU indicates the rates are survey rates based on a weighted average calculation of rates and are not majority rates. LA indicates the State of Louisiana. 2012 is the year of survey on which these classifications and rates are based. The next number, 007 in the example, is an internal number used in producing the wage determination. 5/13/2014 indicates the survey completion date for the classifications and rates under that identifier.

Survey wage rates are not updated and remain in effect until a new survey is conducted.

Union Average Rate Identifiers

Classification(s) listed under the UAVG identifier indicate that no single majority rate prevailed for those classifications; however, 100% of the data reported for the classifications was union data. EXAMPLE: UAVG-OH-0010 08/29/2014. UAVG indicates that the rate is a weighted union average rate. OH indicates the state. The next number, 0010 in the example, is an internal number used in producing the wage determination. 08/29/2014 indicates the survey completion date for the classifications and rates under that identifier.

A UAVG rate will be updated once a year, usually in January of each year, to reflect a weighted average of the current negotiated/CBA rate of the union locals from which the rate is based.

WAGE DETERMINATION APPEALS PROCESS

1.) Has there been an initial decision in the matter? This can be:

- * an existing published wage determination
- * a survey underlying a wage determination
- * a Wage and Hour Division letter setting forth a position on a wage determination matter
- * a conformance (additional classification and rate) ruling

On survey related matters, initial contact, including requests for summaries of surveys, should be with the Wage and Hour Regional Office for the area in which the survey was conducted because those Regional Offices have responsibility for the Davis-Bacon survey program. If the response from this initial contact is not satisfactory, then the process described in 2.) and 3.) should be followed.

With regard to any other matter not yet ripe for the formal

process described here, initial contact should be with the Branch of Construction Wage Determinations. Write to:

Branch of Construction Wage Determinations
Wage and Hour Division
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

2.) If the answer to the question in 1.) is yes, then an interested party (those affected by the action) can request review and reconsideration from the Wage and Hour Administrator (See 29 CFR Part 1.8 and 29 CFR Part 7). Write to:

Wage and Hour Administrator
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

The request should be accompanied by a full statement of the interested party's position and by any information (wage payment data, project description, area practice material, etc.) that the requestor considers relevant to the issue.

3.) If the decision of the Administrator is not favorable, an interested party may appeal directly to the Administrative Review Board (formerly the Wage Appeals Board). Write to:

Administrative Review Board
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

4.) All decisions by the Administrative Review Board are final.

=====

END OF GENERAL DECISION

"

**NOTICE OF REQUIREMENT FOR AFFIRMATIVE ACTION TO
ENSURE EQUAL EMPLOYMENT OPPORTUNITY
(EXECUTIVE ORDER 11246)**

EEO Notice

Following is the standard language which must be incorporated into all solicitations for offers and bids on all Federal and Federally-assisted construction contracts or subcontracts in excess of \$10,000 to be performed in designated geographical areas:

NOTICE OF REQUIREMENT FOR AFFIRMATIVE ACTION TO ENSURE EQUAL EMPLOYMENT OPPORTUNITY (EXECUTIVE ORDER 11246)

1. The Offerer's or Bidder's attention is called to the "Equal Opportunity Clause" which is included in the Nondiscrimination Provision and Labor Standards, and the "Standard Federal Equal Employment Opportunity Construction Contract Specifications" set forth herein.
2. The goals and timetables for minority and female participation, expressed in percentage terms for the Contractor's aggregate workforce in each trade on all construction work in the covered area, are as follows:

Timetables	Goals for minority participation for each trade	Goals for female participation in each trade
	See below for county list	6.9%

These goals are applicable to all the Contractor's construction work (whether or not it is Federal or Federally assisted) performed in the covered area.

The Contractor's compliance with the Executive Order and the regulations in 41 CFR Part 60-4 shall be based on its implementation of the Equal Opportunity Clause, specific affirmative action obligations required by the specifications set forth in 41 CFR 60-4.3(a), and its efforts to meet the goals established for the geographical area where the contract resulting from this solicitation is to be performed. The hours of minority and female employment and training must be substantially uniform throughout the length of the contract, and in each trade, and the contractor shall make a good faith effort to employ minority and women evenly on each of its projects. The transfer of minority or female employees or trainees from Contractor to Contractor or from project to project for the sole purpose of meeting the Contractor's goals shall be a violation of the contract, the Executive Order and the regulations in 41 CFR Part 60-4. Compliance with the goals will be measured against the total work hours performed.

3. The Contractor shall provide written notification to the Director of the Office of Federal Contract Compliance Programs within 10 working days of award of any construction subcontract in excess of \$10,000 at any tier for construction work under the contract resulting from this solicitation. The notification shall list the name, address and telephone number of the subcontractor; employer identification number; estimated dollar amount of the subcontract; estimated starting and completion dates of the subcontract; and the geographical area in which the contract is to be performed.

Minority Goals by Economic Areas for Standard Metropolitan Statistical Area (SMSA) or Non-SMSA

029 Charlotte, NC:

SMSA Counties:

1520 Charlotte – Gastonia, NC _____ 18.5%
 NC Gaston; NC Mecklenburg; NC Union.

Non-SMSA Counties _____ 15.7%

NC Alexander; NC Anson; NC Burke; NC Cabarrus; NC Caldwell; NC Catawba; NC Cleveland; NC Iredell; NC Lincoln; NC Rowan; NC Rutherford; NC Stanley; SC Chester; SC Lancaster SC York.

031 Greenville – Spartanburg, SC:

SMSA Counties:

3160 Greenville –Spartanburg, SC _____ 16.0%
 SC Greenville; SC Pickens; SC Spartanburg.

Non-SMSA Counties _____ 17.8%

NC Polk; SC Abbeville; SC Anderson; SC Cherokee; SC Greenwood; SC Laurens; SC Oconee; SC Union.

032 Columbia, SC

SMSA Counties:

1760 Columbia, SC _____ 23.4%
 SC Lexington; SC Richland.

Non-SMSA Counties _____ 32.0%

SC Calhoun SC Clarendon; SC Fairfield; SC Kershaw; SC Lee; SC Newberry; SC Orangeburg; SC Saluda; SC Sumter

033 Florence, SC

Non-SMSA Counties _____ 33.0%

SC Chesterfield; SC Darlington; SC Dillon; SC Florence; SC Georgetown; SC Horry; SC Marion; SC Marlboro; SC Williamsburg.

034 Charleston - North Charleston, SC

SMSA Counties

1440 Charleston - North Charleston, SC _____ 30.0%
 SC Berkeley; SC Charleston; SC Dorchester.

Non-SMSA Counties _____ 30.7%

SC Colleton

035 Augusta, GA:

SMSA Counties:

0600 Augusta, GA – SC _____ 27.2%
 GA Columbia; GA Richmond; SC Aiken

Non-SMSA Counties _____ 32.8%

GA Burke; GA Emanuel; GA Glascock; GA Jefferson; GA Jenkins; GA Lincoln; GA McDuffie; GA Taliaferro; GA Warren; GA Wilkes; SC Allendale, SC Bamberg; SC Barnwell; SC Edgefield; SC McCormick

039 Savannah, GA:

SMSA Counties:

7520 Savannah, GA _____ 30.6%
 GA Bryan; GA Chatham; GA Effingham

Non-SMSA Counties _____ 29.8%

GA Appling; GA Atkinson; GA Bacon; GA Bullock; GA Candler; GA Coffee; GA Evans; GA Jeff Davis; GA Liberty; GA Long; GA McIntosh; GA Montgomery; GA Screven; GA Tattinall; GA Toombs; GA Wayne; SC Beaufort; SC Hampton; SC Jasper.

**STANDARD FEDERAL EQUAL EMPLOYMENT OPPORTUNITY
CONSTRUCTION CONTRACT SPECIFICATIONS
(EXECUTIVE ORDER 11246)**

EEO Specifications

Following is the standard language which must be incorporated into all solicitations for offers and bids on all Federal and Federally-assisted construction contracts or subcontracts in excess of \$10,000 to be performed in designated geographical areas:

STANDARD FEDERAL EQUAL EMPLOYMENT OPPORTUNITY CONSTRUCTION
CONTRACT SPECIFICATIONS (EXECUTIVE ORDER 11246)

1. As used in these specifications:
 - a. "Covered area" means the geographical area described in the solicitation from which this contract resulted;
 - b. "Director" means Director, Office of Federal Contract Compliance Programs, United States Department of Labor, or any person to whom the Director delegates authority;
 - c. "Employer identification number" means the Federal Social Security number used on the Employer's Quarterly Federal Tax Return, U.S. Treasury Department Form 941.
 - d. "Minority" includes:
 1. Black (all persons having origins in any of the Black African racial groups not of Hispanic origin);
 2. Hispanic (all persons of Mexican, Puerto Rican, Cuban, Central or South American or other Spanish Culture or origin, regardless of race);
 3. Asian and Pacific Islander (all persons having origins in any of the original peoples of the Far East, Southeast Asia, the Indian Subcontinent, or the Pacific Islands); and
 4. American Indian or Alaskan Native (all persons having origins in any of the original peoples of North America and maintaining identifiable tribal affiliations through membership and participation or community identification).
2. Whenever the Contractor, or any Subcontractor at any tier, subcontracts a portion of the work involving any construction trade, it shall physically include in each subcontract in excess of \$10,000 the provisions of these specifications and the Notice which contains the applicable goals for minority and female participation and which is set forth in the solicitations from which this contract resulted.

3. If the Contractor is participating (pursuant to 41 CFR 60-4.5) in a Hometown Plan approved by the U.S. Department of Labor in the covered area either individually or through an association, its affirmative action obligations on all work in the Plan area (including goals and timetables) shall be in accordance with that Plan for those trades which have unions participating in the Plan. Contractors must be able to demonstrate their participation in and compliance with the provisions of any such Hometown Plan. Each Contractor or Subcontractor participating in an approved Plan is individually required to comply with its obligations under the EEO clause, and to make a good faith effort to achieve each goal under the Plan in each trade in which it has employees. The overall good faith performance by other Contractors or Subcontractors toward a goal in an approved Plan does not excuse any covered Contractor's or Subcontractor's failure to take good faith efforts to achieve the Plan goals and timetables.
4. The Contractor shall implement the specific affirmative action standards provided in paragraphs 7a through p of these specifications. The goals set forth in the solicitation from which this contract resulted are expressed as percentages of the total hours of employment and training of minority and female utilization the Contractor should reasonably be able to achieve in each construction trade in which it has employees in the covered area. The Contractor is expected to make substantially uniform progress toward its goals in each craft during the period specified.
5. Neither the provisions of any collective bargaining agreement, nor the failure by a union with whom the Contractor has a collective bargaining agreement, to refer either minorities or women shall excuse the Contractor's obligations under these specifications and Executive Order 11246, or the regulations promulgated pursuant thereto.
6. In order for the non-working training hours of apprentices and trainees to be counted in meeting the goals, such apprentices and trainees must be employed by the Contractor during the training period, and the Contractor must have made a commitment to employ the apprentices and trainees at the completion of their training, subject to the availability of employment opportunities. Trainees must be trained pursuant to training programs approved by the U.S. Department of Labor.
7. The Contractor shall take specific affirmative actions to ensure equal employment opportunity. The evaluation of the Contractor's compliance with these specifications shall be based upon its effort to achieve maximum results from its actions. The Contractor shall document these efforts fully and shall implement affirmative action steps at least as extensive as the following:
 - a. Ensure and maintain a working environment free of harassment, intimidation, and coercion at all sites, and in all facilities at which the Contractor's employees are assigned to work. The Contractor, where possible, will assign two or more women to each construction project. The Contractor shall specifically ensure that all foremen, superintendents, and other on-site supervisory personnel are aware of and carry out the Contractor's obligation to maintain such a working environment, with specific attention to minority or female individuals working at such sites or in such facilities.
 - b. Establish and maintain a current list of minority and female recruitment sources, provide written notification to minority and female recruitment sources and to

community organizations when the Contractor or its unions have employment opportunities available and maintain a record of the organizations' responses.

- c. Maintain a current file of the names, addresses and telephone numbers of each minority and female off-the-street applicant and minority or female referral from a union, a recruitment source or community organization and of what action was taken with respect to each such individual. If such individual was sent to the union hiring hall for referral and was not referred back to the Contractor by the union, or if referred, not employed by the Contractor, this shall be documented in the file with the reason therefore, along with whatever additional actions the Contractor may have taken.
- d. Provide immediate written notification to the Director when the union or unions with which the Contractor has a collective bargaining agreement has not referred to the Contractor a minority person or woman sent by the Contractor, or when the Contractor has other information that the union referral process has impeded the Contractor's efforts to meet its obligations.
- e. Develop on-the-job training opportunities and/or participate in training programs for the area which expressly include minorities and women, including upgrading programs and apprenticeship and training programs relevant to the Contractor's employment needs, especially those programs funded or approved by the Department of Labor. The Contractor shall provide notice of these programs to the sources compiled under 7b above.
- f. Disseminate the Contractor's EEO policy by providing notice of the policy to unions and training programs and requesting their cooperation in assisting the Contractor in meeting its EEO obligations; by including it in any policy manual and collective bargaining agreement; by publicizing it in the company newspaper, annual report, etc.; by specific review of the policy with all management personnel and with all minority and female employees at least once a year; and by posting the company EEO policy on bulletin boards accessible to all employees at each location where construction work is performed.
- g. Review, at least annually, the company's EEO policy and affirmative action obligations under these specifications with all employees having any responsibility for hiring, assignment, lay-off, termination or other employment decisions including specific review of these items with on-site supervisory personnel such as Superintendents, General Foreman, etc., prior to the initiation of construction work on any job site. A written record shall be made and maintained identifying the time and place of these meetings, persons attending, subject matter discussed, and disposition of the subject matter.
- h. Disseminate the Contractor's EEO policy externally by including it in any advertising in the news media, specifically including minority and female news media, and providing written notification to and discussing the Contractor's EEO policy with other Contractors and Subcontractors with whom the Contractor does or anticipates doing business.

- i. Direct its recruitment efforts, both oral and written, to minority, female and community organizations, to schools with minority and female students and to minority and female recruitment and training organizations serving the Contractor's recruitment area and employment needs. Not later than one month prior to the date for the acceptance of applications for apprenticeship or other training by any recruitment source, the Contractor shall send written notification to organizations such as the above, describing the openings, screening procedures, and tests to be used in the selection process.
 - j. Encourage present minority and female employees to recruit other minority persons and women and, where reasonable, provide after school, summer and vacation employment to minority and female youth both on the site and in other areas of a Contractor's workforce.
 - k. Validate all tests and other selection requirements where there is an obligation to do so under 41 CFR Part 60-3.
 - l. Conduct, at least annually, an inventory and evaluation at least of all minority and female personnel for promotional opportunities and encourage these employees to seek or to prepare for, through appropriate training, etc., such opportunities.
 - m. Ensure that seniority practices, job classifications, work assignments and other personnel practices, do not have a discriminatory effect by continually monitoring all personnel and employment related activities to ensure that the EEO policy and the Contractor's obligations under these specifications are being carried out.
 - n. Ensure that all facilities and company activities are non-segregated except that separate or single-user toilet and necessary changing facilities shall be provided to assure privacy between the sexes.
 - o. Document and maintain a record of all solicitations of offers for subcontracts from minority and female construction contractors and suppliers, including circulation of solicitations to minority and female contractor associations and other business associations.
 - p. Conduct a review, at least annually, of all supervisors' adherence to and performance under the Contractor's EEO policies and affirmative action obligations.
8. Contractors are encouraged to participate in voluntary associations which assist in fulfilling one or more of their affirmative action obligations (7a through p). The efforts of a contractor association, joint contractor-union, contractor-community, or other similar group of which the contractor is a member and participant may be asserted as fulfilling any one or more of its obligations under 7a through p of these specifications provided that the contractor actively participates in the group, makes every effort to assure that the group has a positive impact on the employment of minorities and women in the industry, ensures that the concrete benefits of the program are reflected in the Contractor's minority and female workforce participation, makes a good faith effort to meet its individual goals and timetables, and can provide access to documentation which demonstrates the effectiveness of actions taken on behalf of the

Contractor. The obligation to comply; however, is the Contractor's and failure of such a group to fulfill an obligation shall not be a defense for the Contractor's noncompliance.

9. A single goal for minorities and a separate single goal for women have been established. The Contractor, however, is required to provide equal employment opportunity and to take affirmative action for all minority groups, both male and female, and all women, both minority and non-minority. Consequently, the Contractor may be in violation of the Executive Order if a particular group is employed in a substantially disparate manner (for example, even though the Contractor has achieved its goals for women generally, the Contractor may be in violation of the Executive Order if a specific minority group of women is underutilized).
10. The Contractor shall not use the goals and timetables or affirmative action standards to discriminate against any person because of race, color, religion, sex, or national origin.
11. The Contractor shall not enter into any Subcontract with any person or firm debarred from Government contracts pursuant to Executive Order 11246.
12. The Contractor shall carry out such sanctions and penalties for violation of these specifications and of the "Equal Opportunity Clause", including suspension, termination and cancellation of existing subcontracts as may be imposed or ordered pursuant to Executive Order 11246, as amended, and its implementing regulations, by the Office of Federal Contract Compliance Programs. Any Contractor who fails to carry out such sanctions and penalties shall be in violation of these specifications and Executive Order 11246, as amended.
13. The Contractor, in fulfilling its obligations under these specifications, shall implement specific affirmative action steps, at least as extensive as those standards prescribed in paragraph 7 of these specifications, so as to achieve maximum results from its efforts to ensure equal employment opportunity. If the Contractor fails to comply with the requirements of the Executive Order, the implementing regulations, or these specifications, the Director shall proceed in accordance with 41 CFR 60-4.8.
14. The Contractor shall designate a responsible official to monitor all employment related activity to ensure that the company EEO policy is being carried out, to submit reports relating to the provisions hereof, as may be required by the Government and to keep records. Records shall at least include for each employee the name, address, telephone numbers, construction trade, union affiliation if any, employee identification number when assigned, Social Security Number, race, sex, status (e.g. mechanic, apprentice, trainee, helper, or laborer), dates of changes in status, hours worked per week in the indicated trade, rate of pay, and locations at which the work was performed. Records shall be maintained in an easily understandable and retrievable form; however, to the degree that existing records satisfy this requirement, contractors shall not be required to maintain separate records.
15. Nothing herein provided shall be constructed as a limitation upon the application of other laws which establish different standards of compliance or upon the application of requirements for the hiring of local or other area residents (e.g., those under the Public Works Employment Act of 1977 and the Community Development Block Grant Program).

ATTACHMENT A

Contacts for Procurement of DBEs

Minority Business Development Agency
(MBDA) Business Center – Columbia SC
1515 Richland Street
Columbia, SC 29201
Office: (803) 743-1154
Fax: (803) 743-1162
Email: busdev@columbiambdacenter.com
Website: <http://columbiambdacenter.com/>

Office of Small & Minority Business Assistance
South Carolina Office of the Governor
1205 Pendleton Street, Suite 474
Columbia, SC 29201
Telephone: (803) 734-5010
Website: www.govoepp.state.sc.us/osmba

South Carolina Chamber of Commerce
1201 Main Street, Suite 1700
Columbia, SC 29201
Telephone: (803) 799-4601
Website: www.scmminoritybusiness.net

South Carolina Department of Transportation
Office of Business Development & Special Programs
Post Office Box 191
Columbia, SC 29202
Telephone: (803) 737-1372
Website: <http://www.scdot.org/doing/businessDevelop.aspx>

ATTACHMENT B

FORMS

Instructions:

A. General Instructions:

MBE/WBE utilization is based on 40 CFR Part 33. The reporting requirement reflects the class deviation issued on November 8, 2013, clarified on January 9, 2014 and modified on December 2, 2014. EPA Form 5700-52A must be completed annually by recipients of financial assistance agreements where the combined total of funds budgeted for procuring supplies, equipment, construction or services exceeds \$150,000. This reporting requirement applies to all new and existing awards and voids all previous reporting requirements.

In determining whether the \$150,000 threshold is exceeded for a particular assistance agreement, the analysis must focus on funds budgeted for procurement under the supplies, equipment, construction, services or "other" categories, and include funds budgeted for procurement under sub-awards or loans

Reporting will also be required in cases where the details of the budgets of sub-awards/loans are not clear at the time of the grant awards and the combined total of the procurement and sub-awards and/or loans exceeds the \$150,000 threshold.

When reporting is required, all procurement actions are reportable, not just the portion which exceeds \$150,000.

If at the time of award the budgeted funds exceed \$150,000 but actual expenditures fall below, a report is still required.

If at the time of award, the combined total of funds budgeted for procurements in any category is less than or equal to \$150,000 and is maintained below the threshold, no DBE report is required to be submitted.

Recipients are required to report 30 days after the end of each federal year, per the terms and conditions of the financial assistance agreement.

Last reports are due October 30th or 90 days after the end of the project period, whichever comes first.

MBE/WBE program requirements, including reporting, are material terms and conditions of the financial assistance agreement.

B. Definitions:

Procurement is the acquisition through contract, order, purchase, lease or barter of supplies, equipment, construction or services needed to accomplish Federal assistance programs.

A **contract** is a written agreement between an EPA recipient and another party (also considered "prime contracts") and any lower tier agreement (also considered "subcontracts") for equipment, services, supplies, or construction necessary to complete the project. This definition excludes written agreements with another public agency. This definition includes personal and professional services, agreements with consultants, and purchase orders.

A **minority business enterprise (MBE)** is a business concern that is (1) at least 51 percent owned by one or more minority individuals, or, in the case of a publicly owned business, at least 51 percent of the stock is owned by one or more minority

individuals; and (2) whose daily business operations are managed and directed by one or more of the minority owners. In order to qualify and participate as an MBE prime or subcontractor for EPA recipients under EPA's DBE Program, an entity must be properly certified as required by 40 CFR Part 33, Subpart B.

U.S. citizenship is required. Recipients shall presume that minority individuals include Black Americans, Hispanic Americans, Native Americans, Asian Pacific Americans, or other groups whose members are found to be disadvantaged by the Small Business Act or by the Secretary of Commerce under section 5 of Executive order 11625. The reporting contact at EPA can provide additional information.

A **woman business enterprise (WBE)** is a business concern that is, (1) at least 51 percent owned by one or more women, or, in the case of a publicly owned business, at least 51 percent of the stock is owned by one or more women and (2) whose daily business operations are managed and directed by one or more of the women owners. In order to qualify and participate as a WBE prime or subcontractor for EPA recipients under EPA's DBE Program, an entity must be properly certified as required by 40 CFR Part 33, Subpart B.

Business firms which are 51 percent owned by minorities or women, but are in fact not managed and operated by minorities or females do not qualify for meeting MBE/WBE procurement goals. U.S. Citizenship is required.

Good Faith Efforts

A recipient is required to make the following good faith efforts whenever procuring construction, equipment, services, and supplies under an EPA financial assistance agreement. These good faith

efforts for utilizing MBEs and WBEs must be documented. Such documentation is subject to EPA review upon request:

1. Ensure DBEs are made aware of contracting opportunities to the fullest extent practicable through outreach and recruitment activities. For Indian Tribal, State and Local and Government recipients, this will include placing DBEs on solicitation lists and soliciting them whenever they are potential sources.
2. Make information on forthcoming opportunities available to DBEs and arrange time frames for contracts and establish delivery schedules, where the requirements permit, in a way that encourages and facilitates participation by DBEs in the competitive process. This includes, whenever possible, posting solicitations for bids or proposals for a minimum of 30 calendar days before the bid or proposal closing date.
3. Consider in the contracting process whether firms competing for large contracts could subcontract with DBEs. For Indian Tribal, State and local Government recipients, this will include dividing total requirements when economically feasible into smaller tasks or quantities to permit maximum participation by DBEs in the competitive process.
4. Encourage contracting with a consortium of DBEs when a contract is too large for one of these firms to handle individually.
5. Use the services and assistance of the SBA and the Minority Business Development Agency of the Department of Commerce.
6. If the prime contractor awards subcontracts, require the prime contractor to take the steps in paragraphs (a) through (e) of this section.

C. Instructions for Part I:

1A. Specify Federal fiscal year this report covers. The Federal fiscal year runs from October 1st through September 30th (**e.g. November 29, 2014 falls within Federal fiscal year 2015**)

1B. Specify report type. Check the annual reporting box. Also indicate if the project is completed.

1C. Indicate if this is a revision to a previous year and provide a brief description of the revision you are making.

2A-B. Please refer to your financial assistance agreement for the mailing address of the EPA financial assistance office for your agreement.

The "EPA DBE Reporting Contact" is the DBE Coordinator for the EPA Region from which your financial assistance agreement was originated. For a list of DBE Coordinators please refer to the EPA OSBP website at http://epa.gov/osbp/dbe_cord.

3A-B. Identify the agency, state authority, university or other organization which is the recipient of the Federal financial assistance and the person to contact concerning this report.

4A. Provide the Assistance Agreement number assigned by EPA. A separate report must be submitted for each Assistance Agreement.

***For SRF recipients:** In box 4a list numbers for ALL OPEN Assistance Agreements being reported on this form.

4B. Refer back to Assistance Agreement document for this information.

5A. Provide the total amount of the Assistance Agreement which includes Federal funds plus recipient matching funds and funds from other sources.

***For SRF recipients only:** SRF recipients will not enter an amount in 5a. SRF recipients should check the "N/A" box.

5B. Self-explanatory.

5C. Provide the total dollar amount of **ALL** procurements awarded this reporting period by the recipient, sub-recipients, and SRF loan recipients, **including** MBE/WBE expenditures, not just the portion which exceeds \$150,000. For example: Actual dollars for procurement from the procuring office; actual contracts let from the contracts office; actual goods, services, supplies, etc., from other sources including the central purchasing/ procurement centers).

***NOTE:** To prevent double counting on line 5C, if any amount on 5E is for a subcontract and the prime contract has already been included on Line 5C in a prior reporting period, then report the amount going to MBE or WBE subcontractor on line 5E, but exclude the amount from Line 5C. To include the amount on 5C again would result in double counting because the prime contract, which includes the subcontract, would have already been reported.

***For SRF recipients only:** In 5c please enter the total annual procurement amount under all of your SRF Assistance Agreements. The figure reported in this section is **not** directly tied to an individual Assistance Agreement identification number. (**SRF state recipients report state procurements in this section**)

5D. State whether or not sub-awards and/or subcontracts have been issued under the financial assistance agreements by indicating “yes” or “no”.

5E. Where requested, also provide the total dollar amount of all MBE/WBE procurement awarded during this reporting period by the recipient, sub-recipients, SRF loan recipients, and prime contractors in the categories of construction, equipment, services and supplies. These amounts include Federal funds plus recipient matching funds and funds from other sources.

6. If there were no MBE/WBE accomplishments this reporting period, please briefly how certified MBEs/WBEs were notified of the opportunities to compete for the procurement dollars entered in Block 5C and why certified MBEs /WBEs were not awarded any procurements during this reporting period.

7. Name and title of official administrator or designated reporting official.

8. Signature, month, day, and year report submitted.

D. Instructions for Part II:

For each MBE/WBE procurement made under this financial assistance agreements during the reporting period, provide the following information:

1. Check whether this procurement was made by the recipient, sub-recipient/SRF loan recipient, or the prime contractor.

2. Check either the MBE or WBE column. If a firm is both an MBE and WBE, the recipient may choose to count the entire procurement towards EITHER its MBE or WBE accomplishments. The recipient may also divide the total amount of the procurement (using any ratio it so chooses) and count those divided amounts toward its MBE and WBE accomplishments. If the recipient chooses to divide the procurement amount and count portions toward its MBE and WBE accomplishments, please state the appropriate amounts under the MBE and WBE columns on the form. **The combined MBE and WBE amounts for that MBE/WBE contractor must not exceed the “Value of the Procurement” reported in column #3**

3. Dollar value of procurement.

4. Date of procurement, shown as month, day, year. Date of procurement is defined as the date the contract or procurement was awarded, **not** the date the contractor received payment under the awarded contract or procurement, unless payment occurred on the date of award. **(Where direct purchasing is the procurement method, the date of procurement is the date the purchase was made)**

5. Using codes at the bottom of the form, identify type of product or service acquired through this procurement (e.g., enter 1 if construction, 2 if supplies, etc.).

6. Name, address, and telephone number of MBE/WBE firm.

**This data is requested to comply with provisions mandated by: statute or regulations (40 CFR Parts 30, 31, and 33 and/or 2 CFR Parts 200 and 1500); OMB Circulars; or added by EPA to ensure sound and effective assistance management. Accurate, complete data are required to obtain funding, while no pledge of confidentiality is provided.

The public reporting and recording burden for this collection of information is estimated to average 1 hour per response annually. Burden means the total time, effort, or financial resources expended by persons to generate, maintain, retain, or disclosure or provide information to or for a Federal agency. This includes the time needed to review instructions; develop, acquire, install, and utilize technology and systems for the purposes of collecting, validating, and verifying information, processing and maintaining information, and disclosing and providing information; adjust the existing ways to comply with any previously applicable instructions and requirements; train personnel to be able to respond to a collection of information; search data sources; complete and review the collection of information; and transmit or otherwise disclose the information. An agency may not conduct or sponsor, and a person is not required to respond to, a collection of information unless it displays a currently valid OMB control number.

Send comments on the Agency's need for this information, the accuracy of the provided burden estimates, and any suggested methods for minimizing respondent burden, including through the use of automated collection techniques to the Director, OPPE Regulatory Information Division, U.S. Environmental Protection Agency (2136), 1200 Pennsylvania Avenue, NW, Washington, D.C. 20460. Include the OMB Control number in any correspondence. Do not send the completed form to this address.



As of March 7, 2016, the following EPA Forms are suspended:

- EPA Form 6100-2 DBE Subcontractor Participation Form
- EPA Form 6100-3 DBE Subcontractor Performance Form
- EPA Form 6100-4 DBE Program Subcontractor Utilization Form

Upon reinstatement SC SRF Staff will inform SRF loan recipients, consultants and contractors as to the correct use and submittal requirements for these forms.



Equal Employment Opportunity (EEO) Documentation Form



SRF Project Number _____

Project Name _____ Division _____

Project Sponsor _____

This form is required of Prime Contractors and any Subcontractors with subcontracts valued at \$10,000 or greater for SRF equivalency projects only.

1. Proposed Prime Contractor or Subcontractor: _____

Address: _____

Telephone Number: _____

2. Fill out and attach "Certification by Proposed Prime or Subcontractor Regarding Equal Employment Opportunity" (DHEC Form 3592). ____ Attached

3. Attach a copy of the Employer Information Report EEO-1 (also known as Standard Form 100) if the firm meets the criteria outlined on page 3. ____ Attached, **or** ____ N/A (Check N/A if the firm does not meet the EEO-1 Report criteria.)

4.a. Name of company official responsible for EEO: _____

b. Attach a copy of the contractor's Affirmative Action Plan. ____ Plan attached, **or** ____ Letter attached stating subcontractor will be using the prime's Affirmative Action Plan

5.a. List current construction contracts, with dollar amount: (Attach a separate sheet if needed.)

b. List contracting federal agencies, if applicable:

6. Detail the sex and race/ethnic composition of the company's workforce, temporary and permanent, by job category. List statistics by percent or number.

Job Category	Male	Female	African American	Asian	Hispanic	Native American	White

Number of Disabled: _____

7. Check applicable employment sources:

- Newspaper Advertisement
- Job Service
- Walk-In Applications
- Employee Referrals
- Trade Schools
- Trade Associations
- Other: _____

8. List anticipated employment needs for this project, indicating percentage or number of female/minority participation in each trade:

Trade	Female	African American	Asian	Hispanic	Native American

OR

Check here if you plan to only use your existing workforce.

9. **Prime Contractors Only:** Fill out and attach "Prime Contractor's Subagreement Certification" (DHEC Form 3591). Attached

10. Contract Price: \$_____

11. Duration of Contract: _____

12. **All Prime Contractors** and **Subcontractors** when the subcontract equals or exceeds \$25,000: Fill out and attach "Certification Regarding Debarment, Suspension and Other Responsibility Matters" (DHEC Form 3590). Attached, or NA (Subcontract is < \$25,000)

Signature of Authorized Official

Printed Name and Title of Authorized Official

Date

Submit by email to DHEC project manager or by mail to:
SRF Section - Water Facilities Permitting Division, S.C. DHEC, 2600 Bull Street, Columbia, SC 29201

Instructions – DHEC 2323

PURPOSE: The *EEO Documentation Form* is used to document compliance with Equal Employment Opportunity (EEO) requirements, which prohibit discrimination in employment practices on the basis of race, color, religion, national origin, sex, age or handicap. The affirmative action program is designed to enhance hiring, training, and promotion opportunities for minorities and women and is governed by Executive Order 11246. EEO compliance applies to State Revolving Fund (SRF) projects designated as equivalency projects.

INSTRUCTIONS: This form must be completed by each prime contractor and any subcontractor whose contract amount exceeds \$10,000 for SRF equivalency projects only.

Enter the requested project information and answer each question. Submit any requested attachments with this form.

DHEC REVIEW AND FILING: The SRF Section will use this form to document prime contractor and subcontractor compliance with the EEO requirements. The form will be kept in the DBE/EEO file for the named project and will be retained for three years following the final SRF disbursement to the project's Sponsor - per Retention Schedule 15795.

RE: Employer Information - Report EEO-1

Under the direction of the U.S. Equal Employment Opportunity Commission (EEOC), the Joint Reporting Committee (JRC) is responsible for the full-length, multi-phase processing of employment statistics collected on the Employer Information Report EEO-1. This report, also known as Standard Form 100, details the sex and race/ethnic composition of an employer's work force by job category.

The Employer Information EEO-1 survey is conducted *annually* under the authority of Public Law 88-352, Title VII of the Civil Rights Act of 1964, as amended by the Equal Employment Opportunity Act of 1972. All employers with 15 or more employees are covered by Public Law 88-352 and are required to keep employment records as specified by Commission regulations. Based on the number of employees and federal contract activities, certain large employers are required to file an EEO-1 Report on an annual basis.

The EEO-1 Report must be filed by:

- (A) All private employers who are: (1) subject to Title VII of the Civil Rights Act of 1964 (as amended by the Equal Employment Opportunity Act of 1972) with 100 or more employees EXCLUDING State and local governments, primary and secondary school systems, institutions of higher education, Indian tribes and tax-exempt private membership clubs other than labor organizations; OR (2) subject to Title VII who have fewer than 100 employees if the company is owned or affiliated with another company, or there is centralized ownership, control or management (such as central control of personnel policies and labor relations) so that the group legally constitutes a single enterprise and the entire enterprise employs a total of 100 or more employees.
- (B) **All federal contractors (private employers)** who: (1) are not exempt as provided for by 41 CFR 60-1.5; (2) have 50 or more employees, **and** (a) are prime contractors or first-tier subcontractors, and have a contract, subcontract, or purchase order amounting to \$50,000 or more; or (b) serve as depository of Government funds in any amount; or (c) is a financial institution which is an issuing and paying agent for U.S. Savings Bonds and Notes.

When filing the EEO-1 Report for the first time, go to the EEOC website at: <https://www.eeoc.gov/employers/eeo-1-survey> and select "First Time Filers". If you have previously registered, you should receive a notification letter by mail prior to the survey opening, and will be informed when and how to file your report.



Bidder's American Iron and Steel Certification



SRF Project Number _____

Project Name _____ Division _____

Project Sponsor _____

Both the Clean Water State Revolving Fund (CWSRF) and the Drinking Water State Revolving Fund (DWSRF) require loan recipients to use iron and steel products that are produced in the United States in a manner that complies with the American Iron and Steel (AIS) requirement for projects that involve the construction, alteration, maintenance, or repair of a public water system or treatment works. For more information about AIS requirements and authorization, visit the U.S. Environmental Protection Agency (EPA)'s website: <http://www.epa.gov/cwsrf/state-revolving-fund-american-iron-and-steel-ais-requirement>.

As a bidder for the project listed above, I certify that I have read, understand, and will comply with the "American Iron and Steel" provisions as required by federal law. Furthermore, I understand that AIS provisions apply to any and all portions of this project, including subcontracted portions and that I certify to the best of my knowledge and belief that I will identify domestic sources of AIS-covered products, provide verification documentation for AIS-compliance, and when needed provide waiver documentation per current EPA guidance.

I understand that a false statement on this certification may be grounds for rejection or termination of any award.

Signature of Bidder Date

Printed Name and Title of Bidder

Name of Bidder's Company

Bidder's Company Address

Bidder's Telephone Number

Instructions – DHEC 2556

PURPOSE: The Bidder's "American Iron and Steel" Certification is used to certify that, as required by federal law, all of the iron and steel products permanently incorporated into a project funded with assistance by the State Revolving Fund are produced in the United States in a manner that complies with the AIS requirement, unless a waiver is granted by the EPA.

GENERAL INFORMATION: American Iron and Steel (AIS) Guidance identifies "iron and steel" products as the following products made primarily of iron or steel: lined or unlined pipes and fittings, manhole covers, *municipal castings, hydrants, tanks, flanges, pipe clamps and restraints, valves, *structural steel, *reinforced concrete, and *construction materials. (*Note that several of these products are actually categories of products.)

Relevant AIS information is posted on the EPA's website, including guidance, examples of AIS-compliant documentation, currently approved national waivers, and information on how to request an individual project waiver: <http://www.epa.gov/cwsrf/state-revolving-fund-american-iron-and-steel-ais-requirement>.

INSTRUCTIONS: The contractor bidding on a project funded in whole or in part by the SRF will enter SRF project number, name, and project sponsor's name (utility, town, etc.).

Certify that the contractor will comply with AIS requirements by signing the form. Include the date, name, and title of the bidder, name of bidder's company, bidder's address, and bidder's telephone number. Please note that AIS covered materials to be supplied by a subcontractor must be AIS compliant as well.

The Project Sponsor must submit this form from the winning bidder (typically as part of the bid package) either by email to the DHEC project manager or by mail to: SRF Section - Water Facilities Permitting Division, S.C. DHEC, 2600 Bull Street, Columbia, SC 29201.

DHEC REVIEW AND FILING: The SRF Section will use this form to document bidder compliance with AIS. The form will be kept in the Bidding file for the named project and will be retained for three years following the final SRF disbursement to the project's Sponsor - per Retention Schedule 15795.



**Certification Regarding
Debarment, Suspension, and
Other Responsibility Matters***



SRF Project Number _____

Project Name _____

Project Sponsor _____

**See Instructions for who must submit this form and where/when it should be submitted.*

The prospective participant certifies to the best of its knowledge and belief that it and its principals:

1. Are not presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from covered transactions by any Federal department or agency;
2. Have not within a three year period preceding this proposal been convicted of or had a civil judgment rendered against them for commission of fraud or a criminal offense in connection with obtaining, attempting to obtain, or performing a public (Federal, State or local) transaction or contract under a public transaction; violation of Federal or State antitrust statutes or commission of embezzlement, theft, forgery, bribery, falsification or destruction of records, making false statements, or receiving stolen property;
3. Are not presently indicted for or otherwise criminally or civilly charged by a government entity (Federal, State or local) with commission of any of the offenses enumerated in paragraph (2) of this certification; and
4. Have not within a three year period preceding this application/proposal had one or more public transactions (Federal, State or local) terminated for cause or default; and
5. Will not contract with an entity that is presently debarred, declared ineligible, or voluntarily excluded from covered transactions by any Federal department or agency.

I understand that a false statement on this certification may be grounds for rejection of this proposal or termination of the award. In addition, under 18 U.S.C. Sec. 1001, a false statement may result in a fine of up to \$10,000 or imprisonment for up to 5 years, or both.

Name of Prospective Participant (Town, Utility, Contractor, Subcontractor)

Printed Name and Title of Authorized Official

Signature of the Authorized Official

Date

___ I am unable to certify the above statements. Attached is my explanation.

Submit by email to DHEC project manager or by mail to:
SRF Section - Water Facilities Permitting Division, S.C. DHEC, 2600 Bull Street, Columbia, SC 29201

INSTRUCTIONS – DHEC 3590

PURPOSE: The *Certification Regarding Debarment, Suspension, and Other Responsibility Matters* form (Debar form) is used to certify that potential participants are not debarred, suspended, or otherwise excluded from or ineligible for participation in Federal assistance programs under Executive Order 12549 “Debarment and Suspension”, as required for State Revolving Fund (SRF) projects designated as equivalency projects.

INSTRUCTIONS:

- This form is to be filled out by prospective participants in the State Revolving Loan fund program, including towns, public utilities, contractors, and subcontractors (when the subcontract is greater than \$25,000).
- Fill in the project sponsor’s name, project name, and SRF project number.
- Fill in the potential participants name and name of authorized official for the participant. Sign and date the form to certify that the potential participant is not debarred, suspended, or otherwise excluded from or ineligible for participation in Federal assistance programs under Executive Order 12549 “Debarment and Suspension,” or, provide an explanation why the potential participant cannot.
- Where/when to submit:
 - A prospective loan recipient (Sponsor) must return the signed certification or explanation with the preliminary engineering report.
 - A prospective prime contractor must submit a signed certification or explanation to the entity awarding the contract (Sponsor) for submittal to the SRF Section. Upon receipt, the Sponsor must visit sam.gov and search to confirm that the contractor is not presently excluded from participation in federally-assisted opportunities.
 - A prospective subcontractor, with a subcontract worth over \$25,000, must submit a signed certification or explanation to the (prospective) prime contractor for the project for submittal to the SRF Section. Upon receipt, the prime contractor must then visit sam.gov and search to confirm that the entity is not presently excluded from participation in federally-assisted opportunities.
 - See also, SRF guidance documents.

DHEC REVIEW AND FILING. The SRF Section will use this form to document compliance with Executive Order 12549. The Sponsor’s Debar form will be kept in the Loan file for the named project, and the prime contractor or subcontractor’s Debar form will be kept in the DBE/EEO or Bidding file for the named project and will be retained for three years following the final SRF disbursement to the project’s Sponsor - per Retention Schedule 15795.



Prime Contractor's Subagreement Certification



SRF Project Number _____

Project Name _____ Division _____

Contractor's Name and Address _____

Contractor's Telephone _____

CERTIFICATION

I, as the authorized representative of the above named contracting firm, certify that we:

- Plan to subcontract a portion of this project and will submit to SCDHEC evidence of the positive steps taken to utilize minority and women's businesses as required by Executive Order 11246 prior to entering into any subagreement. We agree to submit MBE/WBE utilization reports (U.S. EPA Form 5700-52A or equivalent). *(Please fill out page 2 of this form with each tentative subcontractor and/or any uncommitted work.)*
- Do not elect to subcontract any portion of this project. We understand that should we elect, at a later date, to subcontract a portion of this project, we will be required to provide evidence of the positive steps taken to utilize minority and women-owned businesses as required by Executive Order 11246 prior to entering into any subagreement. Failure to do so may result in costs associated with that subagreement declared ineligible for SRF assistance.

Printed Name and Title of Contractor's Representative

Signature of Contractor's Representative

Date

Submit by email to DHEC project manager or by mail to:
SRF Section - Water Facilities Permitting Division, S.C. DHEC, 2600 Bull Street, Columbia, SC 29201

PURPOSE / INSTRUCTIONS / REVIEW & RETENTION:

For SRF equivalency projects, prime contractors certify whether they plan to utilize subcontractors to complete project construction using the Prime Contractor's Subagreement Certification. The prime contractor's representative will enter the requested project information and indicate subcontracting intentions. The representative will sign the certification and fill out page 2 with requested information as needed. A revised DHEC 3591 must be submitted any time the information on page 1 or 2 changes.

The SRF Section will use this form to document the subcontracting intentions of the prime contractor. The form will be kept in the DBE/EEO file for the named project and will be retained for three years following the final SRF disbursement to the project's Sponsor - per Retention Schedule 15795.

List all tentative subcontractors/vendors you plan to use for this project, identify any that are suppliers and indicate whether the subcontractor/vendor is a minority business enterprise (MBE) or a women-owned business enterprise (WBE). If more space is needed, attach additional sheets using the same format.

1. Type of Work _____
Subcontractor's Name and Address _____

Contact Person _____ Telephone Number _____
Subcontract Amount _____ Duration of Subcontract _____
 MBE WBE Supplier

2. Type of Work _____
Subcontractor's Name and Address _____

Contact Person _____ Telephone Number _____
Subcontract Amount _____ Duration of Subcontract _____
 MBE WBE Supplier

3. Type of Work _____
Subcontractor's Name and Address _____

Contact Person _____ Telephone Number _____
Subcontract Amount _____ Duration of Subcontract _____
 MBE WBE Supplier

4. Type of Work _____
Subcontractor's Name and Address _____

Contact Person _____ Telephone Number _____
Subcontract Amount _____ Duration of Subcontract _____
 MBE WBE Supplier

5. Type of Work _____
Subcontractor's Name and Address _____

Contact Person _____ Telephone Number _____
Subcontract Amount _____ Duration of Subcontract _____
 MBE WBE Supplier

List of subcontract work yet to be committed with approximate price and duration of subcontract:

1. _____
2. _____
3. _____
4. _____

Submit by email to DHEC project manager or by mail to:
SRF Section - Water Facilities Permitting Division, S.C. DHEC, 2600 Bull Street, Columbia, SC 29201



**Equal Employment Opportunity
(EEO) Certification by Proposed
Prime Contractor or Subcontractor***



SRF Project Number _____ Project Name _____

Prime Contractor Name _____ Division _____

Subcontractor Name _____

Subcontractor Address _____

PURPOSE / INSTRUCTIONS

This certification is required pursuant to Executive Order 11246, Part II, Section 203 (b), (30 F.R. 12319-25) *for SRF equivalency projects*. Any bidder or prospective contractor, or any of their proposed subcontractors, shall state as an initial part of the bid or negotiations of the contract whether it has participated in any previous contract or subcontract subject to the equal opportunity clause; and, if so, whether it has filed all compliance reports due under applicable instructions. (For information about the EEO-1 report/survey visit <http://www.eeoc.gov/employers/eeo1survey/index.cfm>.)

Where the certification indicates that the prime or subcontractor has not filed a compliance report due under applicable instructions, such contractor shall be required to submit a compliance report.

PRIME CONTRACTOR OR SUBCONTRACTOR CERTIFICATION

1. Bidder has participated in a previous contract or subcontract subject to the Equal Opportunity Clause.
 Yes No (If "No" go to "Certification" and sign.)
2. Compliance Reports were required to be filed in connection with such contract or subcontract.
 Yes No (If "No" go to "Certification" and sign.)
3. Bidder has filed all compliance reports due under applicable instructions, including EEO-1 (SF-100).
 Yes No
4. If answer to item 3 is "No", please explain in detail on reverse side of this certification.

Certification: The information above is true and complete to the best of my knowledge and belief. (A willfully false statement is punishable by law – U.S. Code, Title 18, Section 1001).

 Signature of Contractor/Subcontractor Representative Date

 Printed Name & Title of Contractor/Subcontractor Representative

Submit by email to DHEC project manager or by mail to:
 SRF Section - Water Facilities Permitting Division, S.C. DHEC, 2600 Bull Street, Columbia, SC 29201

**This form is required of Prime Contractors and any Subcontractors with subcontracts valued at \$10,000 or greater.*

REVIEW & RETENTION: The SRF Section will use this form to document whether or not a contractor has submitted EEO Compliance Reports. The form will be kept in the DBE/EEO file for the named project and will be retained for three years following the final SRF disbursement to the project's Sponsor - per Retention Schedule 15795.

**SECTION 01001
GENERAL REQUIREMENTS**

PART 1 GENERAL

1.01 GENERAL

- A. A brief description of the Work is stated in the Advertisement for Bids. To determine the full scope of the project or any particular part of the project, coordinate the applicable information in the several parts of these Contract Documents.

PART 2 SEQUENCE OF OPERATIONS

2.01 SCHEDULING

- A. Prior to starting the Work, confer with the Engineer and Owner's representative to develop an approved Work schedule. Do not make connections between existing Work and new Work until necessary inspection and tests have been completed on the new Work and it is found to conform in all respects to the requirements of the Contract Documents.
- B. Work on existing facilities shall be performed on a schedule and in a manner that will permit the existing water system to operate continuously, unless agreed to by the Owner as described herein.

2.02 SHUTDOWN OR ALTERATION OF EXISTING OPERATIONS OR UTILITIES

- A. Continuous operation of the existing wastewater system is of critical importance.
- B. Connections to existing services or utilities, or other Work that requires the temporary shutdown of any existing operations or utilities shall be planned in detail with appropriate scheduling of the Work and coordinated with the Owner or Engineer. The approved schedule for shutdown or restart shall be indicated on the Contractor's Progress Schedule, and advance notice shall be given in order that the Owner or Engineer may witness the shutdown, tie-in, and startup.
- C. All materials and equipment (including emergency equipment) necessary to expedite tie-ins shall be on hand prior to the shutdown of existing services or utilities.

2.03 OPERATION OF EXISTING SYSTEM PROHIBITED

- A. At no time undertake to close off any lines or open valves or take any other action which would affect the operation of the existing system, except as specifically required by the Drawings and Specifications and after approval is granted by the Owner. Request approval to change the system operation three

GENERAL REQUIREMENTS

(3) working days in advance of the time that interruption of the existing system is required.

2.04 EQUIPMENT AND SYSTEM TESTING

- A. Functional (or run) testing, in the presence of the manufacturer's representative and/or Engineer, will be required for each item of equipment following installation. Functional testing is defined, as that testing necessary to determine if installed equipment and systems will operate as intended.
- B. In addition to the functional test, specific performance testing of installed equipment and systems shall be conducted by the Contractor as required in the section specifying the equipment or system.
- C. The Contractor shall furnish all labor, materials, tools, equipment, instruments, and services necessary to perform the functional and performance testing.

2.05 SEQUENCE OF OPERATIONS

- A. The Work shall proceed in the following sequence:
 - 1. The Work sequence shall be scheduled by the Contractor.

PART 3 SITE CONDITIONS

3.01 SITE INVESTIGATION AND REPRESENTATION

- A. The Contractor acknowledges satisfaction as to the nature and location of the Work, the general and local conditions, particularly those bearing upon availability of transportation, access to the site, disposal, handling and storage of materials, availability of labor, water, electric power, roads, and uncertainties of weather, river stages, or similar physical conditions at the site, the conformation and conditions of the ground, the character of equipment and facilities needed preliminary to and during the prosecution of the Work, and all other matters which can in any way affect the Work or the cost thereof under this Contract.
- B. The Contractor further acknowledges satisfaction as to character, quality, and quantity of surface and subsurface materials to be encountered from his inspection of the site and from reviewing any available records of exploratory Work furnished by the Owner or included in these Documents. Failure by the Contractor to become acquainted with the physical conditions of the site and all the available information will not relieve the Contractor from responsibility for properly estimating the difficulty or cost of successfully performing the Work.
- C. The Contractor warrants that as a result of examination and investigation of all the aforesaid data, the Contractor can perform the Work in a good and workmanlike manner and to the satisfaction of the Owner. The Owner assumes

GENERAL REQUIREMENTS

no responsibility for any representations made by any of its officers or agents during or prior to the execution of this Contract, unless (1) such representations are expressly stated in the Contract, and (2) the Contract expressly provides that the responsibility therefor is assumed by the Owner.

3.02 INFORMATION ON SITE CONDITIONS

- A. General: Any information obtained by the Engineer regarding site conditions, groundwater elevations, existing construction of site facilities as applicable, and similar data will be available for inspection at the office of the Engineer upon request. Such information is offered as supplementary information only. Neither the Engineer nor the Owner assumes any responsibility for the completeness or interpretation of such supplementary information.

3.03 CONTRACTOR'S RESPONSIBILITY FOR UTILITY PROPERTIES AND SERVICE

- A. Utilities and structures adjacent to or expected to be encountered in the Work are the Contractor's sole responsibility to locate. A utility notification service is available and shall be used to notify those utilities that participate in the service.
- B. Where the Contractor's operations could cause damage or inconvenience to railway, telegraph, telephone, television, power, oil, gas, water, sewer, or irrigation systems, the operations shall be suspended until all arrangements necessary for the protection of these utilities and services have been made by the Contractor.
- C. Notify all utility offices which are affected by the construction operation at least forty-eight (48) hours in advance. Under no circumstances expose any utility without first obtaining permission from the appropriate agency. Once permission has been granted, locate, expose, and provide temporary support for all existing underground utilities.
- D. The Contractor shall be solely and directly responsible to the Owner and operators of such properties for any damage, injury, expense, loss, inconvenience, delay, suits, actions, or claims of any character brought because of any injuries or damage which may result from the construction operations under this Contract.
- E. Neither the Owner nor its officers or agents shall be responsible to the Contractor for damages as a result of the Contractor's failure to protect utilities encountered in the Work.
- F. If the Contractor while performing the Contract discovers utility facilities not identified by the public agency in the Contract Drawings or Specifications, he shall immediately notify the public agency and utility in writing.

GENERAL REQUIREMENTS

- G. The public utility, where they are the Owner, shall have the sole discretion to perform repairs or relocation Work or permit the Contractor to do such repairs or relocation Work at a reasonable price.
- H. The Contractor shall replace, at his own expense, all existing utilities or structures removed or damaged during construction, unless otherwise provided for in these Contract Documents or ordered by the Engineer.

3.04 INTERFERING STRUCTURES

- A. Take necessary precautions to prevent damage to existing structures whether on the surface, aboveground, or underground. An attempt has been made to show major structures on the Drawings. The completeness and accuracy of information shown cannot be guaranteed, and it is presented simply as a guide to avoid known possible difficulties.
- B. Protect underground and aboveground existing structures from damage, whether or not they lie within the limits of the easements obtained by the Owner. Where such existing fences, gates, barns, sheds, buildings, or any other structure must be removed in order to properly carry out the construction, or are damaged during construction, restore to their original condition to the satisfaction of the property owner involved at the Contractor's own expense. Notify the Engineer of any damaged underground structure, and make repairs or replacements before backfilling.
- C. Without additional compensation, the Contractor may remove and replace in a condition as good as or better than original, such small miscellaneous structures as fences, mailboxes, and signposts that interfere with the Contractor's operation.

3.05 FIELD RELOCATION

- A. During the progress of construction, it is expected that minor relocations of the Work will be necessary. Such relocations shall be made only by direction of the Engineer. If existing structures are encountered which prevent the construction, and which are not properly shown on the Drawings, notify the Engineer before continuing with the construction in order that the Engineer may make such field revisions as necessary to avoid conflict with the existing structures. If the Contractor fails to so notify the Engineer when an existing structure is encountered, and proceeds with the construction despite this interference, he shall do so at his own risk.

PART 4 SALVAGE OF MATERIALS

4.01 SALVAGE OF EQUIPMENT AND MATERIALS REMOVED

GENERAL REQUIREMENTS

- A. If existing equipment or materials are removed and replaced, they shall be salvaged by the Contractor.

PART 5 TEMPORARY CONSTRUCTION UTILITIES AND FACILITIES

5.01 CONTRACTOR'S AND ENGINEER'S FIELD OFFICE

- A. The Contractor shall establish and maintain a field office on this Project and have available at the office a responsible representative who can officially receive communications from the Engineer. The Contractor shall have one complete, up-to-date set of Drawings, Specifications and Contract Documents (including all Addenda and Change Orders) in this office at all times, available for reference at any time. The office shall be provided with internet service, copy machine, air conditioning and heat. Provide a separate room, not less than 8'x10' with a desk and chair, for the Engineer's field office.

5.02 TEMPORARY WATER

- A. The Contractor shall provide all water required to accomplish the actual construction, including water required for testing, flushing and sterilization. Temporary piping for transporting the water to the Work shall be paid for by the Contractor.

5.03 TEMPORARY ELECTRIC POWER

- A. The Contractor shall be responsible for obtaining a source of electric power for construction. The Contractor shall pay the cost of electric service for construction and testing until substantial completion is achieved.

5.04 SAFETY REQUIREMENT FOR TEMPORARY ELECTRIC POWER

- A. Temporary electric power installation shall meet the construction safety requirements of OSHA, State, and other governing agencies.

5.05 SANITARY FACILITIES

- A. The Contractor shall provide and maintain sanitary facilities for his employees and his subcontractors' employees that will comply with the regulations of the local and state departments of health and as directed by the Engineer.

5.06 RECEIVING, INSPECTION, AND UNLOADING PRODUCTS

- A. Contractor shall record the receipt of products at the job site.
- B. Upon receipt of products at the job site, Contractor shall inspect for completeness and evidence of damage during shipment.

GENERAL REQUIREMENTS

1. Owner's representative may be present for inspection.
 2. Should there appear to be damage, notify the Owner's representative immediately and inform the Manufacturers and the Transportation Company.
 3. Expedite replacement of damaged, incomplete, or lost items.
- C. After completion of inspection, unload products in accordance with manufacturer's instructions for unloading, or as specified. Do not unload damaged or incomplete products to be returned to manufacturer for replacement, except as necessary to expedite return shipment.

5.07 PROJECT SIGN

- A. Provide and erect where directed a project sign.
1. Maintain in good condition until project completion.
- B. Sign shall be approximately 4'x8' of 3/4" exterior plywood, mount on 4"x4" treated posts with bottom edge approximately 5' above ground line.
1. Comply with construction details, lettering and coloring as shown on Attachment No. 1.

5.08 HANDLING, STORAGE, AND MAINTENANCE OF PRODUCTS

- A. Handle products in accordance with the manufacturer's written recommendations, and in a manner to prevent damage.
- B. Store products prior to installation as recommended by the manufacturer.
1. Store products such as pipe and reinforcing steel off the ground in approved storage yards.
 2. Store items subject to damage by the elements, vandalism, or theft in secure buildings.
 3. Provide environmentally controlled storage facilities for items requiring environmental control for protection.
- C. Provide manufacturer's recommended maintenance during storage, installation, and until products are accepted for use by Owner.
- D. Store products to provide access for inspection and inventory control. Contractor shall document products in storage to facilitate inspection and to estimate progress payments for products delivered but not installed in the Work.

GENERAL REQUIREMENTS

5.09 STORAGE OF MATERIALS

- A. Materials shall be so stored as to ensure the preservation of their quality and fitness for the Work. When considered necessary, they shall be placed on wooden platforms or other hard, clean surfaces, and not on the ground. Stored materials shall be located so as to facilitate prompt inspection. Private property shall not be used for storage purposes without the written permission of the Owner or lessee.
- B. Delicate instruments and materials subject to vandalism shall be placed under locked cover and, if necessary, provide with temperature control as recommended by the manufacturer.

PART 6 SAFETY AND CONVENIENCE

6.01 CONSTRUCTION SAFETY PROGRAM

- A. The Contractor shall develop and maintain for the duration of this Contract, a safety program that will effectively incorporate and implement all required safety provisions. The Contractor shall appoint an employee who is qualified and authorized to supervise and enforce compliance with the safety program.
- B. The duty of the Engineer to conduct construction review of the Contractor's performance is not intended to include a review or approval of the adequacy of the Contractor's safety supervisor, the safety program, or any safety measures taken in, on, or near the construction site.

6.02 SAFETY EQUIPMENT

- A. The Contractor, as part of his safety program, shall maintain at his office or other well-known place at the job site, safety equipment applicable to the Work as prescribed by the governing safety authorities, all articles necessary for giving first-aid to the injured, and shall establish the procedure for the immediate removal to a hospital or a doctor's care of any person who may be injured on the job site.
- B. The Contractor shall do all Work necessary to protect the general public from hazards, including, but not limited to, pedestrian sidewalk or walkway, and trenches or excavations in roadway. Barricades, lanterns, and proper signs shall be furnished in sufficient amount to safeguard the public and the Work.
- C. The performance of all Work and all completed construction, particularly with respect to ladders, platforms, structure openings, scaffolding, shoring, lagging, machinery guards and the like, shall be in accordance with the applicable governing safety authorities.

GENERAL REQUIREMENTS

- D. During construction, the Contractor shall construct and at all times maintain satisfactory and substantial temporary chain link fencing, solid fencing, railing, barricades or steel plates, as applicable, at all openings, obstruction, or other hazards in streets, sidewalks, floors, roofs, and walkways. All such barriers shall have adequate warning light as necessary, or required, for safety.

6.03 ACCIDENT REPORTS

- A. If death or serious injuries or serious damage are caused, the accident shall be reported immediately by telephone or messenger to the Engineer. In addition, the Contractor must promptly report in writing to the Engineer all accidents whatsoever arising out of or in connection with, the performance of the Work whether on, or adjacent to, the site, giving full details and statements of witnesses.
- B. If claim is made by anyone against the Contractor or any subcontractor on account of any accidents, the Contractor shall promptly report the facts in writing to the Engineer, giving full details of the claim.

6.04 SAFE ACCESS BY FEDERAL, STATE, AND LOCAL GOVERNMENT OFFICIALS

- A. Authorized representatives of the GEPD and other government officials shall at all time have safe access to the Work, and the Contractor shall provide proper facilities for such access and inspection.

6.05 PROTECTION OF PROPERTY

- A. Protect stored materials, cultivated trees and crops, and other items located adjacent to the proposed Work. Notify property owners affected by the construction at least forty-eight (48) hours in advance of the time construction begins. During construction operations, construct and maintain such facilities as may be required to provide access by all property owners to their property. No person shall be cut off from access to his residence or place of business for a period exceeding eight (8) hours, unless the Contractor has made special arrangements with the affected persons.

6.06 FIRE PREVENTION AND PROTECTION

- A. The Contractor shall perform all Work in a fire-safe manner. He shall supply and maintain on the site adequate fire-fighting equipment capable of extinguishing incipient fires. The Contractor shall comply with applicable Federal, State, and local fire-prevention regulations. Where these regulations do not apply, applicable parts of the National Fire Prevention Standard for Safeguarding Building Construction Operation (NFPA No. 241) shall be followed.

GENERAL REQUIREMENTS

6.07 TRAFFIC MAINTENANCE AND SAFETY

- A. Comply with all rules and regulations of the State, County, and City authorities regarding closing or restricting the use of public streets or highways. No public or private road shall be closed, except by express permission of the Owner. Conduct the Work so as to assure the least possible obstruction to traffic and normal commercial pursuits. Protect all obstructions within traveled roadways by installing approved signs, barricades, and lights where necessary for the safety of the public. The convenience of the general public and residents adjacent to the project and the protection of persons and property are of prime importance and shall be provided for in an adequate and satisfactory manner.
- B. When flagmen and guards are required by regulation or when deemed necessary for safety, they shall be furnished with approved orange wearing apparel and other regulation traffic-control devices.

6.08 ACCESS AND NOTIFICATION FOR POLICE, FIRE, AND POSTAL SERVICE

- A. Notify the fire department and police department before closing any street or portion thereof. No closing shall be made without the Owner's approval. Notify said departments when the streets are again passable for emergency vehicles. Conduct operations with the least interference to fire equipment access and at no time prevent such access.
- B. The Contractor shall leave a night emergency telephone number or numbers with the police departments, so that contact may be made easily at all times in case of barricade or flare trouble or other emergencies.
- C. Maintain postal service facilities in accordance with the requirements of the U.S. Postal Service, and at the completion of the Work in each area, replace them in their original location and in a condition satisfactory to the U.S. Postal Service.

PART 7 USE OF EXPLOSIVES

- A. The Contractor shall use all precaution, control, and safety features necessary to insure the safety of life or property in the area of operation.
- B. Blasting operations shall be performed under the most skilled supervision. Where necessary, Contractor shall use suitable mats or other approved methods to smother blast.
- C. No loaded holes shall be left unattended.
- D. Extreme care shall be taken to minimize the amount and degree of ground vibration, noise, overpressure, and flying debris.

GENERAL REQUIREMENTS

- E. All explosives shall be stored in a safe manner, in compliance with local, state and federal laws and ordinances.

PART 8 PRESERVATION, RESTORATION, AND CLEANUP

8.01 EROSION CONTROL

- A. The Contractor shall protect floodplains and wetlands by complying with the requirements in Title 33 of the Code of Federal Regulations Part 330, Appendix A and storm water permit.

8.02 SITE RESTORATION AND CLEANUP

- A. At all times during the Work, keep the premises clean and orderly, and upon completion of the Work, repair all damage caused by equipment and leave the project free of rubbish or excess materials of any kind.
- B. All existing drainage ditches and culverts shall be reopened and graded and natural drainage restored. Restore culverts broken or damaged to their original condition and location.

8.03 FINISHING OF SITE, BORROW, AND STORAGE AREAS

- A. Upon completion of the project, all areas used by the Contractor shall be properly cleared of all temporary structures, rubbish, and waste materials and properly graded to drain and blend in with the abutting property. Areas used for the deposit of waste materials shall be finished to properly drain and blend with the surrounding terrain.

8.04 RESEEDING AND FERTILIZING

- A. If damaged originally seeded areas inside and outside of the construction area shall be fertilized and reseeded with first-quality seed or planted with new sod as approved by the property owner. All ground preparation, reseeded, and sodding shall be done in accordance with the best accepted practices for lawn planting. The Contractor shall be responsible for obtaining a satisfactory grass turf acceptable to the property owner.

8.05 STREET CLEANUP DURING CONSTRUCTION

- A. Thoroughly clean all foreign material caused by the construction operations from all streets and roads at the conclusion of each day's operation.

PART 9 SUBMITTALS DURING CONSTRUCTION

9.01 GENERAL

GENERAL REQUIREMENTS

- A. Requirements in this Section are in addition to any specific requirements for submittals specified in other Sections of these Contract Documents.
- B. Submittals to the Owner shall be addressed to:

**City of Lake City
202 Kelley Street
Lake City, SC 29560**
- C. Submittals to the Engineer shall be addressed to:

Constantine Engineering
4000 Faber Place Drive, Suite 330
Charleston, SC 29405
Attn: Dan Huggins
- D. Submitted data shall be fully sufficient in detail for determination of compliance with the Contract Documents.
- E. Review, acceptance, or approval of substitutions, schedules, shop Drawings, lists of materials, and procedures submitted or requested by the Contractor shall not add to the Contract amount, and all additional costs which may result therefrom shall be solely the obligation of the Contractor.
- F. The Owner is not precluded, by virtue of review, acceptance, or approval, from obtaining a credit for construction savings resulting from allowed concessions in the Work or materials therefore.
- G. It shall not be the responsibility of the Owner to provide engineering or other services to protect the Contractor from additional costs accruing from such approvals.
- H. No equipment or material for which listings, Drawings, or descriptive material is required shall be installed until the Engineer has on hand copies of such approved lists and the appropriately stamped final shop Drawings.
- I. The review of Drawings by the Engineer will be limited to general design requirements only, and shall in no way relieve the Contractor from responsibility for errors or omissions contained therein.
- J. Submittals will be acted upon by the Engineer as promptly as possible, and returned to the Contractor no later than the time allowed for review in SHOP DRAWING SUBMITTAL PROCEDURE. Delays caused by the need for resubmittals shall not constitute reason for an extension of Contract time.

GENERAL REQUIREMENTS

9.02 OPERATIONS AND MAINTENANCE (O&M) MANUALS

- A. The CONTRACTOR shall furnish four (4) copies and one (1) PDF of a complete instruction manual for installation, operation, maintenance, and lubrication requirements for each component of mechanical and electrical equipment or system under this Contract. All equipment manufacturers and/or suppliers shall be made aware of these requirements and all associated costs shall be included in the costs for furnishing the equipment or system. Each instruction manual furnished shall be fixed in a hard-back binder which is clearly labeled to designate the system or equipment for which it is intended with reference to the building and equipment number and the Specification section where the item is specified.
- B. The manuals shall be furnished at least thirty (30) calendar days prior to the scheduled completion of the Work but in no case shall submission of the manuals be delayed beyond seventy-five (75%) percent completion point of the Work. Submission of the manuals shall precede any payment to the CONTRACTOR for Work completed in excess of the seventy-five (75%) percent completion level. Any deficiencies found by the ENGINEER to exist in the manuals submitted shall be corrected by the CONTRACTOR within thirty (30) calendar days following notification by the ENGINEER of the deficiencies.
- C. Each instruction manual shall include, but not be limited, to the following:
 - 1. Diagrams and illustrations.
 - 2. Detailed description of the function of each principal component of the system.
 - 3. Performance and nameplate data.
 - 4. Installation instructions.
 - 5. Procedure for starting.
 - 6. Proper adjustment.
 - 7. Test procedures.
 - 8. Procedure for operating.
 - 9. Shutdown instructions.
 - 10. Emergency operating instructions and troubleshooting guide.
 - 11. Safety precautions.

GENERAL REQUIREMENTS

12. Maintenance and overhaul instructions which shall include detailed assembly Drawings with part numbers, parts list, instructions for ordering spare parts, and complete preventive maintenance instruction required to ensure satisfactory performance and longevity of the equipment.
 13. Lubrication instructions, which shall list points to be greased or oiled, shall recommend type, grade, and temperature range of lubricants, and shall recommend frequency of lubrication.
 14. List of electrical relay settings and control and alarm contact settings.
 15. Electrical interconnection wiring diagram for equipment furnished, including all control and lighting systems.
 16. Start-up reports.
- D. Manuals shall be complete in all respects for all equipment, controls, accessories, and associated appurtenances.
- E. Manuals shall be assembled in one (1) or more binders, each with title page, typed table of contents, and heavy section dividers with numbered plastic index tabs. Each manual shall be divided into sections paralleling the equipment Specifications. Binders shall be three (3) ring, hard-back type. All data shall be punched for binding and composition and printing shall be arranged so that punching does not obliterate any data. The Project title, division designation, and manual title printed thereon shall be furnished by the ENGINEER.
- F. Where more than one (1) binder is required, they shall be labeled "Vol. 1", "Vol. 2", and so on. The table of contents for the entire set, identified by volume number, shall appear in each binder. Submit manual organization and format to the Engineer for approval prior to manual preparation.
- G. Each O & M Manual shall be transmitted to the ENGINEER prior to the installation of the equipment and all equipment shall be serviced in accordance with the manufacturer's recommendations prior to operation. A service record shall be maintained on each item of equipment and shall be delivered to the ENGINEER prior to final acceptance of the Project.

9.03 MAINTENANCE SUMMARY FORMS

- A. In addition to the O & M Manuals, provide Maintenance Summaries in the format of the form bound at the end of this Section and described below. The timing of submission of these forms shall be the same as prescribed above for the Operation and Maintenance Manuals.
- B. An individual Maintenance Summary for each equipment item shall be completed following the outlined provided; and four (4) copies and one (1) PDF

GENERAL REQUIREMENTS

submitted for review by the ENGINEER. The manufacturer's standard form will not be acceptable as a substitute for the Maintenance Summary.

- C. The term "Maintenance Operation" as used in the Maintenance Summary bound at the end of this Section is understood to mean any routine operation required to ensure the satisfactory performance and longevity of the equipment. Examples of some typical Maintenance Operations are lubrications, belt tensioning, adjustment of pump packing glands, routine adjustments, etc.
- D. The Maintenance Summary may take as many pages as required. However, the order and format shown must be adhered to. Only 8½ inch by eleven (11) inch paper will be accepted.

9.04 RECORD DRAWINGS

- A. Comply with SECTION 01720.

9.07 MANUFACTURER'S CERTIFICATE OF PROPER INSTALLATION

- A. Where required in the Specifications, the Contractor shall submit manufacturer's certification of proper installation of equipment prior to startup or performance testing. Such certificate shall state that the equipment or system has been installed in accordance with the manufacturer's recommendation and has been inspected by a manufacturer's authorized representative, that it has been serviced with the proper initial lubricants, that applicable safety equipment has been properly installed, and the proper electrical and mechanical connections have been made.

9.08 MATERIAL AND EQUIPMENT COLORS

- A. The Engineer will provide a schedule of colors within thirty (30) days after approval of materials and equipment and after receiving samples of all standard colors those items requiring selections.
- B. No individual color selections will be made until after approval of all pertinent materials and equipment and after receipt of appropriate samples.

9.09 CERTIFICATES OF COMPLIANCE WITH SPECIFIED STANDARDS AND CODES

- A. A Certificate of Compliance shall be furnished for materials specified to a recognized standard or code prior to the use of any such materials in the Work. The Engineer may permit the use of certain materials or assemblies prior to sampling and testing if accompanied by a Certificate of Compliance. The certificate shall be signed by the manufacturer of the material or the manufacturer of assembled materials and shall state that the materials involved comply in all respects with the requirements of the Specifications. A Certificate

GENERAL REQUIREMENTS

of Compliance shall be furnished with each lot of material delivered to the Work and the lot so certified shall be clearly identified in the certificate.

- B. All materials used on the basis of a Certificate of Compliance may be sampled and tested at any time. The fact that material is used on the basis of a Certificate of Compliance shall not relieve the Contractor of responsibility for incorporating material in the Work which conforms to the requirements of the Contract Documents and any such material not conforming to such requirements will be subject to rejection whether in place or not.
- C. The Engineer reserves the right to refuse permission for use of material on the basis of a Certificate of Compliance.
- D. The form of the Certificate of Compliance and its disposition shall be as directed by the Engineer.

9.10 STARTING OF SYSTEMS

A. Definitions:

1. System: A system means the overall process or a portion thereof, that performs a specific function. A system may consist of two (2) or more subsystems as well as two (2) or more types of equipment.
2. Subsystem: A subsystem is a portion of a larger systems consisting of two (2) or more types of equipment.
3. Functional Testing: Tests necessary to demonstrate that installed equipment and systems function as specified and operate in the manner intended. Functional testing is a prerequisite to performance testing for equipment and systems specified to have a performance test.
4. Performance Testing: Tests necessary to demonstrate, after successful functional testing, that equipment and systems meet specified performance requirements.
5. Startup:
 - a. Startup of any portion of the entire facility is considered complete when, in the opinion of the Engineer, the facility or designated portion has properly operated for seven (7) continuous days without significant interruption. The startup period is in addition to the specified functional and performance testing and training.
 - b. Significant interruption during startup shall include any of the following events:

GENERAL REQUIREMENTS

1. Failure of a system (process, control, building service, etc.) that is not permanently corrected within four (4) hours after such failure occurs.
 2. Failure of a process equipment unit (mechanical, electrical, instrument, etc.) that is not permanently corrected within six (6) hours after such failure occurs.
 3. Failure of an analytical, HVAC, building service, or hoisting equipment unit that is not permanently corrected within eight (8) hours after such failure occurs.
- c. "Permanently corrected" shall consist of all the following:
1. Work repaired and replaced to conform with specified requirements.
 2. Parts and components replaced as recommended by original manufacturer and conforming with reviewed submittals.
 3. Piping and valves properly installed and connected.
 4. Wiring properly terminated and enclosed in raceways.
 5. Accessories, including spare parts and lubricants, furnished as specified.
- d. Occurrence of a significant interruption shall require startup then in progress to be stopped and restarted after permanent corrections are made.
6. Operation: The operation period begins when the facility has been substantially completed as defined in the GENERAL CONDITIONS.
- B. Testing and Startup Responsibilities
1. Contractor's Responsibilities: The Contractor shall:
 - a. Furnish labor and materials, tools, instruments, and service for checking, testing, and startup specified for each equipment item. This includes such services as required by the manufacturer's representatives, subcontractors, electricians, instrumentation technicians, and pipe fitters.
 - b. Prepare testing schedule and incorporate testing and startup activities in the progress schedule for the Work.

GENERAL REQUIREMENTS

- c. Designate one (1) person (other than field superintendent) to be responsible for coordinating and expediting testing and start-up responsibilities, and to be present during all pre-startup meetings and available to Owner's personnel during the testing and startup.
 - d. Obtain and furnish qualified manufacturer's representative to assist testing of each equipment type and system.
 - e. Develop a standard testing log to be used as a record of testing each item and subsystem. This log shall:
 - 1. Be subject to approval of Engineer.
 - 2. Include subsystem and equipment name.
 - 3. Have provisions for recording dates of completion for checking, inspection by manufacturer, verification of instrumentation and controls, and completion of subsystem tests, and;
 - 4. Provide space for problems remaining with equipment and for signature of Engineer and manufacturer's representative indicating acceptance.
 - f. Notify Engineer and Owner at least fourteen (14) days prior to the date when each equipment system is scheduled to be initially started; also submit testing plan starting schedule, quantity and source of utilities, chemicals, and other materials needed.
 - g. Furnish spare parts and special tools as specified for the respective equipment.
 - h. Furnish O & M information needed for O & M Manuals, as specified herein.
2. Owner's Responsibilities: The Owner will:
- a. Furnish for Contractor's use during startup:
 - 1. Potable and/or raw water for testing, as appropriate.
 - 2. Chemicals including chlorine, polyaluminum chloride, lime, sodium bisulfite and sodium hexametaphosphate, provided adequate prior notice is given by Contractor.

GENERAL REQUIREMENTS

3. Sample containers for Contractor's use in sample collection.
 - b. Provide sampling labor and materials and laboratory analysis.
 - c. Furnish Owner's representative to witness all tests.
- C. Testing Preparation
1. Cleaning and Checking: Prior to initial startup of equipment:
 - a. Inspect and clean equipment, devices, and connected piping so they are free of foreign material.
 - b. Lubricate equipment in accordance with manufacturer's instructions.
 - c. Turn rotating equipment by hand and check motor-driven equipment for correct rotation.
 - d. Open and close valves by hand and operate other devices to check for binding, interference, or improper functioning.
 - e. Check power supply to electric-powered equipment for correct voltage.
 - f. Obtain manufacturer's certification of proper installation, where specified.
 2. Ready-To-Test Determination: Equipment shall be determined ready to test by Engineer based on the following:
 - a. Notification by Contractor of equipment and system readiness for testing.
 - b. Submittal of testing plan stating detailed procedures including quantity and source of utilities, chemicals, and other materials needed for each test.
 - c. Receipt of O & M Manuals incorporating review comments.
 - d. Receipt of manufacturer's certification of proper installation, where specified.
 - e. Cleanliness of equipment, devices, and connected work.

GENERAL REQUIREMENTS

- f. Adequate completion of work adjacent to, or interfacing with, equipment to be tested.
3. Pre-testing Meeting: Contractor shall arrange a meeting to review the Contractor's detailed testing plan for each equipment item and system, at least two (2) days prior to the first test run.

D. Functional Testing

1. Subsystem Tests: Startup and operate the individual components and subsystems that make up each equipment system, as specified in the respective sections of the Specifications. Functional testing of a complete system shall not begin until subsystem testing is completed to the Engineer's satisfaction.
2. Equipment and System Tests: Contractor shall functionally test each separate piece of equipment, and each system requiring simultaneous operation of interdependent equipment, in accordance with the following procedures:
 - a. Separate items of equipment demonstrated to function properly during subsystem testing shall require no further functional test, if documentation of subsystem testing is accepted by Engineer.
 - b. Functional testing of each system shall begin after subsystems and equipment units have been satisfactorily tested.
 - c. Functional testing will begin at a time mutually agreed upon by the Engineer, Owner, Manufacturer's Representative(s) and Contractor.
 1. The Owner or Engineer will be present during tests.
 2. Notify Engineer, Owner, and Manufacturer's Representative at least seven (7) days prior to schedule date of functional tests.
 - d. Performance tests, where specified for individual equipment, shall not begin until functional testing of the complete systems in which they operate is completed to the satisfaction of the Engineer.
 - e. If, in the opinion of the Engineer, each system meets the requirements specified, they will be accepted as conforming for the purposes of advancing to the performance testing phase. If, in the opinion of the Engineer, the functional test results do not meet the requirements specified, the systems will be considered as nonconforming.

GENERAL REQUIREMENTS

1. In the case of a nonconforming system, advancement to the performance testing phase shall not commence until the Contractor has made such adjustments, changes, and additions necessary to correct the system and retest it as specified and, in the opinion of the Engineer, the system functions as specified.
 3. Documentation: Contractor shall document subsystem and system tests in writing, in a format acceptable to the Engineer. Obtain respective manufacturer's signature and approval for subsequent performance testing or startup on the appropriate test logs.
- E. Performance Testing
1. Testing Fluid: Performance testing shall use plant fluid or material that the equipment or system is designed to handle during normal service conditions, unless otherwise specified.
 2. Equipment and Subsystem Tests: Contractor shall:
 - a. Clean and check equipment and devices, as specified herein prior to starting equipment and subsystem performance tests.
 - b. Performance testing will begin at a time mutually agreed upon by the Engineer, Owner, Manufacturer's Representative(s), and Contractor.
 1. The Owner or Engineer will be present during tests.
 2. Notify Engineer, Owner, and manufacturer's representative at least seven (7) days prior to schedule date of performance testing.
 - c. Operate the necessary equipment units as specified in the respective O & M Manuals for a continuous period of four (4) hours.
 - d. Follow Engineer-approved testing plan and detailed procedures specified for each equipment unit and subsystem.
 - e. Complete acceptable performance testing of all equipment and subsystems included in a system, and submit test documentation before starting the system performance test.
- F. Startup

GENERAL REQUIREMENTS

1. Performance testing of all individual equipment and subsystems shall be completed before the startup period begins, unless otherwise allowed by the Engineer.
2. Prepare startup activity schedule.
 - a. Schedule shall identify and sequence distinct activities to be conducted or tasks to be accomplished.
 - b. Examples of startup activities to be conducted are:
 1. Demonstrate manual and automatic operation of equipment.
 2. Simulate power failure and observe operation of components, tripping of breakers, etc.
 - c. Conduct additional non process activities such as:
 1. Operate all plumbing systems.
 2. Operate all HVAC systems.
 3. Open, close, lock, and unlock all doors and windows to check master keying.
 4. Check all electrical and lighting systems.
 - d. Indicate timing and interdependence of activities in the program, indicating each system, subsystem, and unit to be operated. Allow for rotation of standby units with operating units so that each unit is started and stopped at least twice and receives approximately the same elapsed time of operation.
3. After review and revisions requested by Engineer and Owner, begin the startup activities. Attend a pre-startup meeting not more than five (5) days to startup to review the program and resolve questions.
4. During startup operations, keep complete records of each activity and performance of each system, subsystem, and equipment unit. Use similar forms approved for functional testing, or as otherwise submitted and approved by Engineer.
5. If performance testing of certain systems cannot be completed before successful startup, continue such performance tests after entire facility is in continuous operation.

GENERAL REQUIREMENTS

6. After successful startup as defined in this Section, perform remaining Work to not interfere with facility operations.

G. Continuous Operation

1. Owner will accept equipment and systems as ready for continuous operation only after successful testing and startup is completed and documented, test and startup reports submitted and manufacturers' services completed for training of Owner's personnel.
2. After successful performance testing of a particular equipment type or system, Owner may elect to start up a portion of the equipment or system for continuous operation in accordance with the GENERAL CONDITIONS. Such operation will not interfere with testing of other equipment and systems that may still be underway, and shall not preclude the need to start up the portion operated in combination with the rest of the facility when all testing is completed.
3. Where completed systems require disinfection, they shall only be accepted for continuous operation after disinfection work specified is satisfactorily completed.

9.11 SUPPLIERS'/ MANUFACTURERS' SPECIAL SERVICES

- A. Installation Assistance: Competent and experienced technical personnel shall represent the manufacturers of all equipment and systems as may be necessary to resolve assembly or installation problems at the Work site which are attributable to, or associated with, the equipment furnished.
- B. Functional Testing: Where functional testing services are called for in the Technical Specifications, or when technical assistance is necessary to resolve performance problems that may become apparent during the performance test, the manufacturer's representative shall provide such assistance as necessary to demonstrate the specified performance.
- C. Startup: Where startup services are called for in the Technical Specifications, or when technical assistance is necessary due to any malfunction of the equipment or system furnished, the manufacturer's representative shall provide such services as necessary to provide the Owner with an acceptable operating facility.
- D. Costs for Services:
 1. Costs for providing services during installation, testing, and for the training of Owner's personnel shall be included in the costs for providing the applicable specified equipment.

GENERAL REQUIREMENTS

2. Where the number of days for services is not stated in the Technical Specifications, services shall be furnished for installation, testing, and plant startup as required to provide the Owner with a satisfactory operating facility.

END SECTION

Attachments: SRF and Rural Development Project Sign Requirements

Signage to Increase Public Awareness of SRF Assistance Agreements

An United States Environmental Protection Agency (EPA) initiative to enhance public awareness of EPA assistance agreements nationwide has been passed through to State Revolving Fund programs. The EPA "signage requirement" applies to SC SRF projects identified to meet federal requirements. Complying with the signage requirement is an eligible SRF expense.

Factors for an SRF Project Sponsor to consider when choosing a signage option include the complexity and location of the project and the nature of the community. There are a number of implementation options that are described below.

Implementation options:

- **Standard Signage:** This is use of a traditional sign that includes the name of the facility, project, and community; project cost; the DHEC logo; and the EPA logo. Other information could be included as space allows. This option should be selected for projects where the sign would be easily visible, such as near a major road or thoroughfare or where the facility is in a location where this would effectively publicize the project. When choosing this option, contact your DHEC project manager to request the DHEC and EPA logos and use guidelines.

The remaining signage options advertise SRF assistance in different formats, but each option should share the following information:

- 1 *Name of facility, project and community*
 - 2 *Project administered by DHEC's State Revolving Fund Section*
 - 3 *Project was [wholly / partially] funded with EPA funding*
 - 4 *Brief description of the project*
 - 5 *Brief listing of water quality benefits to be achieved*
- **Posters or Brochures:** A poster or brochure would share the information listed above and could include a website address for the SC SRF program (<http://www.scdhec.gov/srf>). Pictures of the proposed facility or project location could also be included in this format. Posters or brochures should be placed in a public location that is accessible to a wide audience of community members (e.g., town or city hall, community center, local park, public library, local government facility, court house or other public meeting space). This option may be more appropriate for projects located in rural areas.

- **Newsletter, Periodical, or Press Release:** For communities where there is no suitable public space or where advertisement through signage is unlikely to reach community members effectively, projects may be advertised in a community newsletter or similar periodical. The newsletter, periodical, or press release would contain the information indicated above.
- **Insert or Pamphlet in Water/Sewer Bill:** This approach would effectively publicize the project to those individuals directly benefitting from the project using the information listed above. The layout of such an insert might be an informative paragraph or more like a brochure.
- **Online and Social Media Publicity:** Many communities are increasingly finding that the online forum is the most cost-effective approach to publicize their programs and reach a broad audience of stakeholders. Online publicity may appear on the town, community, or facility website if available. Social media sites such as Facebook or Twitter can also be used. This option could be a more cost-effective option than traditional signs or print media. Since the web offers a visual platform, pictures and other visual elements could be incorporated when sharing the information listed above. In the case of some projects, such as nonpoint source projects, there might be additional opportunities for online publicity through partner agencies or organizations.

Below is sample language that may be used for any of the above options:

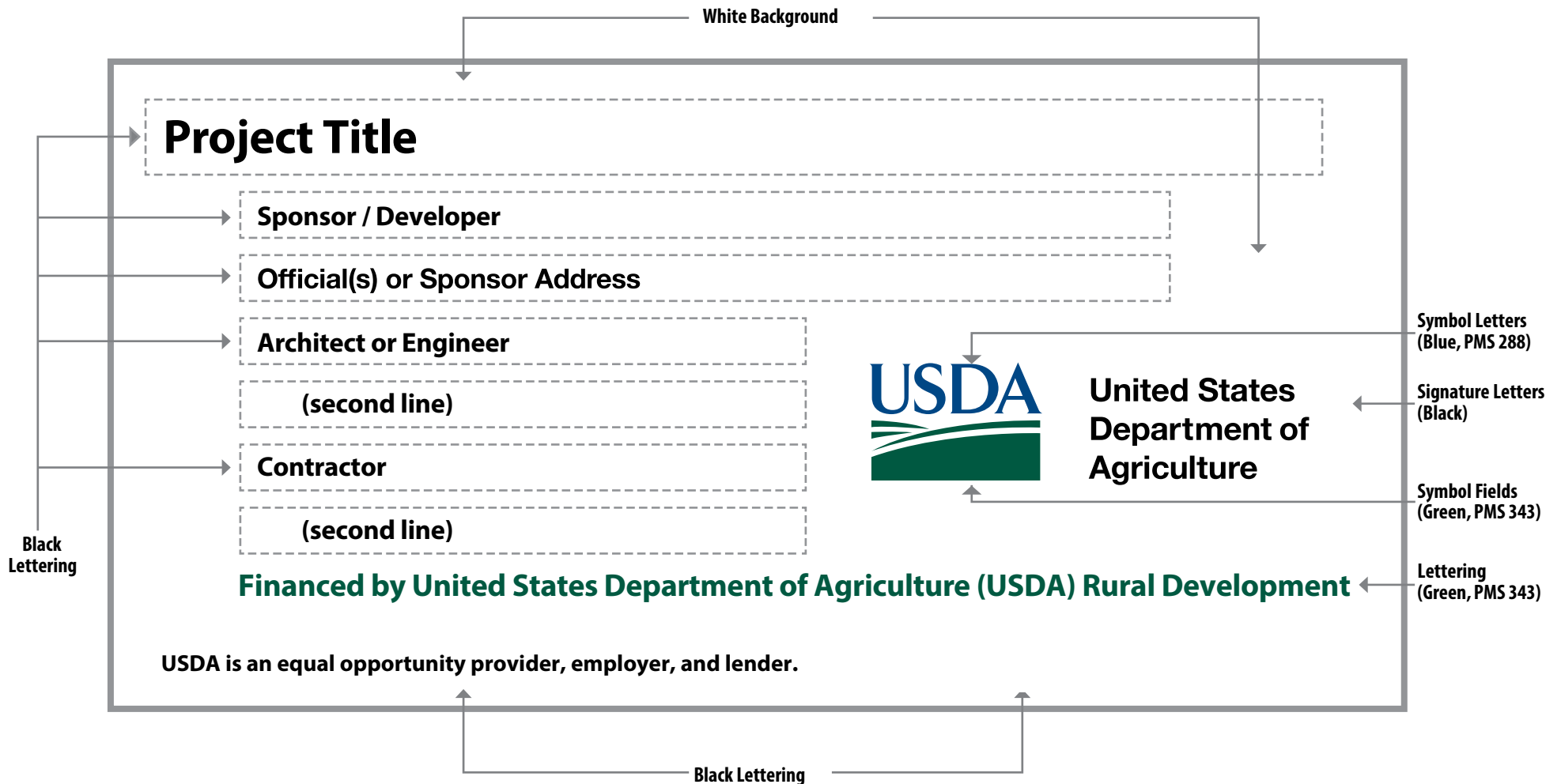
Construction of upgrades and improvements to the [Name of Facility or Infrastructure Component @ Project Location] is being financed by the [Clean Water/Drinking Water] State Revolving Fund (SRF). The [CW/DW] SRF program is administered by the South Carolina Department of Health and Environmental Control with joint funding from the U.S. Environmental Protection Agency and the State of South Carolina. This project will [description of project] and will provide [details specifying particular water quality benefits] for community residents and businesses in and near [name of town, city, and/or water body or watershed to benefit from the project]. [CW/DW] SRF programs operate around the country to provide states and communities the resources necessary to maintain and improve the infrastructure that protects our valuable water resources.

A hard copy of the selected option will need to be provided to your SRF project manager for documentation. If a sign, poster, or online publicity method is used, submitting a Word or PDF copy is acceptable.

If you have any questions on how to meet the signage requirement, contact your SRF project manager.

TEMPORARY CONSTRUCTION SIGN FOR RURAL DEVELOPMENT PROJECTS

Recommended Fonts: Helvetica, Arial, or Myriad Pro



SIGN DIMENSIONS : 1200 mm x 2400 mm x 19 mm (approx. 4' x 8' x 3/4")
PLYWOOD PANEL (APA RATED A-B GRADE-EXTERIOR)

**SECTION 01010
SUMMARY OF WORK**

PART 1 GENERAL

1.01 SUMMARY

- A. This Section includes the following:
 - 1. Work covered by the Contract Documents.
 - 2. Organization and interpretation of Contract Documents.

1.02 WORK COVERED BY CONTRACT DOCUMENTS

- A. Project Identification: City of Lake City Lake Swamp WWTP Upgrade
 - 1. Project Location: Lake City, South Carolina
- B. OWNER: City of Lake City
 - 1. OWNER's Representative: Glen Bodenheimer, City of Lake City, 202 Kelley Street, Lake City, SC 29560
- C. Engineer: Dan Huggins, Constantine Engineering Inc., 4000 Faber Place Drive, Suite 330, North Charleston, SC 29405.
- D. The Project is financed in whole or in part by USDA-Rural Utilities Service (RUS) and by SCDHEC State Revolving Fund (SRF) Program.
 - 1. The Work of this contract under the USDA-RUS Base Bid generally includes the following:
 - a. Existing Rotating Biological Contactors: Removal of all liquid and solid waste and demolition of the structure in its entirety.
 - b. Existing Aeration Basin Nos. 1 and 2: Remove all liquid and solid waste for inspection of fine bubble diffusers. Modify effluent channel to receive channel from new aeration basins.
 - c. Existing Aeration Basin No. 3: Removal of all liquid and solid waste and demolition of the structure in its entirety. Replacement of 20-diffuser assemblies.
 - d. Existing Blower Building: Removal and replacement of four (4) blowers, air piping replacement, removal of generator and fuel tank, HVAC improvements, and electrical improvements.
 - e. Existing Scum Pump Station: Removal and replacement of submersible pumps.
 - f. Existing Clarifier No. 3 RAS Pump Station: Removal and replacement of dry pit submersible pumps with self-priming

SUMMARY OF WORK

pumps, piping replacement, water jetting of RAS suction lines, and electrical and controls for equipment.

- g. Existing Aerobic Digester No. 4: Removal of all liquid and solid waste and demolition of the structure in its entirety.
- h. Septage Receiving Station: New septage receiving station to include new septage receiving equipment, septage receiving pump station with submersible mixer and force main, and electrical and controls for all equipment.
- i. Existing Screening and Grit Structure: Replacement of manual operator with motorized operator for aeration basin bypass.
- j. Aeration Basin: New aeration basin to include aeration basing structure, inlet splitter box with weir gates and slide gates, air piping, and fine bubble diffusers.
- k. Blower Building: New blower building to include building structure, blowers, air piping, HVAC system, and electrical and controls for all equipment.
- l. Generator: New 500 kw diesel generator with integral fuel tank, enclosure, and automatic transfer switch.
- m. All site civil, electrical, and instrumentation works required for the construction of the above facilities.

2. The Work of this contract under the SRF Base Bid generally includes the following:

- a. Existing Screening and Grit Structure: Replacement of conveyor belt for screenings conveyor, and PLC replacement in Grit Control Panel.
- b. Existing Clarifiers Nos. 1, 2 & 3: Removal of all liquid and solid waste, water jet cleaning of suction headers, and sandblasting and painting of all carbon steel clarifier equipment. Clarifier drive replacement for Clarifiers Nos. 1 & 2.
- c. Existing Dewatering Building Improvements: Refurbishment of belt press, kill switch replacement on dewatered sludge conveyor belt, belt press control panel replacement, and replacement of the Effluent Pump/RAS Pump Control Panel.

E. Project will be constructed under a single prime contract.

1.03 ORGANIZATION AND INTERPRETATION OF CONTRACT DOCUMENTS

A. Specifications and Drawings included in these Contract Documents establish the performance, quality requirements, location and general arrangement of materials and equipment, and establish the minimum standards for quality of workmanship and appearance.

SUMMARY OF WORK

- B. A part of the work that is necessary or required to make each installation satisfactory and operable for its intended purpose, even though it is not specifically included in the Specifications or on the Drawings, shall be performed as incidental work as if it were described in the Specifications and shown on the Drawings.

PART 2 PRODUCTS (Not Used)

PART 3 EXECUTION (Not Used)

END OF SECTION

SECTION 01014
COORDINATION WITH OWNER'S OPERATIONS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Requirements for coordinating with Owner's operations during the Work and included requirements for tie-ins and shutdowns necessary to complete the Work without impact on Owner's operations except as allowed in this Section.
2. Contractor shall provide labor, materials, tools, equipment and incidentals shown, specified and required to coordinate with Owner's operations during the Work.

B. General Requirements:

1. Except for shutdowns specified in this Section, perform the Work such that Owner's facility remains in continuous satisfactory operation during the Project. Schedule and conduct the Work such that the Work does not: impede Owner's production or processes, create potential hazards to operating equipment and personnel, reduce the quality of the facility's products or effluent, or cause odors or other nuisances. Unless otherwise agreed upon, all plant shutdowns shall be limited to Monday-Thursday.
2. Work not specifically covered in this Section or in referenced Sections may, in general, be completed at any time during regular working hours in accordance with the General Conditions and Supplementary Conditions, subject to the requirements in this Section.
3. Contractor has the option of providing additional temporary facilities that can eliminate or mitigate a constraint without additional cost to Owner, provided such additional temporary facilities: do not present hazards to the public, personnel, structures, and equipment; that such additional temporary facilities do not adversely affect Owner's ability to comply with Laws and Regulations, permits, and operating requirements; that such temporary facilities do not generate or foster the generation of odors and other nuisances; and that requirements of the Contract Documents are fulfilled.
4. Coordinate shutdowns with Owner and Engineer. When possible, combine multiple tie-ins into a single shutdown to minimize impacts on

COORDINATION WITH OWNER'S OPERATIONS

Owner's operations and processes.

5. Do not shut off or disconnect existing operating systems, unless accepted by Engineer in writing. Operation of existing equipment will be by Owner unless otherwise specified or indicated. Where necessary for the Work, Contractor shall seal or bulkhead Owner-operated gates and valves to prevent leakage that may affect the Work, Owner's operations, or both. Provide temporary watertight plugs, bulkheads, and line stops as required. After completing the Work, remove seals, plugs, bulkhead, and line stops to satisfaction of Engineer.

C. Continuous Treatment Provision:

1. Federal regulations prohibit bypassing of untreated or partially treated wastewater or sewage during construction Work.
2. Contractor shall provide labor, equipment, materials, and incidentals to provide continuous treatment to the level prior to construction Work.
3. Contractor shall be responsible for providing temporary pumping facilities, systems, piping, valve, appurtenances, equipment, materials, and temporary utilities necessary to complete the Work without treatment bypassing.

D. Related Sections:

1. Section 01010 - Summary of Work

1.2 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. When possible, combine multiple tie-ins into a single shutdown to minimize impacts on Owner's operations and processes.

B. Pre-Shutdown Meetings: Contractor shall schedule and conduct meeting with Owner and Engineer after acceptance of Shutdown Planning Submittal and a minimum of 7 days prior to scheduling shutdown.

C. Sequencing:

1. Perform the Work in the specified sequence. Certain phases or stages of the Work may require working 24-hour days or work during hours outside of regular working hours. Work may be accelerated from a later stage to an earlier stage if Owner's operations are not adversely affected by proposed sequence change, with Engineer's acceptance. Stages

COORDINATION WITH OWNER'S OPERATIONS

specified in this Section are sequential in performance of the Work.

D. Scheduling:

1. Furnish at the Site, in close proximity to the shutdown and tie-in work areas, tools, equipment, spare parts and materials, both temporary and permanent, necessary to successfully complete the shutdown. Complete to the extent possible, prefabrication of piping and other assemblies prior to the associated shutdown. Demonstrate to Engineer's satisfaction that Contractor has complied with these requirements before commencing the shutdown.
2. If Contractor's operations cause an unscheduled interruption of Owner's operations, immediately re-establish satisfactory operation for Owner.
3. Unscheduled shutdowns or interruptions of continued safe and satisfactory operation of Owner's facilities that result in fines or penalties by authorities having jurisdiction shall be paid solely by Contractor if, in Engineer's opinion, Contractor did not conform to the requirements of the Contract Documents, or was negligent in the Work, or did not exercise proper precautions in conducting the Work.
4. Work requiring service interruptions for tie-ins shall be performed during scheduled shutdowns.
5. Temporary, short-term shutdowns of smaller piping, conduits, equipment, and systems may be required. Coordinate requirements for such shutdowns with Engineer and Owner.

1.3 SUBMITTALS

A. Action/Informational Submittals:

1. Substitute Sequence Submittal: When deviation from specified sequence is proposed, provide submittal explaining in detail the proposed sequence change and its effects, including evidence that Owner's operations will not be adversely affected by proposed change. List benefits of proposed sequence change, including benefits to Progress Schedule.
2. Shutdown Planning Submittal:
 - a. For each shutdown, submit an inventory of labor and materials required to perform the shutdown and tie-in tasks, an estimate of time required to accomplish the complete shutdown including time for Owner to take down and start up existing equipment,

COORDINATION WITH OWNER'S OPERATIONS

systems, or conduits, and written description of steps required to complete the Work associated with the shutdown.

- b. Furnish submittal to Engineer at least thirty (30) days prior to proposed shutdown start date. Do not start shutdown until obtaining Engineer's acceptance of shutdown planning submittal, completion of Pre-Shutdown Meeting, providing Shutdown Notification and written acceptance by the Engineer and Owner.
3. Shutdown Notification: After acceptance of shutdown planning submittal, completion of Pre-Shutdown Meeting and prior to starting the shutdown, provide written notification to Owner and Engineer of date and time each shutdown is to start. Provide notification at least 72 hours in advance of each shutdown.

1.4 SITE CONDITIONS

- A. The following constraints apply to coordination with Owner's operations:
 1. Operational Access: Owner's personnel shall have access to equipment and areas that remain in operation.
 2. Schedule and perform equipment and system start-ups for Monday through Thursday. Equipment and systems shall not be placed into operation on Friday, Saturday, and Sunday without prior approval of Owner.
 3. Owner will assist Contractor in dewatering process tanks, basins, conduits, and other work areas to be dewatered for shutdowns. Maintain clean and dry work area by pumping and properly disposing of fluid that accumulates in work areas.

1.5 SUGGESTED SEQUENCE OF WORK

- A. Perform the Work in the specified sequence outlined below or as otherwise approved by Engineer. Portions of each stage of the Work may require working 24-hour days or work during hours outside of regular working hours. Work may be accelerated from a later stage to an earlier stage if Owner's operations are not adversely affected by proposed sequence change, and with Engineer's acceptance. Stages specified in this Section are sequence-dependent.
 1. Milestone 1 can begin immediately and shall consist of the following items:
 - a. Demolition of existing RBC's.

COORDINATION WITH OWNER'S OPERATIONS

- b. Demolition of existing Aeration Basin No. 3.
 - c. Demolition of existing Aerobic Digester No. 4.
 - d. Improvements to existing Clarifier No. 3.
 - e. Existing Clarifier No. 3 RAS pump station improvements.
 - f. Improvements at existing screening and grit structure.
 - g. Existing scum pump station improvements.
 - h. Existing dewatering building improvements.
2. Milestone 2 can begin after Milestone 1:
- a. Construction of Aeration Basin Nos. 3 & 4.
 - b. Construction of new blower building.
 - c. Construction of new septage receiving station.
 - d. Installation of new generator.
 - e. Existing Clarifier Nos. 1 & 2 improvements.
3. Milestone 3 can begin after Milestone 2:
- a. Improvements to existing Aeration Basin Nos. 1 & 2.
 - b. Improvements to existing blower building.

1.6 SHUTDOWNS

A. General:

- 1. Work that may interrupt normal operations shall be accomplished at times convenient to Owner.
- 2. Furnish at the Site, in close proximity to the shutdown and tie-in work areas, tools, equipment, spare parts and materials, both temporary and permanent, necessary to successfully complete the shutdown. Complete to the extent possible, prefabrication of piping and other assemblies prior to the associated shutdown. Demonstrate to Engineer's satisfaction that Contractor has complied with these requirements before commencing the shutdown.

COORDINATION WITH OWNER'S OPERATIONS

3. If Contractor's operations cause an unscheduled interruption of Owner's operations, immediately re-establish satisfactory operation for Owner.
 4. Unscheduled shutdowns or interruptions of continued safe and satisfactory operation of Owner's facilities that result in fines or penalties by authorities having jurisdiction shall be paid solely by Contractor if, in Engineer's opinion, Contractor did not conform to the requirements of the Contract Documents, or was negligent in the Work, or did not exercise proper precautions in conducting the Work.
- B. Treatment Process Shutdown and Site Access Constraints:
1. Owner shall have roadway access at all times to fill chemical tanks, remove dewatered sludge cake as required and access existing facilities for maintenance and operation.
- C. Shutdowns of Electrical Systems: Comply with Laws and Regulations, including the National Electric Code. Contractor shall lock out and tag circuit breakers and switches operated by Owner and shall verify that affected cables and wires are de-energized to ground potential before shutdown Work is started. Upon completion of shutdown Work, remove the locks and tags and notify Engineer that facilities are available for use.
- D. No Shutdown shall occur on Friday, Saturday, or Sunday.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 DETAILED SHUTDOWN REQUIREMENTS

- A. Prior to Typical Shutdown:
1. Obtain Engineer's acceptance of proposed shutdown planning submittal and shutdown notification submittal.
 2. Submittal and approval of all shop drawings required.
 3. Coordinate with plant operations on timing of shutdown and provide required notice to Owner.
 4. Bring necessary piping, couplings, valves, equipment, and appurtenances to the work areas.
 5. Assist Owner in preparing to take equipment, tanks, basins, and conduits

COORDINATION WITH OWNER'S OPERATIONS

temporarily out of service.

6. Coordinate other tie-ins to be performed simultaneously.
7. Install and ensure functionality of temporary systems as applicable.

B. During Typical Shutdown:

1. Remove existing equipment, piping, and accessories as required.
2. Verify operation of new equipment, materials, and systems.
3. Following approval from Engineer, return equipment and system to operation with Owner.

C. Following Typical Shutdown:

1. Verify functionality of equipment and system.
2. Verify operation of new equipment and systems and verify that joints in piping are watertight or gastight as applicable.
3. Repair joints that are not watertight or gastight as applicable.
4. Remove temporary systems as applicable.

3.2 PROPOSED SHUTDOWN SEQUENCE

A. Shutdown No. 1 Description: Installation of MJ plugs on existing 36" MXL to isolate Aeration Basin Nos. 1 & 2 feed during demolition of existing Aeration Basin No. 3 and RBC's.

1. General:
 - a. Impact on Other Equipment and Processes: No Impact. Influent flow can be bypassed to equalization lagoon during shutdown.
 - b. Location: Influent pipe to existing Aeration Basin No. 3 and existing Aeration Basins Nos. 1 & 2.
 - c. This work shall be completed in 8 continuous hours.
2. Prior to Shutdown:
 - a. Remove all liquid and solid waste from existing Aeration Basin No. 3 and the RBC's.

COORDINATION WITH OWNER'S OPERATIONS

- b. Isolate 30" INF with slide gates at drum screens shown on Sheet M02.10. This will divert all flow to the equalization lagoon.
 - c. Close slide gate to RBC's in RBC Splitter Box.
 - d. Close influent slide gates at existing Aeration Basin Nos. 1 & 2.
 - e. Assist Owner in preparing to take equipment, tanks, basins, and conduits temporarily out of service.
 3. During Shutdown:
 - a. Work shall continue until MJ plugs are installed as shown.
 4. Following shutdown:
 - a. Visually confirm piping tie-in locations do not leak prior to backfilling.
 - b. Backfill the tie-in location in accordance with contract documents.
 - c. Open slide gate at drum screens to return influent flow to the existing Aeration Basin Nos. 1 & 2. Close slide gate for bypass to equalization lagoon.
- B. Shutdown No. 2 Description: Tie-in of 30"/36"INF piping to serve new and existing Aeration Basin Nos. 1 & 2:
 1. General:
 - a. Impact on Other Equipment and Processes: No Impact on existing. Influent flow can be bypassed to equalization lagoon during shutdown. The new splitter box will need to be ready to be placed in service.
 - b. Location: Influent pipe to existing Aeration Basin No. 3 and existing Aeration Basins Nos. 1 & 2.
 - c. This work shall be completed in 8 continuous hours, otherwise, bypass pumping from the existing drum screens to the existing Aeration Basins Nos. 1 & 2 will be required.
 2. Prior to Shutdown:
 - a. Isolate 30" INF with slide gates at drum screens shown on Sheet

COORDINATION WITH OWNER'S OPERATIONS

- M02.10. This will divert all flow to the equalization lagoon.
- b. Close influent slide gates at existing Aeration Basin Nos. 1 & 2.
 - c. Assist Owner in preparing to take equipment, tanks, basins, and conduits temporarily out of service.
 - d. Specific requirements: The new splitter box and associated weir gates and slide gates shall be ready to be placed into service.
3. During Shutdown:
 - a. Work shall continue until tie-ins are complete.
 4. Following shutdown:
 - a. Visually confirm piping tie-in locations do not leak prior to backfilling.
 - b. Backfill the tie-in location in accordance with contract documents.
 - c. Open slide gate at drum screens to send influent flow to new splitter box.
- C. Shutdown No. 3 Description: Tie-in of new effluent channel from Aeration Basin Nos. 3 & 4 to existing effluent channel from Aeration Basin Nos. 1 & 2:
1. General:
 - a. Impact on Other Equipment and Processes: No Impact. Influent flow can be bypassed to equalization lagoon during shutdown. The effluent channel at the new aeration basin must be ready to be placed in service.
 - b. Location: New and existing effluent channels at aeration basins.
 - c. This work shall be completed in 8 continuous hours.
 2. Prior to Shutdown:
 - a. Isolate 30" INF with slide gates at drum screens shown on Sheet M02.10. This will divert all flow to the equalization lagoon.
 - b. Plug 30"MXL at existing effluent channel to dewater channel for tie-in.

COORDINATION WITH OWNER'S OPERATIONS

- c. Assist Owner in preparing to take equipment, tanks, basins, and conduits temporarily out of service.
 - d. Specific requirements: The effluent channel at the new aeration basin must be ready to be placed in service.
3. During Shutdown:
- a. Work shall continue until tie-ins are complete.
4. Following shutdown:
- a. Visually confirm piping tie-in locations do not leak prior to backfilling.
 - b. Backfill the tie-in location in accordance with contract documents.
 - c. Remove plug at 36"MXL and open slide gate at drum screens to send influent flow to new splitter box.

END OF SECTION

SECTION 01111
PERMITS, RIGHTS-OF-WAY AND GEOTECHNICAL REPORT

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section establishes requirements pertaining to the securement and payment for licenses, building permits, rights-of-way, etc. necessary for the construction of the project. Geotechnical report is included for reference only.

1.2 SUBMITTALS

- A. Submit to the Engineer satisfactory evidence that all necessary licenses, building permits, etc., have been secured prior to commencing the work.

PART 2 - PRODUCTS

No products are required for this work.

PART 3 - EXECUTION

3.1 BUSINESS LICENSE

- A. Determine licenses necessary to perform the work at project location.
- B. Obtain all necessary licenses at no additional cost to the Owner.

3.2 BUILDING PERMITS

- A. Secure and pay for all building permits required, whether of temporary or permanent nature.

3.3 RIGHTS-OF-WAY, UTILITY LINES

- A. Owner will provide necessary rights-of-way or easements for construction of utility lines, whether on privately or publicly owned property.
- B. The Owner will provide no right-of-way over other property.

3.4 LAND

- A. The necessary land for construction of treatment facilities, etc., will be provided by the Owner.

PERMITS AND RIGHTS-OF-WAY

3.4 PERMITS, AGREEMENTS AND APPROVALS

A. The following permits shall be secured prior to construction:

1. SCDHEC Permit to Construct
2. NOI

3.5 GEOTECHNICAL REPORT

A. The attached geotechnical report is included for reference only.

END OF SECTION

Attachment: Geotechnical Report
SCDHEC Permit to Construct
NOI



REPORT OF SUBSURFACE EXPLORATION

Lake Swamp Wastewater Treatment Plant Improvements

Lake City, South Carolina
ESP Project Number: IT15.300

Prepared For:

Constantine Engineering, Inc.
4000 Faber Place Drive
Suite 330
North Charleston, South Carolina 29405

Prepared By:

ESP Associates, Inc.
2154 North Center Street
Suite E-503
North Charleston, SC 29406

October 1, 2020



October 1, 2020

Dan Huggins, PE
DHuggins@tcgeng.com
Constantine Engineering, Inc.
4000 Faber Place Drive
Suite 330
North Charleston, South Carolina 29405

Reference: **REPORT OF SUBSURFACE EXPLORATION**
Lake Swamp Wastewater Treatment Plant Improvements
Lake City, South Carolina
ESP Project No. IT15.300

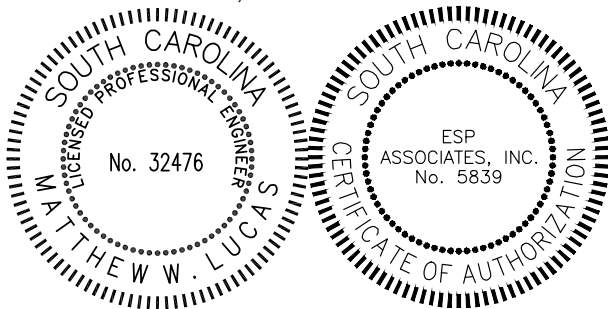
Mr. Huggins:

ESP Associates, Inc. (ESP) has completed a subsurface exploration for the proposed Lake Swamp Wastewater Treatment Plant (WWTP) Improvements in Lake City, South Carolina. This exploration was performed in general accordance with our Proposal No.E4D-20314 dated June 9, 2020, as authorized by issuance of Standard Subcontract Agreement for Professional Services (Constantine Project No. 100392.02) dated August 13, 2020.

ESP appreciates the opportunity to assist you during this phase of the project. If you should have any questions concerning this report, or if we may be of further assistance, please contact us.

Sincerely,

ESP Associates, Inc.



Matthew W. Lucas, PE
Project Manager
SC PE 32476

Michael S. Ulmer, PE
Senior Engineer

MWL/MSU, Submitted via email

Table of Contents

1.0 INTRODUCTION	1
1.1 Purpose of Services	1
1.2 Site Description	1
1.3 Project Description	1
2.0 EXPLORATION PROCEDURES	3
2.1 Field.....	3
2.1.1 Cone Penetration Tests	3
2.1.2 Hand-Auger Borings.....	3
2.2 Site Geology.....	3
2.3 Subsurface Findings	3
2.3.1 Surface Materials and Fill.....	4
2.3.2 Coastal Plain Deposits	4
2.4 Subsurface Water.....	4
3.0 CONCLUSIONS AND RECOMMENDATIONS	5
3.1 Geotechnical Considerations	5
3.2 Site Development.....	5
3.2.1 Site Preparation.....	5
3.2.2 Fill Material and Placement.....	6
3.2.3 Temporary Excavations	6
3.3 Seismic Considerations.....	6
3.4 Foundation Support.....	7
3.4.1 Shallow Foundation Support.....	7
3.5 Considerations for Below-Grade Structures	8
3.5.1 Dewatering	8
3.5.2 Subgrade Stabilization	8
3.5.3 Uplift and Buoyancy Forces	9
3.5.4 Lateral Earth Pressures	9
3.5.5 Lateral Earth Pressure Parameters with Earthquake Effects	10
3.6 Slab-On-Grade	11
4.0 OTHER CONSIDERATIONS	12
4.1 Drainage.....	12
4.2 Construction Adjacent to Nearby Structures.....	12
5.0 LIMITATIONS of REPORT	13

APPENDIX

Field Exploration Procedures
Test Location Plan, Figure 1
Generalized Subsurface Profile, Figure 2
Cone Penetration Test Records, (C-1 through C-5)
Hand Auger Boring Records (C-1 Through C-5)

1.0 INTRODUCTION

1.1 Purpose of Services

The purpose of the exploration was to evaluate the general subsurface conditions within the areas of the structures planned for the improvements at the existing facility. This report contains a brief description of the field testing procedures performed for this study and a discussion of the soil conditions encountered at the site. Our findings, conclusions and recommendations for foundation design, as well as construction considerations for the proposed foundations and below-grade structures are presented within this report.

1.2 Site Description

Improvements are planned at the existing Lake Swamp WWTP located on Cemetery Road approximately half a mile north of its intersection with Hwy 341 in Lake City, South Carolina. The plant is bordered by: agriculture fields to the south and west; wooded properties to the north; and wooded properties, Martha Law Municipal Park, and a lagoon to the east. Project plans indicate the following existing structures are located in the southern portion of the plant site: Aeration Basin No. 1; another Aeration Basin (not labelled); Rotating Biological Contactors No. 1 and No. 2; Aerobic Digesters; and other plant structures, piping, and ancillary elements. An asphalt paved loop drive is located around those plant elements with grass covered areas between the structures. Various other plant structures and drives are located north of this area.

1.3 Project Description

We understand the Aeration Basin (not labelled), Rotating Biological Contactors No 1 and No 2, and a portion of Aerobic Digester structure will be demolished. A new, below-grade Aeration Basin No 2 with a connected splitter box will be constructed northwest of the existing Aeration Basin No 1. Aeration Basin No 2 will be a concrete structure approximately 130 feet long by 65 feet wide. The top of wall elevation will be +71 feet, and the base will bear at approximate elevation +51 feet. The existing ground surface in the area is approximately +70 to +71 feet, so the basin will be approximately 20 feet below grade. The splitter box walls and base will also be concrete and will be approximately 20 feet long by 24 feet wide. The splitter box base will bear approximately at elevation +63 feet. Several pipes will be connected to the basin and splitter box.

A new Septage Receiving structure with a connected 8-foot diameter wet well will be constructed southwest of Aeration Basin No. 2 and the existing asphalt drive. The Septage Receiving structure will be a concrete slab-on-grade approximately 55 feet long by 12 feet wide and will consist of a Septage Receiving Station, a pump, and various aboveground and underground pipes. The Septage Receiving Station will weigh approximately 6,000 pounds and be supported on an equipment pad approximately 12 feet long by 5 feet wide built into the slab-on-grade. The pump will weigh approximately 1,500 lbs, and we assume it will be supported on an isolated footing built into the slab. The wet well will be a precast concrete structure and bear approximately at elevation +57.5 feet.



A new, one-story Blower Building will be constructed south of the Septage Receiving structure. The Blower Building will be approximately 18-feet long by 18-feet wide. We assume the blower building will be of masonry and/or wood-framed construction with a slab-on-grade and have maximum column and wall loads of 30 kips and 2 kips/foot, respectively. The Blower Building will house Blower Nos 1 through 3 and have an electrical room. We understand the blowers will weight approximately 6,000 pounds each and be supported on isolated footings.

The provided grading plan indicates existing ground surface elevations in the areas of the Septage Receiving structure and Blower Building ranges from approximately +70 feet to +71 feet. We assume Finished Floor Elevation will be near the existing grades and cut and fill depths will be 1 foot or less.

Project information was obtained from the 30% design drawings¹ provided by Mr. Dan Huggins, PE with Constantine Engineering, Inc. in an email to Mr. Matthew Lucas, PE of ESP on August 13, 2020. Additional project information was provided by Mr. Huggins in an email to Mr. Lucas dated September 24, 2020.

The project information and assumptions presented herein should be reviewed and confirmed by the appropriate team members. Modifications to our findings and recommendations may be required if the actual conditions vary substantially from the project information and assumptions stated herein.

¹ Lake Swamp WWTP Upgrade – 30% Submittal, prepared for City of Lake City by Constantine Engineering, dated July 2020, Constantine Project No. 100392.02.

2.0 EXPLORATION PROCEDURES

2.1 Field

The following methods were used to evaluate the subsurface conditions of the site. Additional descriptions of the field exploration procedures are also presented in the Appendix. The test locations were located in the field by an ESP geotechnical engineer using the existing structures as references to measure distances and approximate right angles, and their locations are approximate. While in the field, a geotechnical engineer visually examined the soil encountered in the hand auger borings to evaluate the type of soil, soil plasticity, moisture condition, organic content, presence of lenses and seams, colors and apparent geological origin using general guidance from “ASTM D 2488 Standard Practice for Description and Identification of Soils (Visual Manual Procedures).” Test locations are shown on the attached “Test Location Plan,” Figure 1.

2.1.1 Cone Penetration Tests

Five Cone Penetration Test (CPT) soundings labelled C-1 through C-5 were extended 25 to 47½ feet below the existing ground surface on August 19, 2020. The detailed results of CPT testing are presented on the attached “Cone Penetration Test” records. A slotted PVC standpipe was installed in test hole C-3 to a depth of 20 feet to allow for a subsurface water level measurement at least 24 hours later. An ESP representative returned to the site on August 21, 2020, and measured the subsurface water level in the standpipe.

2.1.2 Hand-Auger Borings

Hand-auger borings were extended to depths of 1 to 4 feet below the existing ground surface adjacent to each of the soundings to further evaluate near-surface soils. The borings were attempted to 4 ft, but test locations C-1, C-2, and C-2a were terminated in fill soils due to hand auger refusal. Test location C-5 was terminated a depth of 3 feet because the borehole was caving and could not be advanced deeper. The results of the visual soil classifications for the borings are presented on the attached “Hand Auger Boring Records.” Similar soils were grouped into strata; however, the actual transition between soil types in the field may be gradual in both the horizontal and vertical directions.

2.2 Site Geology

The referenced property is located in Lake City, South Carolina, which is situated in the Lower Coastal Plain Unit of South Carolina. In general, this region contains surface Quaternary alluvial deposits underlain by Tertiary aged, well consolidated layers of sands, silts, or clays that were deposited by marine or fluvial action during the periods of retreating ocean shoreline. These Tertiary “marl” deposits were encountered at the site.

2.3 Subsurface Findings

The exploration indicates the subsurface conditions generally consist of topsoil, fill, and coastal plain deposits. The generalized subsurface conditions at the site are described below and are graphically depicted in the “Generalized Subsurface Profile,” Figure 2 in the Appendix. For more detailed soil

descriptions and stratifications at a particular test location, the attached “Cone Penetration Test” records and “Hand Auger Boring Records” should be reviewed. The ground surface elevations indicated on the records were interpolated from the provided topographic survey and are approximate.

2.3.1 Surface Materials and Fill

The exploration initially encountered organic laden topsoil 2 to 3 inches thick underlain by fill and possible fill soils to a depth 1 to 4 feet below the existing ground surface. The fill soils typically consisted loose to medium dense clayey sand and soft to firm sandy clay with trace roots and trace gravel. Borings C-1, C-2, C-2a, and C-5 were terminated in fill soils due to refusal or borehole cave in; therefore, fill soils could extend deeper than the termination depth of the borings.

2.3.2 Coastal Plain Deposits

Beneath the surface materials and fill, the exploration encountered interbedded layers of firm to very stiff sandy clay and loose to medium dense sand to the top of the marl, which was encountered in sounding C-3 approximately 43 feet below the existing ground surface (approximate elevation +28 feet) and extended to termination at 47¾ feet.

2.4 Subsurface Water

The generalized subsurface water conditions encountered during our exploration are described below in Table 1. For more detailed information, the attached “Cone Penetration Test” records and “Hand Auger Boring Records” should be reviewed. Test Locations were backfilled upon completion of the field testing.

Table 1 – Subsurface Water Summary

Test Location	Water Depth at Time of Testing (feet)	Water Depth at 2 Days After Testing (feet)	Cave-In Depth of CPT at Time of Testing (feet)
C-1	6½	n/a	n/a
C-2	7	n/a	n/a
C-3	n/a	7 ½	n/a
C-4	n/a	n/a	4½
C-5	n/a	n/a	4½*

*Hand auger borehole caved at a depth of 3 ft

Note: Hole cave-in depths may provide an indication of water presence.

Subsurface water levels tend to fluctuate with seasonal and climatic variations, as well as with some types of construction operations. Therefore, water may be encountered during construction at depths not indicated during this study.

3.0 CONCLUSIONS AND RECOMMENDATIONS

3.1 Geotechnical Considerations

Based on the project information previously discussed, the data obtained from the field testing program and our analysis, the site is adaptable to the proposed construction. The primary geotechnical considerations that should be considered and addressed in the proposed development are listed below and are further discussed in the following sections of this report.

- Potentially liquefiable sands
- Shallow foundation recommendations
- Site development recommendations
- Considerations for below-grade structures
 - Dewatering
 - Uplift and Buoyancy Forces
 - Lateral earth pressures (Static and Seismic)
 - Stabilization of excavation bottoms

Our conclusions and recommendations are based on the project information previously discussed and on the data obtained from the field and laboratory testing program. If the structural loading, geometry, or proposed building locations are changed or significantly differ from those discussed, or if conditions are encountered during construction that differ from those encountered by the borings, ESP should be provided this information so that we can review our recommendations based on the new information and make any necessary changes.

3.2 Site Development

3.2.1 Site Preparation

The building areas should be stripped of all topsoil, other organic debris, and unsuitable fill soils to a minimum of 10 feet beyond the structural limits. It has been our experience that stripping depths of topsoil may vary from the depths recorded on the “Hand Auger Boring Records” due to variability between boring locations. Deeper stripping may be required in some areas and may be dependent on surface conditions at the time of grading, such as wetter conditions during winter months. It is often desired by project owners to place topsoil/strippings in non-structural areas of the site.

Upon completion of the stripping operations, the exposed subgrade in the Blower Building and Septage Receiving Station should be evaluated by the Geotechnical Engineer by proofrolling and/or probing and hand-auger borings with DCP testing. Proofrolling should consist of overlapping passes of the exposed areas with a loaded dump truck or similar pneumatic tired vehicle (minimum loaded weight of 20 tons) under the observation of a representative of the geotechnical engineer. Unstable areas should be undercut to suitable soils and replaced with well-compacted structural fill. After the subgrade evaluation, site grading should proceed immediately.

3.2.2 Fill Material and Placement

Fill used for site grading operations should consist of a clean (free of organics and debris), low plasticity soil (Plasticity Index less than 30). The proposed fill should have a maximum dry density of at least 100 pounds per cubic foot as determined by a Standard Proctor Moisture-Density Relationship test, ASTM D 698. All fill should be placed in loose lifts not exceeding 8 inches in thickness and compacted to a minimum of 95 percent of its Standard Proctor maximum dry density. We recommend that field density tests, including one-point Proctor verification tests, be performed on the fill as it is being placed at a frequency determined by an experienced geotechnical engineer to verify the compaction criteria.

3.2.3 Temporary Excavations

Excavations greater than 4 feet in depth should be sloped or shored in accordance with local, state, and federal regulations, including OSHA “Construction Standard for Excavations” (29 CFR Part 1926.650-652). The contractor is usually solely responsible for site safety. This information is provided only as a service and under no circumstances should ESP be assumed to be responsible for construction site safety.

3.3 Seismic Considerations

Important note: South Carolina adopted the 2018 edition of the International Building Code (IBC 2018) on January 1, 2020. For determination of design loads, IBC 2018 references ASCE 7-16, which includes revised seismic hazard provisions. The seismic loads (i.e., the spectral accelerations used to compute the base shear under seismic loading) are higher under IBC 2018 than they are under IBC 2015.

We performed a liquefaction analysis based on the design earthquake prescribed by the 2018 edition of the International Building Code (IBC 2018).²An age correction factor, which increases the liquefaction resistance of older sand deposits of the type that were encountered at this site, was applied.³ This analysis indicates the loose to medium dense sands below the groundwater level to a depth of approximately 20 ft below the existing ground surface have the potential to liquefy during the design seismic event. Our analysis predicts free-field liquefaction-induced settlements on the order of 1 in. are possible at the site.

To help evaluate the consequences of liquefaction, we have computed the Liquefaction Potential Index (LPI), which is an empirical tool used to evaluate the potential for liquefaction to cause damage.⁴ The LPI considers the factor of safety against liquefaction, the depth to the liquefiable soils, and the thickness of the liquefiable soils to compute an index that ranges from 0 to 100. An LPI of 0 means there is no risk of

² Liquefaction, the loss of a soil's shear strength due to the increase in porewater pressure resulting from seismic vibrations, is always a potential concern in coastal South Carolina. Analysis was performed using the “simplified procedure” presented by Youd et al. (2001).

The IBC design earthquake has a hazard equal to 2% probability of exceedance in 50 years. This is statistically equivalent to an event that occurs about once every 2,476 years. The design ground motions incorporate a target risk of structural collapse equal to 1% in 50 years. Our liquefaction analysis was based on an earthquake with a magnitude of 7.3 and ground surface acceleration of 0.32g.

³ Hayati & Andrus (2008), Andrus et al (2009), Hayati & Andrus (2009).

⁴ Iwasaki et al. 1982, Toprak & Holzer (2003).

liquefaction; an LPI of 100 means the entire profile is expected to liquefy. The level of risk is generally defined as:

- **LPI < 5** – surface manifestation and liquefaction-induced damage not expected.
- **5 ≤ LPI ≤ 15** – moderate liquefaction with some surface manifestation possible.
- **LPI > 15** – severe liquefaction and foundation damage is likely.

The LPI for this site is about 4, which indicates the risk of liquefaction is low and liquefaction-induced damage is not expected.

Section 1613.2.2 of the IBC 2018 classifies sites with the potential for liquefaction as Seismic Site Class F. However, the IBC 2018 allows the design spectral response accelerations for a site to be determined without regard to liquefaction provided the structure has a fundamental period of less than or equal to 0.5 seconds and the risks of liquefaction are considered in design. We assume the proposed structures will meet this criteria, but this must be confirmed by the Structural Engineer. Provided the above criteria are met, the design accelerations may be calculated using Site Class D site coefficients, but the Site Class is still F. If the fundamental period of the structures will be greater than 0.5 seconds, the code requires Site-Specific Ground Motions Procedures be performed.

Table 2 – Ground Motion Parameters

Site Class	S _s	S ₁	F _a	F _v	PGA _M	S _{DS}	S _{D1}
F	0.43	0.14	1.46	2.31	0.32	0.41	0.22

3.4 Foundation Support

For satisfactory performance, the foundation for any structure must satisfy two independent design criteria. First, it must have an acceptable factor of safety against bearing failure of the foundation soils under the maximum design loads. Second, the settlement of the foundations due to elastic compression and/or consolidation of the underlying soils should be within tolerable limits for the structures.

3.4.1 Shallow Foundation Support

Our analyses indicate that the proposed Blower Building, Blower No's 1 through 3, and Septage Receiving Station and pump can be supported on shallow foundations bearing on existing site soils or newly-placed structural fill, provided the site preparation and fill placement procedures outlined in this report are implemented. A maximum net allowable bearing pressure of up to 2,000 pounds per square foot (psf) can be used for sizing foundations. Minimum wall and column footing dimensions of 18 and 24 inches, respectively, should be maintained to reduce the possibility of a localized, punching-type shear failure. Exterior foundations and foundations in unheated areas should be designed to bear at least 18 inches below finished grade for frost protection.

We predict total and differential settlement for the proposed structures should be on the order of 1 inch and ½ inch, respectively. This conclusion is contingent upon compliance with the site preparation and fill placement recommendations outlined in this report.

Aeration Basin No. 2, the splitter box, and wet well will be constructed 7 to 20 feet below the ground surface and will be filled with fluids associated with plant operations. We assume the weight of the fluid-filled structures will be less than the weight of the soil removed to install the structure, so there will be no net stress increase and no significant settlement of the underlying soils. If any heavy equipment or loads will be applied to these structures, these could induce settlements of the structures. We should be contacted to reevaluate static settlements based on the addition of any such structural loads.

We recommend that the subgrade soils be observed by a representative of the geotechnical engineer prior to foundation installation. This is to assess their suitability for foundation support and confirm their consistency with the conditions upon which our recommendations are based.

The subgrade materials can be sensitive to moisture variations; therefore, foundation excavations should be opened for a minimum amount of time, particularly during inclement weather. Soils exposed to moisture variations may become highly disturbed and require undercutting prior to placing foundations.

3.5 Considerations for Below-Grade Structures

Aeration Basin No. 2, the Splitter Box, and the wet well will require excavations on the order of 20 feet, 7 feet, and 13 feet deep, respectively, based on the planned bearing depths and existing ground surface elevations on site. The following geotechnical considerations due the planned excavation depths should be taken into account in the planning and design of the below-grade structures.

3.5.1 Dewatering

Dewatering will be required to construct Aeration Basin No. 2, the Splitter Box, the wet well, and associated piping. Dewatering can be accomplished by pumping from sumps located in the excavation or by using a well-point system. Water levels should be maintained at least 12 inches below the excavation bottom to maintain bottom stability. The dewatering program should be designed by the contractor to adequately lower subsurface water levels so the proposed construction can be completed. Pumping should be maintained until construction is complete. These effects of dewater on adjacent structures should be considered in the system design.

3.5.2 Subgrade Stabilization

Based on our experience with similar subsurface conditions and construction activities, we anticipate that soils at the bottom of the deeper excavations for Aeration Basin No. 2, the Splitter Box, and wet well will be soft, wet, and unstable. Excavation bottoms can be stabilized by placing a non-woven geotextile (e.g., Tencate Mirafi® 140N or equivalent) and 18 to 24 inches of crushed stone (e.g., #57 washed stone). The crushed stone can also provide a good leveling course.

3.5.3 Uplift and Buoyancy Forces

Uplift and buoyancy forces will be a factor for the below-grade structures. If the uplift forces are approximately equal to or greater than the weight of the structure, it will be necessary to design the structures to resist uplift forces. Structural keys or an anchor system such as helical piles can be used to resist uplift forces. In general, the structural keys extend beyond the planned footprint of the structure to engage the weight of the soils overlying the keys to resist the uplift forces. If necessary, we can provide recommendations for helical piles.

3.5.4 Lateral Earth Pressures

Soil retaining structures must be capable of resisting lateral earth pressures that will be imposed on them. Lateral earth pressures to be resisted by the walls will be partially dependent upon the method of construction. Assuming the walls are relatively rigid and structurally braced against rotation, they should be designed for a condition approaching the "at-rest" lateral pressure. However, in the event the walls are not restrained or rigidly braced, the "active" pressure conditions will be applicable for design. The following lateral earth pressure parameters are recommended for design. These parameters assume a level backfill, a frictionless wall, and no hydrostatic pressure.

Table 3 – Lateral Earth Pressure Parameters

Lateral Earth Pressure Condition	Coefficient	Equivalent Fluid Pressure
At-Rest Condition	$(K_o) = 0.50$	55.0 psf/ft
Active Condition	$(K_A) = 0.33$	36.7 psf/ft
Passive Condition	$(K_P) = 3.00$	330.0 psf/ft
Unit Weight of Soil (Moist)	110 pcf	
Friction Factor for Foundations and Bearing Soils	0.36	

The recommended lateral earth pressure coefficients do not consider the development of hydrostatic pressure behind the earth retaining wall structures. Hydrostatic forces must be included in the analyses, or where drainage is appropriate, positive wall drainage must be provided for all earth retaining structures. These drainage systems can be constructed of open-graded washed stone isolated from the soil backfill with a geosynthetic filter fabric and drained by perforated pipe, or several wall drainage products are made specifically for this application. Lateral earth pressures arising from surcharge loading and any slopes above the walls should be added to the above earth pressures to determine the total lateral pressure.

During backfilling against the wall, care should be taken to prevent the backfill from being over-compacted, as this could result in excessive lateral stresses against the wall. In the same regard, heavy equipment should not be used for the compaction of the fill or operated adjacent to the wall. A free draining granular material should be used for backfilling behind the wall. We recommend that proper surface drainage be provided to route surface water away from the wall.

3.5.5 Lateral Earth Pressure Parameters with Earthquake Effects

Section 1803.5.12 of IBC 2018 requires structures that are determined to be in Building Design Category D, E, or F be evaluated for lateral pressures on retaining walls due to earthquake motions. For smooth rigid (i.e., non-yielding) walls, Wood⁵ developed the following equations for determining the dynamic thrust and dynamic overturning moment about the base of the wall:

$$\Delta P_{eq} = \gamma H^2 (a_h/g) F_p$$

$$\Delta M_{eq} = \gamma H^3 (a_h/g) F_m$$

Where H is the height of the wall, L is the distance between walls, g is gravity, a_h is the amplitude of the harmonic base acceleration (0.32g for this project), and F_p and F_m are the dimensionless dynamic thrust and moment factors shown in the Figures 3 and 4, respectively.

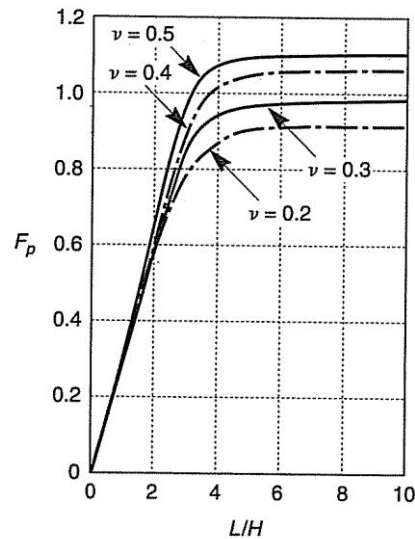


Figure 3: Dimensionless thrust factor for various geometries and soil Poisson's ratio values.

⁵ "Earthquake-induced soil pressures on structures," *Report EERL 73-05*, California Institute of Technology, Pasadena, California, 311 pp.

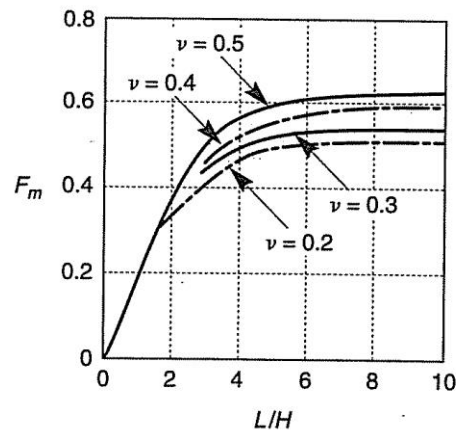


Figure 4: Dimensionless moment factor for various geometries and soil Poisson's ratio values.

The point of application of the dynamic thrust is at a height H_{eq} above the base of the wall where:

$$H_{eq} = \Delta M_{eq} / \Delta P_{eq}$$

A Poisson's ratio of 0.3 may be used for controlled fill and coastal plain soils. If the below grade walls are designed as yielding, cantilevered elements, then the above equations will not apply and those developed by Mononobe-Okabe will be more applicable. We can provide MO parameters if necessary.

3.6 Slab-On-Grade

The slabs-on-grade should be completely isolated from the structural components to allow independent movements between the slab and the foundations of the structure. The slab-on-grade floor system can be adequately supported on the native soils or newly compacted fill provided the site preparation and fill placement procedures outlined in this report are implemented. We recommend a modulus of subgrade reaction (k_s) of 150 pounds per square inch per inch (pci) be used for grade slab design. The value is indicative of a 30-inch-diameter plate load test and must be reduced for wide area loads. If a stone base material is used, an adjusted (composite) modulus of subgrade reaction may be appropriate for slab design.

The need for a base material between the soil subgrade and the slab-on-grade is dependent on subgrade soil strength characteristics, variability of subgrade soil constituents, and the free draining characteristics of the subgrade soils. The inclusion of a water vapor retarder beneath the floor slab is a design element based on the subgrade constituents and design use of the structure and floor covering systems. For design guidance, refer to ACI 360R Design of Slabs on Grade, ACI 302.1R-15 Guide for Concrete Floor and Slab Construction and ASTM E1643 Standard Practice for Installation of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs.

Immediately prior to constructing the floor slabs, we recommend that the areas be proofrolled or otherwise evaluated to detect unstable, soft areas or areas that may have been exposed to wet weather or construction traffic. Areas that are found to be unstable or soft during the evaluation should be undercut and replaced with adequately compacted structural fill. The evaluation should be performed by a representative of the geotechnical engineer.

4.0 OTHER CONSIDERATIONS

4.1 Drainage

Soil strength and settlement potential is highly dependent upon the moisture condition of the supportive soil. Soil characteristics can change dramatically when moisture conditions change. As such, pads for the structures and surrounding grades should be properly designed and constructed to properly control water (surface and subsurface). Pads for the structures should be designed to shed surface water prior to building construction. Grades surrounding structures should be adequately sloped away from the structure to promote positive drainage and prevent water from ponding near or against the structure. Swales and/or storm drainage structures should be constructed to collect and remove all surface water run-off. All roof drain downspouts should be connected to drain leaders that are properly daylighted or connected to storm drainage structures such that water is removed from structural areas. Foundation drains should be designed and constructed to properly protect foundations from changing moisture conditions. Foundation drains constructed should be properly daylighted or connected to storm drain structures to remove all water from foundation areas. Roof drain lines and foundation drain lines should always remain independent of each other. Any subsurface water that may rise near structural grades should be controlled by adequately constructed subsurface drainage mechanisms.

4.2 Construction Adjacent to Nearby Structures

Several aspects of construction at this site could adversely affect the adjacent plant structures and utilities. Therefore, proper design and special care during construction will be needed to protect the adjoining properties. These items are discussed below.

Razing existing structures, jackhammering, and other construction activities can generate vibrations. These vibrations can cause damage to adjacent structures if not properly controlled. Care must be taken to prevent damage of existing structures and newly placed structures, especially fresh concrete. We recommend that vibration monitoring be performed for structures located nearby during the construction activities that generate a large amount of vibration. This will reduce the potential for large magnitude vibrations and damage to plant facilities.

Excavations for the planned plant improvements could undermine foundations of nearby existing plant facilities. The contractor should implement measures to avoid undermining and damaging existing structures when excavating adjacent to existing structures.

General site dewatering can sometimes cause settlement of adjacent structures due to an increase in effective stresses which can consolidate soils. Based on planned structures being near existing structures and planned excavation depths on the order of 7 to 20 feet, this could be a problem at this site. Additionally, pumping of fine soil particles due to improper dewatering techniques can result in unwanted subsidence. As such, dewatering systems should be properly designed and implemented by the contractor to reduce settlement of existing plant structures. Therefore, proper dewatering systems, if required, should be implemented to reduce these effects.

5.0 LIMITATIONS of REPORT

This report has been prepared in accordance with generally accepted geotechnical engineering practice with regard to the specific conditions and requirements of this site. The conclusions and recommendations contained in this report were based on the applicable standards of our practice in this geographic area at the time this report was prepared. No other warranty, expressed or implied, is made.

The analysis and recommendations submitted herein are based, in part, upon the data obtained from the subsurface exploration. The nature and extent of variations between the CPT soundings and hand auger borings will not be known until construction is underway. If variations appear evident, then we request the opportunity to re-evaluate the recommendations of this report. In the event that any changes in the nature, design, or location of the structures are planned, the conclusions and recommendations contained in this report will not be considered valid unless the changes are reviewed and conclusions modified or verified in writing by ESP.

In order to verify that earthwork and foundation recommendations are properly interpreted and implemented, we recommend that ESP be provided the opportunity to review the final plans and specifications. Any concerns observed will be brought to our client's attention in writing.

Our conclusions and recommendations are based on the project information previously discussed and on the data obtained from the field and laboratory testing program. If the structural loading, geometry or proposed building locations are changed or significantly differ from those discussed, or if conditions are encountered during construction that differ from those encountered by the borings, ESP requests the opportunity to review our recommendations based on the new information and make any necessary changes.



FIELD EXPLORATION

Cone Penetration Test: The CPT tooling was advanced from the existing ground surface utilizing a skidsteer rig. In the CPT soundings, an electronically instrumented cone penetrometer was pushed through the soil in order to obtain data for estimating soil strength and consistency.

Hand Auger Boring: Hand auger borings were performed at the approximate locations shown on the attached "Test Location Plan," Figure 1. The borings were advanced by manually twisting an auger into the ground. The soils encountered were identified, in the field, from cuttings brought to the surface by the hand auger process. The different soil strata was noted along with the depth. Auger boring records are attached showing the soil descriptions.

Temporary PVC Standpipes: A temporary PVC standpipe was installed in sounding hole C-3 to prevent the hole from caving. A closed end, hand slotted portion of the PVC pipe was attached to the bottom of the PVC pipe to allow groundwater to enter the standpipe.



ESP Corporate Office

3475 Lakemont Blvd.
Fort Mill, SC 29708
803.802.2440

Mailing
PO Box 7030
Charlotte, NC 28241

Raleigh

2200 Gateway Centre Blvd.
Suite 216
Morrisville, NC 27560
919.678.1070

Greensboro

7011 Albert Pick Rd.
Suite E
Greensboro, NC 27409
336.334.7724

Concord

7144 Weddington Rd.
NW Suite 110
Concord, NC 28027
704.793.9855

Lake Norman

20484 Chartwell Center Dr.
Suite D
Cornelius, NC 28031
704.990.9428

Columbia

2711 Alpine Rd.
Suite 200
Columbia, SC 29223
803.705.2229

Charleston

2154 N. Center St.
Suite E-503
North Charleston, SC 29406
843.714.2040

Wilmington

211 Racine Dr.
Suite 101
Wilmington, NC 28403
910.313.6648

Indianapolis

8673 Bash St.
Indianapolis, IN 46256
317.537.6979

Bradenton

518 13th St. West
Bradenton, FL 34205
941.345.5451

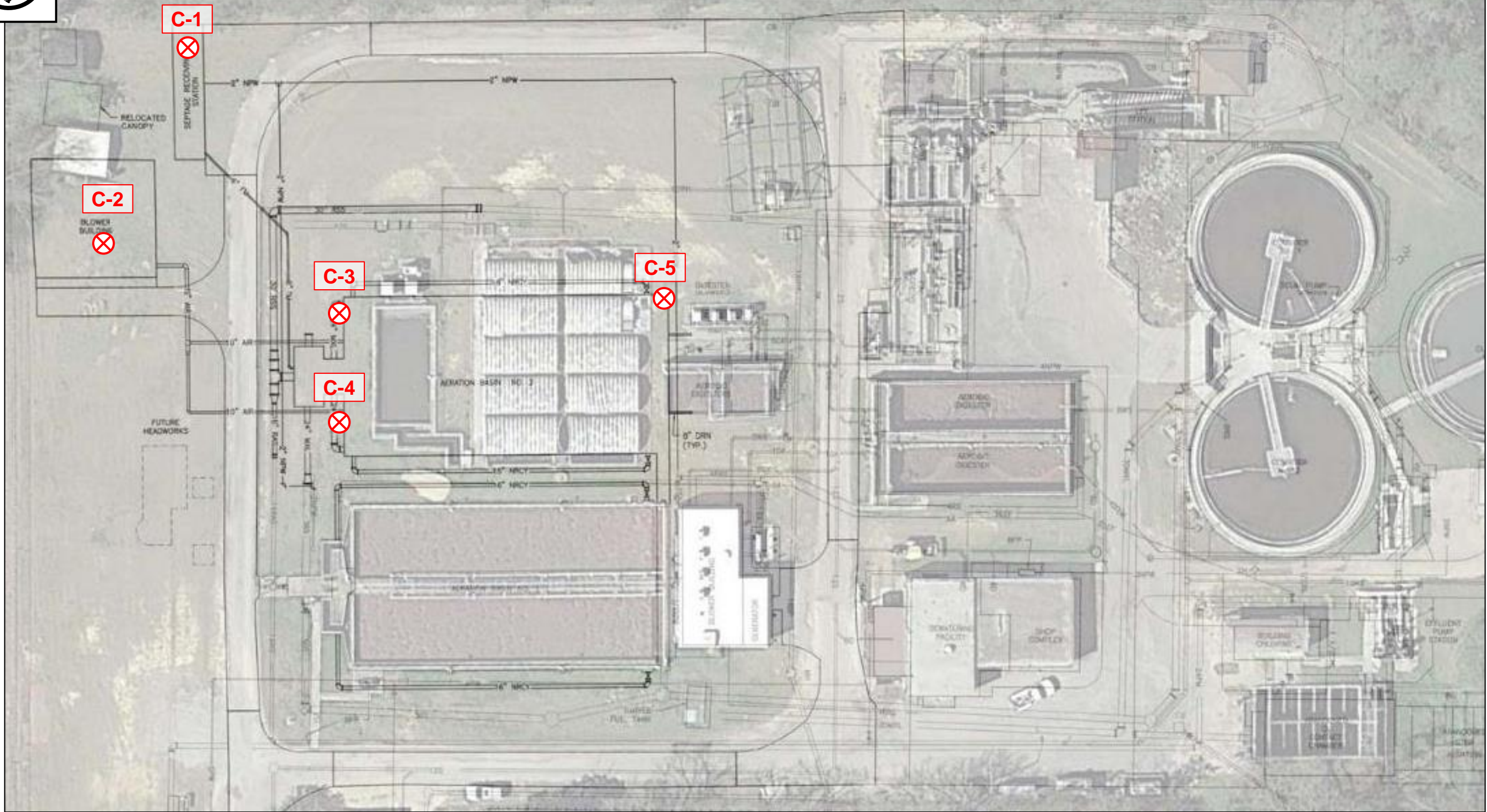
Nashville

500 Wilson Pike Cir.
Suite 310
Brentwood, TN 37024
615.760.8300

Pittsburgh

One Williamsburg Pl.
Suite G-5, Box 13
Warrendale, PA 15086
878.332.2163

800.960.7317
www.espassociates.com



LEGEND

⊗ - APPROXIMATE CPT SOUNDING AND HAND AUGER BORING LOCATION

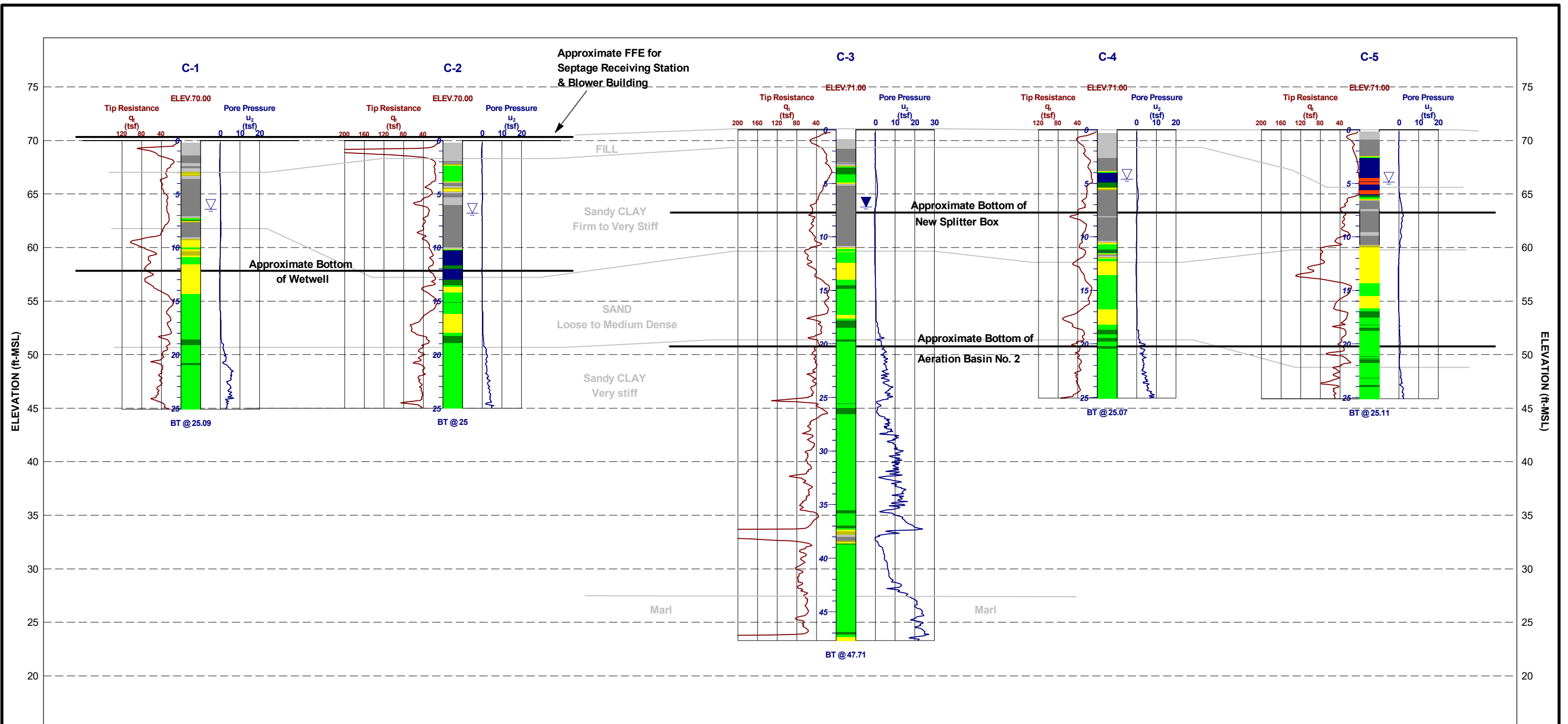
"PIPING PLAN" FOR LAKE SWAMP WWTP UPGRADE PROJECT PREPARED BY CONSTANTINE ENGINEERING, SHEET C00.30 DATED JULY 2020 HAS BEEN APPROXIMATELY OVERLAID ON GOOGLE EARTH AERIAL IMAGE AND IS DISPLAYED HERE AND HAS BEEN MODIFIED TO SHOW APPROXIMATE TEST LOCATIONS ONLY. NO OTHER INFORMATION IS EXPRESSED OR IMPLIED. PRELIMINARY, NOT FOR CONSTRUCTION.

PROPOSAL NO.:	It15.300
SCALE:	NTS
DRAWN BY:	MWL
CHECKED BY:	MSU
DATE:	9/9/2020

SHEET TITLE:	FIGURE 1 TEST LOCATION PLAN
PROJECT:	Lake Swamp Wastewater Treatment Plant Improvements LAKE CITY, SOUTH CAROLINA



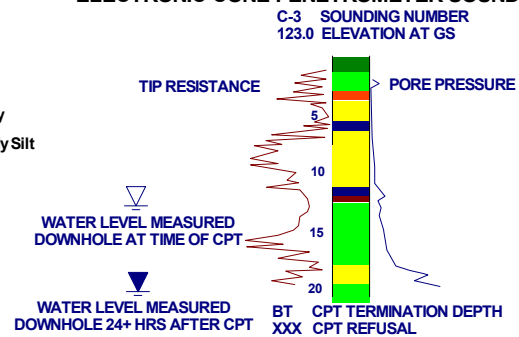
ESP Associates, Inc.
 2154 North Center Street
 Suite 503
 North Charleston, SC 29406
 843-714-2040
www.espassociates.com



CPT MATERIAL GRAPHICS

- Sensitive, Fine Grained Soils
- Organic Soils, Peats
- Clays-Clay to Silty Clay
- Silt Mixtures-Clay Silt to Silty Clay
- Sand Mixtures-Silty Sand to Sandy Silt
- Sands-Clean Sand to Silty Sand
- Gravelly Sand to Sand
- Very Stiff Clay to Clayey Sand
- Very Stiff Fine Grained Soils

ELECTRONIC CONE PENETROMETER SOUNDING



Robertson et al (1990) Q_t vs F_r - MAI = 5

**FIGURE 2:
GENERALIZED SUBSURFACE PROFILE**

PROJECT: Lake Swamp WWTP Improvements
LOCATION: Lake City, SC

PROJECT NUMBER

IT15.300

DATE

9/9/20





Lake Swamp WWTP Improvements
 Lake City, SC
 Project Number: IT15.300

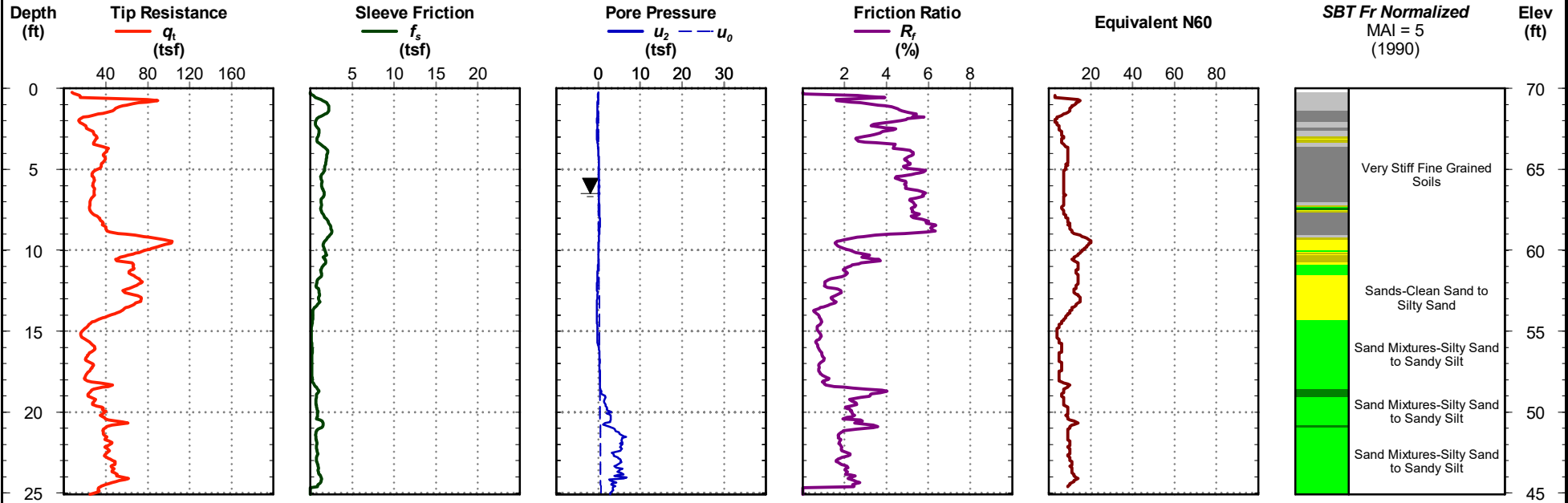
Cone Penetration Test

C-1

Date: Aug. 19, 2020
 Estimated Water Depth: 6.5 ft
 Rig/Operator: Skidsteer | Longview Explorations

Latitude: 33.864587
 Longitude: -79.730927
 Elevation: 70.0

Total Depth: 25.1 ft
 Termination Criteria: Target Depth
 Cone Size: 1.75



CPT REPORT - STANDARD LAKE SWAMP.GPJ_DF STD US LAB_GDT 9/30/20

C-1



Lake Swamp WWTP Improvements
Lake City, SC
Project Number: IT15.300

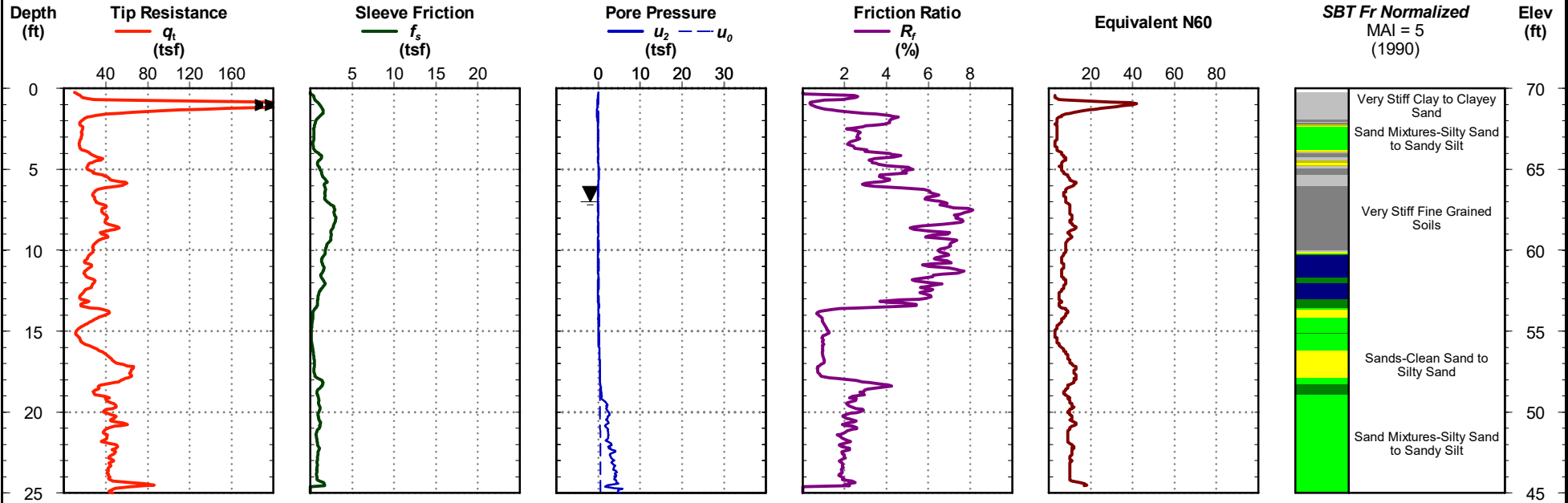
Cone Penetration Test

C-2

Date: Aug. 19, 2020
Estimated Water Depth: 7 ft
Rig/Operator: Skidsteer | Longview Explorations

Latitude: 33.864379
Longitude: -79.730817
Elevation: 70.0

Total Depth: 25.0 ft
Termination Criteria: Target Depth
Cone Size: 1.75



CPT REPORT - STANDARD LAKE SWAMP.GPJ_DF STD US LAB_GDT_9/30/20

C-2



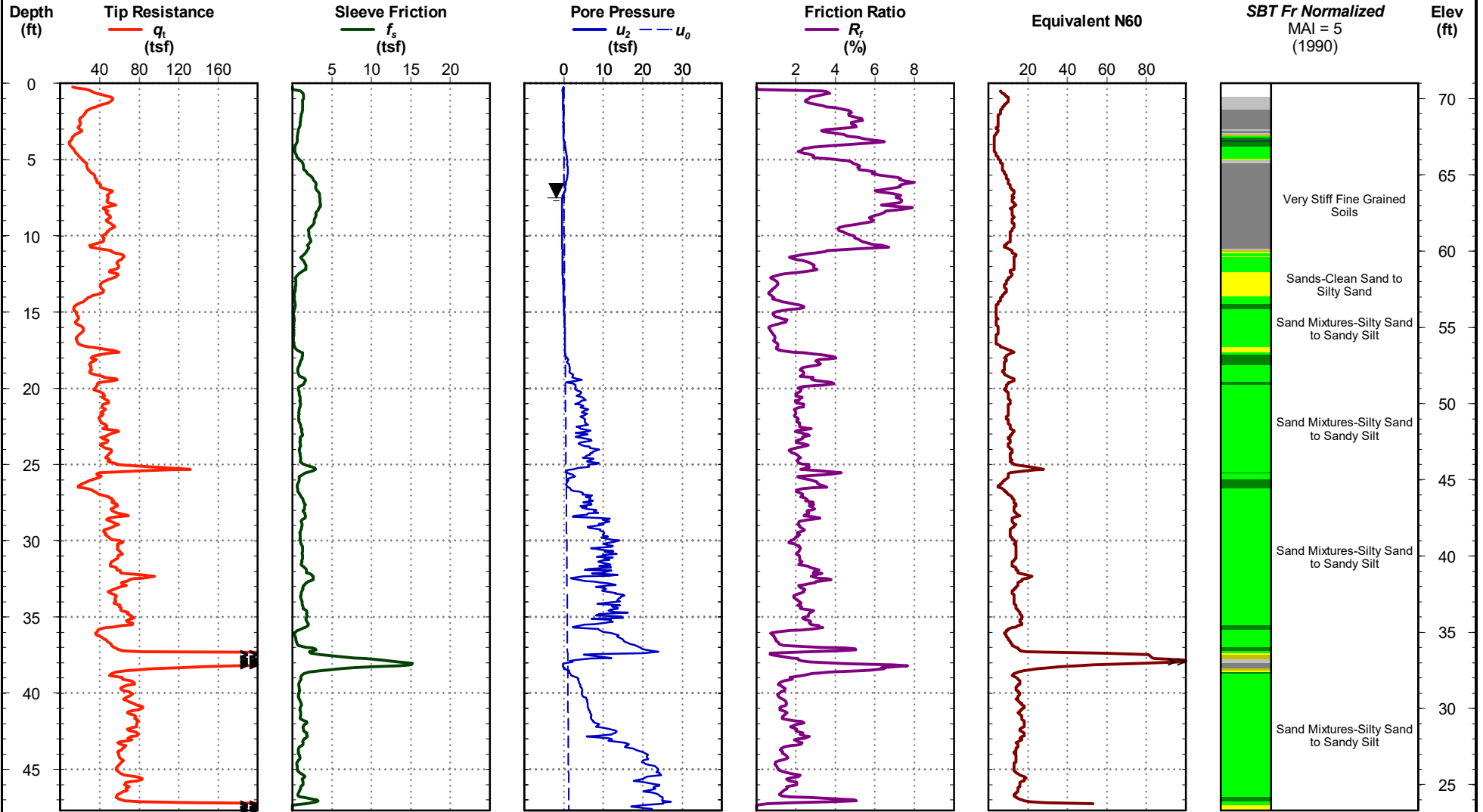
Cone Penetration Test

C-3

Date: Aug. 19, 2020
Estimated Water Depth: 7.5 ft
Rig/Operator: Skidsteer | Longview Explorations

Latitude: 33.86451
Longitude: -79.730529
Elevation: 71.0

Total Depth: 47.7 ft
Termination Criteria: Target Depth
Cone Size: 1.75



CPT REPORT - STANDARD LAKE SWAMP.GPJ_DF STD.US.LAB.GDT_9/30/20

C-3



Lake Swamp WWTP Improvements
Lake City, SC
Project Number: IT15.300

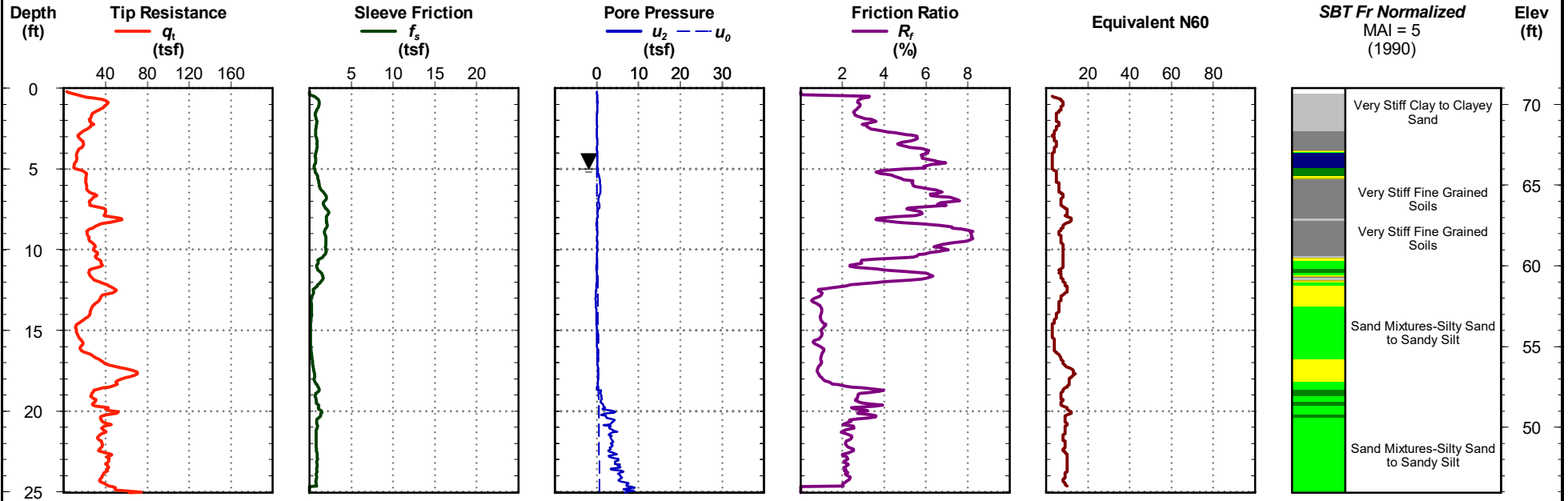
Cone Penetration Test

C-4

Date: Aug. 19, 2020
Estimated Water Depth: 5 ft
Rig/Operator: Skidsteer | Longview Explorations

Latitude: 33.864437
Longitude: -79.730428
Elevation: 71.0

Total Depth: 25.1 ft
Termination Criteria: Target Depth
Cone Size: 1.75



C-4



Lake Swamp WWTP Improvements
Lake City, SC
Project Number: IT15.300

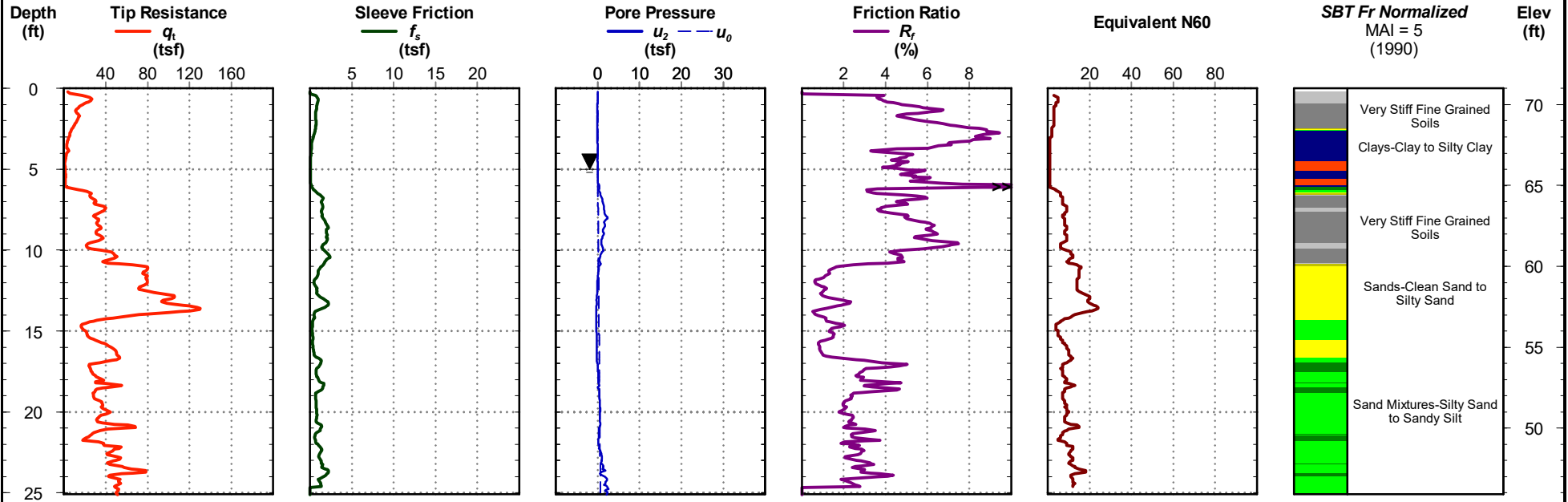
Cone Penetration Test

C-5

Date: Aug. 19, 2020
Estimated Water Depth: 5 ft
Rig/Operator: Skidsteer | Longview Explorations

Latitude: 33.864801
Longitude: -79.730252
Elevation: 71.0

Total Depth: 25.1 ft
Termination Criteria: Target Depth
Cone Size: 1.75



CPT REPORT - STANDARD LAKE SWAMP.GPJ_DF STD US LAB_GDT 9/30/20

C-5

PROJECT: Lake Swamp WWTP Improvements Lake City, SC			HAND AUGER BORING RECORD C-1
PROJECT No.: IT15.300	ELEVATION: Existing Ground Surface	DRILLING METHOD: Hand Auger	DRILLING COMPANY:
LOGGED BY: Matt Lucas	BORING DEPTH: 3.2 Feet	AUGER O.D.:	NOTES:
DATE DRILLED: 08/19/20	WATER LEVEL: <div style="display: flex; justify-content: space-around;"> ∇ Dry @ TOB ▼ N/A </div>		

DEPTH (ft)	GRAPHIC LOG	SOIL DESCRIPTION	WATER LEVEL	ELEV. (ft)	DYNAMIC CONE PENETROMETER TEST DATA (Average Blows/Increment)					BPI
					5	10	15	20	25	
	(dots, silt)	Topsoil								
	(diagonal lines)	FILL: Tannish Gray Clayey SAND, fine, (moist), Trace roots POSSIBLE FILL: Brown and Gray Sandy CLAY, (moist)								
	(dots, silt)	POSSIBLE FILL: Reddish Yellow Clayey SAND, fine, (wet)								
		Auger refusal encountered at 3.2 feet. Boring was terminated at 3.2 feet. Backfilled with soil.								
5				65.0						
10				60.0						

DEPTH MEASUREMENTS ARE SHOWN TO ILLUSTRATE THE GENERAL ARRANGEMENTS OF THE SOIL TYPES ENCOUNTERED AT THE HAND AUGER LOCATIONS. DO NOT USE DEPTH MEASUREMENTS FOR DETERMINATION OF DISTANCES OR QUANTITIES.



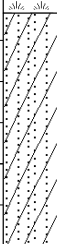
PROJECT: Lake Swamp WWTP Improvements Lake City, SC			HAND AUGER BORING RECORD C-3
PROJECT No.: IT15.300	ELEVATION: Existing Ground Surface	DRILLING METHOD: Hand Auger	DRILLING COMPANY:
LOGGED BY: Matt Lucas	BORING DEPTH: 4.0 Feet	AUGER O.D.:	NOTES:
DATE DRILLED: 08/19/20	WATER LEVEL: <input type="checkbox"/> Dry @ TOB <input checked="" type="checkbox"/> N/A		

DEPTH (ft)	GRAPHIC LOG	SOIL DESCRIPTION	WATER LEVEL	ELEV. (ft)	DYNAMIC CONE PENETROMETER TEST DATA (Average Blows/Increment)					BPI
					5	10	15	20	25	
	silt. sst.	Topsoil								
		FILL: Reddish Yellow Clayey SAND, fine, (moist)								
		COASTAL PLAIN DEPOSITS: Gray and Reddish Yellow Sandy CLAY, (moist)								
		Boring was terminated at 4.0 feet. Backfilled with soil.								
5				66.0						
10				61.0						

DEPTH MEASUREMENTS ARE SHOWN TO ILLUSTRATE THE GENERAL ARRANGEMENTS OF THE SOIL TYPES ENCOUNTERED AT THE HAND AUGER LOCATIONS. DO NOT USE DEPTH MEASUREMENTS FOR DETERMINATION OF DISTANCES OR QUANTITIES.



PROJECT: Lake Swamp WWTP Improvements Lake City, SC			HAND AUGER BORING RECORD C-5
PROJECT No.: IT15.300	ELEVATION: Existing Ground Surface	DRILLING METHOD: Hand Auger	DRILLING COMPANY:
LOGGED BY: Matt Lucas	BORING DEPTH: 3.0 Feet	AUGER O.D.:	NOTES:
DATE DRILLED: 08/19/20	WATER LEVEL: <input type="checkbox"/> Dry @ TOB <input checked="" type="checkbox"/> N/A		

DEPTH (ft)	GRAPHIC LOG	SOIL DESCRIPTION	WATER LEVEL	ELEV. (ft)	DYNAMIC CONE PENETROMETER TEST DATA (Average Blows/Increment)					BPI
					5	10	15	20	25	
		Topsoil FILL: Reddish Brown Clayey SAND, fine, (moist to wet)								
		Boring was terminated at 3.0 feet. Backfilled with soil.								
5				65.0						
10				60.0						

DEPTH MEASUREMENTS ARE SHOWN TO ILLUSTRATE THE GENERAL ARRANGEMENTS OF THE SOIL TYPES ENCOUNTERED AT THE HAND AUGER LOCATIONS. DO NOT USE DEPTH MEASUREMENTS FOR DETERMINATION OF DISTANCES OR QUANTITIES.





Healthy People. Healthy Communities.

March 10, 2021

GLEN BODENHEIMER, ASSISTANT FINANCE DIRECTOR
CITY OF LAKE CITY
4000 FABER PLACE DR
NORTH CHARLESTON, SC 29405

RE: CONSTRUCTION PERMIT NO. WW043101
LAKE CITY/LAKE SWAMP WWTP UPGRADE
NPDES PERMIT NO. SC0046311
FLORENCE COUNTY

Dear Glen Bodenheimer:

Enclosed is a SC Wastewater Construction Permit for the above referenced project. Construction is to be performed in accordance with this permit and supporting engineering report, plans, and specifications approved by this Office.

This facility will be required to have an operator who has been certified by the Environmental Certification Board of the South Carolina Department of Labor, Licensing and Regulation. This facility has been classified as Group IV-B (Biological), necessitating an operator holding a Grade of B or higher certificate. Questions regarding operator certifications should be directed to Ms. Pam Dunkin, South Carolina Environmental Certification Board, P.O. Box 11409 Columbia, SC 29211, (803) 896-4430.

This system cannot be placed into operation until final approval is granted by the appropriate Bureau of Environmental Health Services (BEHS) Regional Office. Your Regional contact is as follows, Larry Ragsdale in the EA Pee Dee Region, 927 Shine Avenue, Myrtle Beach, SC 29577. Please contact this regional office when construction begins.

Upon completion of any construction, a letter must be submitted to the EA Pee Dee Regional Office from the registered engineer certifying that the construction has been completed in accordance with the approved plans and specifications. An inspection may then be scheduled. The BEHS Regional Office will approve the system for operation upon successful completion of this project.

Sincerely,

A handwritten signature in black ink, appearing to read "Tyra N. Foulks".

Tyra N. Foulks
Domestic Wastewater Permitting Section
Water Facilities Permitting Division

cc: Larry Ragsdale, EA Pee Dee Region
Daniel Huggins, Constantine Engineering, 4000 Faber Place Dr North Charleston, SC 29405
Brian Asbil, BOW
Chuck Gorman, SRF



Wastewater Construction Permit

Bureau of Water

PROJECT NAME: Lake City/Lake Swamp WWTP Upgrade	COUNTY: Florence
LOCATION: OAKLEY RD, OAKLEY, SC 29439	

PERMISSION IS HEREBY GRANTED TO: **Glen Bodenheimer, Assistant Finance Director**
City of Lake City
P O Box 1329
Lake City, SC 29560

For the construction of an upgrade to an existing wastewater treatment plant in accordance with the construction plans, specifications, design calculations and the Construction Permit Application signed by Daniel Huggins, Registered Professional Engineer, S.C Registration Number: 22097.

PROJECT DESCRIPTION: This project consists of demolition, upgrades, modifications, and the addition of new equipment. Temporary sludge dewatering and disposal of sludge from the rotating biological contactors, aeration basin No. 1 – No. 3, clarifier No. 3 and the aerobic digester (small digester to be demolished). All sludge and debris shall be transported to the Republic Service Lee County Landfill #3121311-1101, as denoted within the NPDES permit No. SC0046311. **A more detailed description is on page 2.**

TREATMENT FACILITY: The wastewater will be discharged to Lynches river from LAKE CITY LAKE SWAMP WWTP - SC0046311 at a design flow rate of 5,200,000 gallons per day (GPD). The design flow rate of 6.0 MGD and 7.0 MGD are also covered under this construction permit. (No new flow will be contributed from this permit.) The effluent concentrations of those constituents the wastewater treatment system is designed remove or reduce are contained in NPDES Permit No. SC0046311.

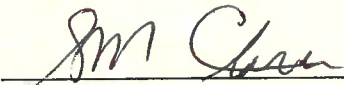
Treatment Plant Classification: **Group IV-B**

STANDARD CONDITION:

NOTE: In accepting this permit, the owner agrees to the admission of properly authorized persons at all reasonable hours for the purpose of sampling and inspection. This is a permit for construction only and does not constitute DHEC approval, temporary or otherwise, to place the system in operation. An Approval to Place in Operation is required and can be obtained following the completion of construction by contacting the EA Pee Dee Region at 843-238-4378. Additional permits may be required prior to construction (e.g., Stormwater).

SPECIAL CONDITIONS: See Page 2

PERMIT NUMBER:	WW043101
ISSUANCE DATE:	March 10, 2021
EXPIRATION DATES:	Construction must be completed and the Approval to Place in Operation granted prior to March 10, 2024 or this permit will expire.


 Shawn M. Clarke, P.E., Director
 Water Facilities Permitting Division

TNF:

Detailed Description: Upgrades include the demolition of Rotating Biological Contactors no. 1 and no. 2, a portion of the Aerobic Digester, aeration basin #3, tanks, and pumps and appurtenances. Upgrade and clean (3) secondary clarifiers, upgrade the existing blower building with new blowers, mechanical screen improvements, and upgrade the belt filter press. The addition of a new blower building equipped with (3) new blowers and an electric room, a new below-grade Aeration basin with a connected splitter box, new yard piping, submersible mixers, (7) horizontal electric motor driven positive displacement blowers, (2) self-priming RAS pumps, (2) scum pumps, and fine bubble membrane diffusers for (2) tanks. A new Septage Receiving structure with a connected 8 ft diameter wet well, (1) submersible mixer will be included in wet well. The new septage receiving pump station will consist of a pump and various above ground and underground pipes. Replace grit control panel, manual operator with motorized operator, removal, and replacement of the sump pump in the dry pit, replace the drive motor and gear reduction unit and the manifold seal in the clarifiers. Replace belt press control panel, effluent PS and RAS PS control panels and replace kill switch in the existing dewatering building. Blowers No. 1 – No. 4 shall be placed in the existing blower building and blowers No. 5 – No. 7 shall be placed in the new blower building. Equipment list below:

Description	Capacity
Self-priming pump (Septage Receiving Station)	150 gpm
Self-priming RAS Pump No. 3 and No. 4	1,200 gpm
Positive Displacement Blowers No. 1 – No. 4	1,600 scfm
Positive Displacement Blowers No. 5 – No. 7	2,500 scfm
Scum Pumps	145 gpm
Fine Bubble Membrane Diffuser	---
Submersible Mixers	---

Additional Permit: SRF No. 413-01 For projects pursuing funding under the State Revolving Fund, the issuance of this construction permit does not relieve the owner of responsibility to fulfill the SRF program requirements. This project incorporates funding under the State Revolving Fund, specifically for the screens and grit structure, clarifiers No. 1 and No. 2 and dewatering improvements.

Conditions

1. The permittee shall update and maintain at the permitted facility a complete Operations and Maintenance (O&M) Manual for the wastewater treatment system. The manual shall be made available for on-site review during normal working hours. The manual shall contain operation and maintenance instructions for all equipment and appurtenances associated with the wastewater treatment system. The manual shall contain a general description of the treatment process(es), operating characteristics that will produce maximum treatment efficiency and corrective action to be taken should operating difficulties be encountered.
2. In accordance with Regulation 61-9, The permittee shall at all times properly operate and maintain in good working order and operate as efficiently as possible all facilities and systems of treatment and control (and related appurtenances) which are installed or used by the permittee to achieve compliance with the terms and conditions of this permit. Proper operation and maintenance include effective performance based on design facility removals, adequate funding, adequate operator staffing and training and also includes adequate laboratory controls and appropriate quality assurance procedures. This provision requires the operation of back-up or auxiliary facilities or similar systems which are installed by a permittee only when the operation is necessary to achieve compliance with the conditions of the permit.

Dan Huggins

From: StormWaterLessThan1 <Stormwaterlessthan1@dhec.sc.gov>
Sent: Tuesday, January 12, 2021 10:21 AM
To: Dan Huggins
Subject: Re: Lake Swamp WWTP Upgrade

We are in receipt of your Non-Coastal Stormwater Less than One-Acre (LTOA) Notification.

Please allow this email to serve as confirmation of the Department's receipt of the notification form. Via submittal of this form, you have complied with your obligation for notification under the S.C. Stormwater Management Regulations and your notification has been placed on file with the Department (SCDHEC).

If you are certain your site meets all LTOA program requirements, you may proceed with construction activities identified in the notification submitted to the Department. Please note that ONLY construction activities identified in your notification may be performed at your site. The operator of the activity is responsible for compliance with the plan and assuring no sediment is discharged off-site or to Waters of the State. The operator is also responsible for obtaining any additional approvals that may be necessary for the planned activity.

Please be aware, the Department may conduct periodic inspections of your project/site and failure to meet all applicable requirements, as defined by the Department or the respective MS4, or failure to comply resulting in discharge of sediment to Waters of the State and/or adjacent properties may subject you to applicable penalties under the S. C. Pollution Control Act.

If you are not certain your site meets all LTOA program requirements or if you have additional questions, do not proceed with construction activities. Please review the information on the following links and contact the Department or, if applicable, the respective MS4.

<http://www.scdhec.gov/Environment/WaterQuality/Stormwater/WherettoApply/>

<http://www.scdhec.gov/environment/WaterQuality/Stormwater/lessthan1acre/>

<http://www.scdhec.gov/Environment/docs/nonCoastal-LT1A.pdf>

If you have further questions, please call 803-898-4300 and ask for Stormwater Permitting.

Sincerely,

The Division of Dam Safety and Stormwater Permitting

**SECTION 01500
PRE-CONSTRUCTION VIDEO**

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Furnish all necessary labor, materials and equipment to perform color audio-video recording of the project site surfaces as specified herein. Contractor shall furnish to the Engineer and Owner an original copy of a continuous color audio-video DVD recording.
- B. The Owner reserves the right to reject the audio-video DVD because of poor quality, unintelligible audio or uncontrolled pan or zoom. Any video rejected by the Owner shall be re-videoed at no additional cost to the Owner. The Contractor shall submit two (2) DVD's to the Engineer for format and content approval prior to the start of any work.
- C. The purpose of the color audio-video taping of the project is to provide the necessary information for restoration of the surface features after completion of the project. The Contractor shall be responsible for repairing any damage(s) or defect(s) not documented as existing prior to construction.

PART 2 - PRODUCTS

No products are required for this work.

PART 3 - EXECUTION

3.1 RECORDED INFORMATION

- A. Prior to the commencement and upon completion of any construction, equipment or material mobilization, the Contractor shall perform an audio-video survey of the project site area which will be excavated or which has the potential to be disturbed by the Contractor's operations.

END OF SECTION

**SECTION 01720
PROJECT RECORD DOCUMENTS**

PART 1 GENERAL

1.01 WORK INCLUDED

The Contractor shall obtain from the Engineer, one (1) set of blueline prints of the Contract Drawings. These prints shall be kept and maintained in good condition at the project site and a qualified representative of the Contractor shall enter upon these prints, from day-to-day, the actual "as-built" record of the construction progress. Entries and notations shall be made in a neat and legible manner and these prints shall be delivered to the Engineer upon completion of the construction.

1.02 MAINTENANCE OF DOCUMENTS

- A. Maintain at job site, one copy of:
 - 1. Contract Drawings
 - 2. Specifications
 - 3. Addenda
 - 4. Reviewed Shop Drawings
 - 5. Change Orders
 - 6. Other Modifications to Contract
- B. Store documents in approved location, apart from documents used for construction.
- C. Provide files and racks for storage of documents.
- D. Maintain documents in clean, dry legible condition.
- E. Do not use record documents for construction purposes.
- F. Make documents available at all times for inspection by Engineer and Owner.

1.03 MARKING DEVICES

- A. Provide colored pencil or felt-tip marking pen for all marking.

PROJECT RECORD DOCUMENTS

1.04 RECORDING

- A. Label each document "PROJECT RECORD" in 2-inch high printed letters.
- B. Keep record documents current.
- C. Do not permanently conceal any work until required information has been recorded.
- D. Contract Drawings: Legibly mark to record actual construction:
 - 1. Horizontal and vertical location of underground utilities and appurtenances referenced to permanent surface improvements.
 - 2. Location of internal utilities and appurtenances concealed in construction referenced to visible and accessible features of structure.
 - 3. Field changes of dimension and detail.
 - 4. Changes made by Change Order or Field Order.
 - 5. Details not on original Contract Drawings.
- E. Specifications and Addenda: Legibly mark up each Section to record:
 - 1. Manufacturer, trade name, catalog number, and supplier of each product and item of equipment actually installed.
 - 2. Changes made by Change Order or Field Order.
 - 3. Other matters not originally specified.
- F. Shop Drawings: Maintain as record documents; legibly annotate Shop Drawings to record changes made after review.

1.05 SUBMITTAL

- A. At completion of project, deliver record documents to Engineer.

END OF SECTION

SECTION 02060 DEMOLITION

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Work included: Demolish and remove from the site those items so indicated on the Drawings, including buildings, building pads, parking and roadway areas, miscellaneous structures, poles, walls, utilities, signs, etc.

1.2 QUALITY ASSURANCE

- A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.
- B. Comply with the International Building Code with due regard to the protection of the public and the provision of safeguards during the performance of the work.
- C. Use equipment adequate in size, capacity and numbers to accomplish the work in a timely manner.
- D. Comply with requirements of governmental agencies having jurisdiction.
- E. Contractor is responsible for being aware of and complying with Asbestos NESHAP regulations, as well as other applicable codes, laws and regulations.
 - 1. The Owner is to be notified immediately upon discovery of asbestos materials.

PART 2 - PRODUCTS

- A. No products are required in this Section.

PART 3 - EXECUTION

3.1 SURFACE CONDITIONS

- A. Examine the areas and conditions under which work of this Section will be performed. Correct conditions detrimental to the safe, timely, and proper completion of the Work. Do not proceed until unsatisfactory conditions are corrected.

3.2 DEMOLITION

A. General:

1. Prior to start of demolition, carefully study the Drawings and these Specifications.
2. In company with the Owner's representative, visit the site and verify the extent of demolition to be performed under this Contract.

B. Using only the means and equipment approved for this purpose by the governmental agencies having jurisdiction, demolish and completely remove from the job site the existing construction designated to be removed.

1. Shut off, cap, reroute, and otherwise protect existing public utility lines in accordance with the requirements of the public agency or utility having jurisdiction.
2. Remove rocks larger than 2" diameter, roots, wood, and debris.

C. Demolished material shall be considered to be property of the Contractor and shall be completely removed from the job site, unless noted otherwise.

D. Use means necessary to prevent dust from becoming a nuisance to the public, to neighbors, and to other work being performed on or near the site.

E. Use any means necessary to protect the public safety during the demolition process.

F. Use whatever means necessary to protect the adjacent structures from damage during demolition.

G. Existing concrete and asphaltic paving, curbs, sidewalk, and miscellaneous yard structures within the areas designated for new construction work shall be completely demolished and all debris removed from the site.

H. Excavation caused by demolition shall be backfilled with fill free from rubbish and debris.

I. Where parts of existing pavements or structures are to remain in service, demolish the portions to be removed, repair damage, and leave the pavement or structure in proper condition for intended use.

1. Removed asphalt or concrete pavement, concrete, and masonry to the lines designated by saw-cutting, drilling, chipping, or other suitable methods. Leave the resulting surfaces reasonably true and even, with sharp straight corners that will result in neat joints.

DEMOLITION

2. Where existing reinforcing rods are to extend into new construction, remove the concrete so that the reinforcing is clean and undamaged. Cut off other reinforcing 1/2" below the surface and fill with epoxy resin binder flush with the surface.
- G. Protection of trees: It may become desirable to save certain trees in areas where cut or fill is eighteen inches or less and in parking areas. Consequently, the Contractor shall obtain approval from Engineer prior to removal of significant trees from such areas. The Contractor shall protect existing trees to remain during construction by constructing barricades around such trees as directed.
- H. Erosion control: Construct and maintain erosion control as shown on the Drawings and in accordance with the local County's requirements.

3.3 SALVAGED ITEMS

- A. Items to be Salvaged to the Owner:

EQUIPMENT NAME	EQUIPMENT LOCATION	DELIVER TO OWNER'S LOCATION
Generator, fuel tank, and automatic transfer switch	Existing blower building	On WWTP plant site at new aluminum canopy

END OF SECTION

**SECTION 02101
CIVIL SITEWORK**

PART 1 GENERAL

1.01 WORK INCLUDED

- A. This Section covers the Work necessary to complete the sitework for the project. Civil sitework includes clearing, grading for roads and driveways, chain link fencing and gates, and finish grading and grassing.

1.02 GENERAL

- A. RELATED WORK SPECIFIED IN OTHER SECTIONS
 - 1. See Sections EARTHWORK and ROADS AND DRIVEWAYS for additional requirements.

PART 2 PRODUCTS

2.01 GENERAL

- A. The use of a manufacturer's name and model or catalog number is for the purpose of establishing the standard of quality and general configuration desired only. Products of other manufacturers will be considered in accordance with the General Conditions.

2.02 SEEDING AND MULCHING

- A. Topsoil: Topsoil shall be a natural, friable soil, representative of product soils in the vicinity. It shall be well-drained, free from admixture of subsoil and foreign matter, objects larger than two (2) inches in diameter, toxic substances, and any other deleterious material that may be harmful to plant growth and be a hindrance to grading, planting, and maintenance operations. Soil excavated on site may be used provided it meets the requirements of topsoil.
- B. The type of quick growing seed used shall be appropriate to provide an early ground cover during the particular season when planting is done. The rate of spread shall be as specified in Section 3.01D.
- C. For areas requiring sod it shall be Tifton Bermuda free of weeds and other undisuable grasses. Minimum ½ yard cuts.
- D. Fertilizer: Commercial plant food containing eight (8%) percent nitrogen, eight (8%) percent available phosphate, and eight (8%) percent potassium, uniform in composition, dry, free-blowing, and delivered in containers bearing manufacturer's guaranteed analysis.

2.03 ROADS AND DRIVEWAYS

- A. Roads and driveways shall be asphalt as specified in Section ROADS AND DRIVEWAYS.

2.04 FENCING

- A. Materials shall be new and products of recognized, reputable manufacturers. Used, rolled, or regalvanized materials are not acceptable.
- B. Hot-dip galvanized after fabrication where shown on the plans. Posts and other appurtenances shall have a minimum zinc coating of 1.2 ounces per square foot of surface.
- C. Fabric: Chain link fence fabric, seventy-two (72) inches high, woven of No. 9 gauge wire, in standard two (2)-inch diamond-mesh pattern, selvages twisted and barbed, galvanized after weaving with 1.2 ounce zinc coating meeting the requirements of ASTM A392, Class 1.
- D. Galvanized Posts: Federal Specification RR-F-191, fence posts, gates, and accessories, except as hereinafter modified. Standard lengths for setting in ground or in concrete as required for conditions shown.
- E. Galvanized Line Posts: For fences up to eight (8)-feet zero (0)-inches high, use 2½-inch outside diameter, ASTM A120, Schedule 40 steel pipe, weight 3.65 pounds per linear foot.
- F. Galvanized End, Corner, Angle, and Pull Posts: Use 2 7/8-inch outside diameter standard weight steel pipe, weight 5.79 pounds per linear foot.
- G. Galvanized Gate Posts: For single swing gates up to six (6)-feet wide, use 2 7/8-inch outside diameter steel pipe, 5.79 pounds per foot. For single swing gates six (6)-feet wide to thirteen (13)-feet wide, use four (4)-inch outside diameter steel pipe, 9.1 pounds per foot. For other sizes, follow manufacturer's recommendations.
- H. Galvanized Post Tops: Post tops shall be pressed steel, or malleable iron, designed as a weathertight closure cap for tubular posts. Provide one (1) cap for each post, unless equal protection is afforded by combination post top cap and barbed wire supporting arm where barbed wire is required. Where top rail is used, provide tops to permit passage of top rail.
- I. Galvanized Tension Wire: Tension wire shall be zinc or aluminum-coated coil spring steel wire not less than No. 7 gauge (0.177 inch diameter). Provide tie clips of manufacturer's standard as approved for attaching the wire to the fabric, at intervals not exceeding twenty-four (24)-inches.

- J. Galvanized Stretcher Bars and Bands: Stretcher bars shall be one-piece lengths equal to full height of fabric with a minimum cross-section of 3/16 inch by 3/4-inch. Provide one (1) stretcher bar for each gate and end post and two (2) for each corner and pull post. Bar bands shall be heavy-pressed steel, spaced not over fifteen (15)-inches on center to secure stretcher bars to tubular end, corner, pull, and gate posts.
- K. Galvanized Top Rail: Not less than eighteen (18)-foot-long tubular steel, 1 5/8-inch outside diameter, weight 2.27 pounds per linear foot. Couplings to be outside-sleeve type and at least six (6)-inches long. Top rail to extend through line post tops to form continuous brace from end-to-end of each stretch of fence.
- L. Galvanized Braces: Brace pipe shall be the same material as the top rail and shall be installed midway between the top rail and extend from the terminal post to the first adjacent line post. Braces shall be securely fastened to the posts by heavy-pressed steel and malleable fittings, then securely trussed from line post to base of terminal post with a 3/8-inch truss rod and tightener.
- M. Galvanized Fittings: Malleable steel, cast iron, or pressed steel galvanized to meet the requirements of ASTM A153. Fittings to include extension arms for barbed wire, stretcher bars and clamps, clips, tension rods, brace rods, hardware, fabric bands and fastenings, and all accessories. Provide forty-five (45) degree bracket type supports to accommodate three (3) strands of barbed wire as shown.
- N. Galvanized Barbed Wire: Four-point pattern with three strands of No. 12-1/2 gauge wire, and one (1) inch barbs five (5)-inches apart. Zinc-coated barbed wire shall meet the requirements of ASTM A121, Class 3.

PART 3 EXECUTION

3.01 GRADING, SEEDING AND MULCHING

- A. Pre-Finish Grading: Complete rough grading to grades indicated on the Drawings or to accomplish adequate drainage patterns required by the site layout. Rough grading shall allow for the addition of materials needed to accomplish finish grading. Fill areas required during subgrade preparation shall be compacted to eighty-five (85%) percent of the relative maximum density. Topsoil shall be spread over the prepared rough grade using a rubber-tired tractor with grader blade or equivalent.
- B. Fertilizing: Apply commercial fertilizer at the rate of nine hundred twenty (920) pounds per one-acre or at a rate determined from soil tests, distributing uniformly with a rotary mechanical spreader. Apply soil additives such as lime if the soil pH requires adjustment.

- C. Finish Grading: After placing topsoil and applied materials, rake the topsoil to a uniform grade so that all areas drain, as indicated on the grading plan or as required to complete drainage patterns. Lightly compact with a cultipacker before planting grass. Remove all trash from the area prior to planting grass.
- D. Seeding:
 - 1. Seeding and mulching operations will not be permitted when wind velocities exceed fifteen (15) miles per hour. Seed shall be sown only when the soil is moist and in proper condition to induce growth. No seeding shall be done when the ground is unduly wet or otherwise not in a tillable condition.
 - 2. Whenever a suitable amount of area has been graded, it shall be made ready and grassed as specified in this Section. Grassing shall be incorporated into the project at the earliest practical time in the life of the Contract.
- E. The several operations involved in the work shall proceed in the following sequence: preparation of the ground; seeding; spreading of mulch; cutting-in mulch; and rolling or preparation of the ground; installation of erosion control matting, placing soil; hydroseeding; placing excelsior mat.
- F. The ground over which the seed is to be sown shall be prepared by diskharrowing and thoroughly pulverizing the soil to a suitable depth. The prepared soil shall be loose and reasonably smooth. It shall be reasonably free of large clods, roots, and other material, which will interfere with the work or subsequent mowing and maintenance operations. Apply lime at two (2) tons per acre, and 8,8,8 commercial fertilizer at nine hundred twenty (920 lbs.) pounds per acre.
- G. While the soil is still loose and moist, the seed shall be scattered uniformly over the grassing area. The rate of spread for the seed mixture shall be per schedule.

August through February

Winter

Kentucky 31	30 lbs/acre
Reseeding Crimson Clover	15 lbs/acre
Bermuda Grass (Unhulled)	30 lbs/acre
Perennial Rye Grass	30 lbs/acre

March through July

Spring

Kentucky 31	30 lbs/acre
Kobe Lespedeza (Var. Tenn)	30 lbs/acre
Bermuda Grass (Cynodon Ductylon)	20 lbs/acre

(Hulled)

- H. Approximately two (2) inches, loose thickness of mulch material shall be applied uniformly over the seeded area, and the mulch material cut into the soil with equipment specified, to produce a loose mulched thickness of three (3) to four (4) inches. Care shall be exercised that the materials are not cut too deeply into the soil.
- I. Immediately after completion of the seeding, the entire mulched area shall be rolled thoroughly with the equipment specified. At least two (2) trips of the entire area will be required.
- J. Maintenance:
 - 1. Water to keep surface soil moist. Repair washed out areas by filling with topsoil, liming, fertilizing, and seeding. Replace mulch on banks when washed or blown away. Mow grass to two (2) inches after grass reaches at least three (3) inches in height, and mow frequently enough to keep grass from exceeding 3 ½ inches.
 - 2. If a satisfactory stand of grass has not been established in eight (8) weeks, the Contractor shall renovate and reseed the grass or unsatisfactory portions thereof immediately. A satisfactory stand of grass is defined as having no bare spots larger than three (3) square feet and not more than ten (10%) percent of total area with bare spots larger than one (1) square foot.
 - 3. The seeded areas shall be watered to provide optimum growth conditions for the establishment of the grass. In no case, however, shall the period of maintaining such moisture be less than two weeks after the planting. Manual watering shall continue at least every four (4) days until the end of the growing season.
- K. The Contractor shall maintain the planted areas in a satisfactory condition until final acceptance of the project. Such maintenance shall include filing, leveling, and repairing of any washed or eroded areas. Replant any areas in which the establishment of the grass stand does not develop satisfactorily.
- L. Clean-up the job site following seeding and mulching. Remove rubbish, excess materials, temporary structures, and equipment. Leave the work in a neat and presentable condition.
- M. Bermuda Sod shall be installed in all swales, ditches, all slopes 3:1 or greater, within 10' of all building structures, and within 3' of all walkways and driveways.

3.02 FENCING

- A. Installation of fencing shall meet the requirements of ASTM F567.
- B. Erect fencing in straight lines between angle points by personnel experienced in this type of construction. Erect in accordance with the manufacturer's recommendations as approved and with these Specifications. Post holes shall be a minimum of two (2) feet eight (8) inches below finished grade. Space posts not more than ten (10) feet on centers and in true lines. Set posts plumb and to a depth of two (2) feet six (6) inches. The top rail of the fence shall be at the top of the fabric. Fill remainder of hole with concrete to extend around the posts to a point two (2) inches above finished grade.

The top surface shall have a crowned watershed finish. After concrete has set, install accessories. Fasten chain link fabric to end posts with stretcher bars and clamps and to line posts and top rail with wire or bands at approximately fourteen (14) inch centers and twenty-four (24) inch centers, respectively.

Install three (3) strands of barbed wire on the brackets, tighten, and secure at each bracket. Brace gate posts diagonally to adjacent line posts to ensure stability. Hang gates and adjust all hardware so that gates operate satisfactorily from open or closed position.

3.03 ROADS AND DRIVEWAYS

- A. Proposed access roads and driveways shall be of the type specified in Section ROADS AND DRIVEWAYS and shall be constructed to the lines and grade shown on the Drawings. All roads and driveways shall include two (2%) percent slopes away from a centerline crown. If required, adjacent grades shall include drainage ditches along the shoulder of the road.
- B. Excavated areas beneath sidewalks, roads, driveways, curbs and gutters shall be backfilled with suitable fill material and compacted to a minimum ninety-eight (98%) percent of the maximum relative density. The final subgrade surface shall be compacted to an even density and shall be smooth and true to line and grade prior to placing road surfacing.

END OF SECTION

**SECTION 02140
DEWATERING**

PART 1 GENERAL

1.01 WORK INCLUDED

- A. Furnish all labor and equipment required to dewater all excavations. Dewatering of all excavations shall be the responsibility of the Contractor, and no additional compensation will be allowed for same.

1.02 RELATED WORK

- A. Earthwork is included in Section 02200.

1.03 SUBMITTALS

- A. None.

PART 2 PRODUCTS

- A. None in this Section.

PART 3 EXECUTION

3.01 GENERAL

- A. Dewatering of many of the construction excavations shall be required as necessary to provide a dry work environment as indicated by the geotechnical report, drawings and these specifications. Dewatering equipment shall be of adequate size and quantity to assure maintaining proper conditions for installing pipe, concrete, backfill or other material or structure in the excavation. Dewatering shall include proper removal of any and all liquid, regardless of its source, from the excavation and the use of all practical means available to prevent surface runoff from entering any excavation.
- B. The dewatering system shall be capable of relieving all hydrostatic pressure against the height of the excavation walls and of lowering the hydrostatic level below the bottom of the base slab a minimum of four (4) feet in the work areas both prior to excavation, and during excavation and construction.
- C. Provide fully redundant system to keep excavation free of water in event of pump failure.
- D. Operate the dewatering system continuously twenty-four (24) hours per day, seven (7) days per week until all structures have been satisfactorily constructed, including placement of fill materials, and no longer require dewatering.

DEWATERING

- E. Water pumped or drained from excavations must be treated by an appropriately sized sediment and erosion control device prior to leaving the site.

END OF SECTION

**SECTION 02200
EARTHWORK**

PART 1 GENERAL

1.01 WORK INCLUDED

- A. Clear, excavate, dewater, sheet, backfill, and do related Work necessary to complete Work shown or specified.
- B. Codes, Specifications, and standards referred to by number or title shall form a part of this Specification to the extent required by the references thereto. Latest revisions as of the date of bid opening shall apply, unless otherwise specified.

1.02 DEFINITIONS

A. Excavation

- 1. Removal of earth and rock to form cavities for the construction of foundations and structures and to form trenches for the installation of piping.
- 2. Cavity formed by the removal of earth and rock.

B. Earth

Unconsolidated material in the crust of the earth derived by weathering and erosion. Includes:

- 1. Materials of both inorganic and organic origin.
- 2. Boulders less than 1/3 cubic yard in volume, gravel, sand, silt, and clay.
- 3. Materials which can be excavated with backhoe, trenching machine, dragline, clam shell, bulldozer, highlift, or similar excavating equipment without the use of explosives, rock rippers, rock hammers, or jack hammers.

C. Rock

A natural aggregate of mineral particles connected by strong and permanent cohesive forces. Rock includes any combination of the following:

- 1. Limestone, sandstone, dolomite, granite, marble, and lava.
- 2. Boulders 1/3 cubic yard or more in volume.

EARTHWORK

3. Materials which cannot be excavated by equipment, which is used to remove earth overburden without the use of explosives, rock rippers, rock hammers, or jack hammers.
 4. Materials which cannot be excavated with a trackhoe, trenching machine, dragline, clam shell, bulldozer, highlift, or similar excavating equipment without the use of explosives, rock rippers, rock hammers, or jack hammers.
- D. Undercutting
1. Excavation of rock and unsuitable earth below the bottom of a foundation, structure, or pipe to be constructed or installed.
- E. Subgrade
1. Undisturbed bottom of excavation.
- F. Pipe Bedding
1. Material required from invert of pipe to bottom of trench.
- G. Pipe Zone Backfill
1. Material required from invert of pipe to top of pipe.
- H. Pipe Cover
1. Material required from top of pipe to top of trench.
- I. Topsoil
1. Earth containing sufficient organic materials to support the growth of grass, free from rocks, roots and debris.

1.03 QUALITY ASSURANCE

- A. Contractor to hire an independent testing laboratory to perform specified services and necessary field density tests to ensure that proper compaction is obtained.

1.04 JOB CONDITIONS

- A. Maintain bench marks, monuments, and other reference points. Replace any disturbed or destroyed bench marks, monuments, or other reference points.
- B. Selected information from subsurface investigations performed by other consultants are included in the Specifications. Should the Contractor encounter subsurface or latent conditions at the site materially differing from those shown he shall immediately give notice to the Engineer of such conditions before they are disturbed. The Engineer will thereupon investigate the conditions; and if he finds that they materially differ from those shown on the Drawings or indicated in the Specifications, he will make such changes in the Drawings, the Specifications, or the Drawings and Specifications as he may find necessary. Any increase or decrease of cost resulting from such changes will be adjusted in the manner provided in the GENERAL CONDITIONS.

1.05 BURNING OF MATERIALS

- A. No burning on the site is allowed.

1.06 DISPOSAL OF CLEARING DEBRIS

- A. The Contractor shall dispose of construction debris resulting from clearing, grubbing, excavation, rock removal, demolition, dewatering and pavement replacement removal, in a landfill approved by the Engineers.
- B. Materials used for silt barriers shall be removed and disposed of upon acceptance of restoration of grounds.

1.07 EXCAVATED MATERIALS IN PAVED ROADS

- A. Unsuitable materials excavated in areas of pavement shall be removed by the Contractor from the job site during the excavation process.
- B. Materials excavated shall be disposed of in a landfill approved by the Engineers.

1.08 EROSION CONTROL AND PREVENTION OF STREAM POLLUTION

- A. The Contractor shall control soil erosion and prevent pollution of streams, storm drains, and watercourses by means of installing silt fences, silt barriers and sediment pools or other means which can be required by the Engineers, state, local or federal agencies involved. The Contractor shall comply with the Owner's Stormwater Permit and Title 33 of the CFR Part 330, Appendix A regarding erosion control and the protection of floodplains and wetlands.

- B. The Contractor shall comply with all applicable local, State, and Federal codes and Agencies in controlling erosion and preventing stream pollution.

PART 2 PRODUCTS

2.01 PIPE BEDDING, BACKFILL AND FOUNDATION BACKFILL

- A. Pipe trench backfill for ductile iron pipe shall adhere to Type 2 laying condition, as per AWWA C150, with four (4) inches loose bedding material.
- B. Pipe Bedding
 - 1. Native soil excavated from the trench, free of rocks, foreign materials, and frozen earth.
- C. Pipe Zone Backfill
 - 1. Native soil material free from rocks, foreign material, and frozen earth, lightly consolidated to top of pipe.
 - 2. Topsoil is not acceptable as pipe zone backfill.
 - 3. Imported material will only be required where native material is inadequate.
- D. Pipe Cover
 - 1. Native soil material free from rocks, foreign material, and frozen earth, compacted as necessary to prevent settlement and erosion.

2.02 STRUCTURE FOUNDATION

- A. Structure Bedding
 - 1. Crushed limestone or crushed dolomite meeting or exceeding minimum standards for gradation of the AHD #57.
 - 2. Crushed limestone or crushed dolomite shall meet or exceed the minimum standards for deleterious substances as follows:

Maximum Allowable
Percentage by Weight

a.	Coal and lignite	0.25%
b.	Clay lumps	0.25%
c.	Material passing #200 sieve	1.00%
d.	Thin or elongated pieces	1.00%
e.	Other deleterious material	2.00%
f.	Maximum total of a,b,c, and e	6.00%

3. Crushed limestone or crushed dolomite shall be free of foreign material when placed in pipe trench.

B. Structure Foundation Backfill

1. Crushed limestone or crushed dolomite meeting or exceeding minimum standards for gradation of the AHD #1 for conditions of excessive undercutting rock or soil.
2. Spoil rock or blasted rock from quarry in sized (4) four inches to four (4) feet for conditions of sinkholes or voids filled with soupy saturated materials.
3. Type of materials and mixtures of various sized materials shall be as directed by the Engineers.

2.03 EARTH BACKFILL

- A. Backfill shall be earth of such gradation and moisture content that the soil will compact to the specified density and remain stable.
- B. Suitable backfill shall be the following soils, classified by the Unified Soil Classification System, ASTM D-2487:

Group Symbols

Typical Names

GW.....Well-graded gravel and gravel-sand mixtures, little or no fines

GP.....Poorly graded gravel and gravel-sand mixtures, little or no fines

<u>Group Symbols</u>	<u>Typical Names</u>
GM.....	Silty gravel, gravel-sand-clay mixtures
GC.....	Clayey gravel, gravel-sand-clay mixtures
SW.....	Well-graded sand and gravelly sands, little or no fines
SP.....	Poorly graded sands and gravelly sands, little or no fines
SM.....	Silty sands, sand-silt mixtures
SC.....	Clayey sands, sand-clay mixtures
ML.....	Inorganic silts, very fine sands, rock flour, silty or clayey fine sands.
CL.....	Inorganic clays of low to medium plasticity gravelly clays, sandy clays, silty clays, Lean clays

- C. Materials which are unsuitable for backfill include rocks greater than two (2) inches in their largest dimension, and pavement spoil, rubbish, construction debris, wood, metal, plastics, and the following soils, classified by the Unified Soil Classified System, ASTM D-2487:

<u>Group Symbols</u>	<u>Typical Names</u>
OL.....	Organic silts and organic silty clays of low plasticity
MH.....	Inorganic silts, micaceous or diatomaceous fine sands or silts, elastic silts
CH.....	Inorganic clays of high plasticity, fat clays
OH.....	Organic clays of medium to high plasticity
PT.....	Peat, muck, and other highly organic soils

PART 3 EXECUTION

3.01 EXISTING STRUCTURES, PIPING, AND WIRING

- A. All poles, fences, sewer, gas, water, or other pipes, cables, wires, conduits, and manholes, buildings, and structures shall be supported and protected from injury by the Contractor.

EARTHWORK

- B. The Contractor shall proceed with caution during excavation so the exact location of underground utilities and structures, both known and unknown, may be determined. The Contractor shall be responsible for the repair of utilities and structures when broken or otherwise damaged.
- C. Whenever, in the opinion of the Engineer, it is necessary to explore and excavate to determine the location of underground structures, the Contractor shall make exploration and excavations for such purpose.
- D. Wherever sewer, gas, water, or other pipes or conduits cross the excavation, the Contractor shall support said pipes and conduits without damage to them and without interrupting this Contract. The manner of supporting such pipes and conduits shall be subject to the approval of the Engineer.
- E. When utility lines that have to be removed or relocated are encountered within the areas of operations, the Contractor shall notify the Utility Company in ample time for the necessary measure to be taken to prevent interruption of the service.
- F. The Contractor shall conduct the Work in such a way that no equipment, material, or debris will be placed or allowed to fall upon private property in the vicinity of the Work, unless he shall have first obtained the property owner's written consent thereto and shall have shown said written consent to the Engineer.
- G. All excavated material shall be piled in a manner that will avoid obstructing walkways and driveways. Hydrants under pressure, valve pit covers, valve boxes, curb stop boxes, or other utility drainage ways shall be kept clear or other satisfactory provisions made for drainage.

3.02 CLEARING

- A. Clear and remove logs, stumps, brush, vegetation, rubbish, and other perishable matter from the project site.
- B. Do not remove or damage trees that do not interfere with the finished Work. Completely remove trees required to be removed, including stumps and roots. Properly treat damaged trees which can be saved.

3.03 STRIPPING AND STOCKPILING OF TOPSOIL

- A. Strip topsoil and vegetation from the excavated areas. Stockpile clean topsoil in location designated by the Engineer.
- B. Do not intermix grass, weeds, roots, root mat, brush, and stones larger than one (1) inches with stockpiled topsoil.

3.04 DEWATERING

- A. Provide sufficient dewatering equipment and make proper arrangements for the disposal of water from dewatering operation. Dewatering shall not damage property, create nuisances, or interfere with other Work. Do not use sanitary sewers for the disposal of water from dewatering operations.

3.05 EXCAVATING

- A. Make excavations to elevations and dimensions necessary to permit erection of forms and inspection of foundation and to install piping. Completely remove unsuitable material.
- B. Trees, boulders, and other surface encumbrances, located so as to create a hazard to employees in excavation Work or in the vicinity thereof at any time during operations, shall be removed or made safe before excavating is begun.
- C. Contractor shall be responsible for the determination of the angle of repose of the soil in which the excavating is to be done. Excavate all slopes to at least the angle of response except for areas where solid rock allows for line drilling or pre-splitting.
- D. It is the Contractor's responsibility to control the Work such that sides, slopes, and faces of all excavations shall meet accepted OSHA requirements by scaling, benching, barricading, rock bolting, wire meshing, or other equally effective means. Give special attention to slopes, which may be adversely affected by weather or moisture content.
- E. The Contractor should flatten the excavation sides when an excavation has water conditions, silty materials, loose boulders, and areas where erosion, deep frost action, and slide planes appear.
- F. The Contractor should shore or otherwise support sides of excavations in hard or compact soil in compliance with all OSHA, State, and local safety codes.
- G. Use diversion ditches, dikes, or other suitable means to prevent surface water from entering an excavation and to provide adequate drainage of the area adjacent to the excavation. Do not allow water to accumulate in an excavation. If possible, the grade should be away from excavation.
- H. The Contractor shall provide protection against slides and cave-ins, as required by OSHA, State and local codes.
- I. Store and retain materials as to prevent materials from falling or sliding back into the excavation. Install substantial stop log or barricades when mobile equipment is utilized adjacent to excavations.

- J. The limits of excavation for structures shall be the external dimensions of the structure plus the space necessary for the construction and removal of the forms and construction of masonry Work.
- K. The width of trenches for pipe shall provide a clearance as required by OSHA, State and local codes.
- L. The Contractor is reminded to test the air in excavations in locations where oxygen deficiency or gaseous conditions are possible.
- M. The Contractor is reminded to provide ladders where employees are required to be in excavations as required by OSHA, State and local codes.
- N. The Contractor is reminded to provide adequate barriers and physically protect excavations. Barricade or cover all wells, pits, shafts, and similar excavations. Backfill temporary wells, shafts, and similar excavations upon completion of exploration and similar operations.

3.06 SHEETING

- A. The Contractor has the option of sheeting excavations.
- B. Supporting system, such as piling, cribbing, shoring, and bracing, shall be designed by a qualified Contractor's representative and meet accepted OSHA requirements.
- C. Materials used for sheeting, sheet piling, cribbing, bracing, shoring, and underpinning should be in good, serviceable conditions. Timbers should be sound, free from large or loose knots, and of proper dimensions.
- D. Brace the side of the excavation as necessary to resist the extra pressure due to superimposed loads.
- E. Provide shoring, bracing, or underpinning as necessary to ensure the safety of adjoining buildings or walls. Such shoring, bracing or underpinning shall be inspected daily or more often, as conditions warrant, by a competent contractor's representative and the protection effectively maintained.
- F. The Contractor shall be held responsible for the sufficiency of all sheeting and bracing used, and for all damage to persons or property resulting from the improper quality, strength, placing, maintaining, or removing of the same. This includes damage to trees, sidewalks, and to other property on the project site, as well as on private grounds.
- G. Drive sheeting ahead of excavation. Do not remove sheeting until the excavation backfill has reached within two (2) feet of the top of the excavation, except that

the lower course of sheeting may be removed from a double sheeted excavation. When sheeting is drawn, completely fill all cavities remaining in or adjoining the excavation. When sheeting is left in place, completely fill all cavities behind such sheeting.

3.07 STORAGE AND REMOVAL OF EXCAVATED MATERIAL

- A. Suitable excavated material required for filling and backfilling operations may be stockpiled on the job site.
- B. Remove unsuitable materials from the job site as unsuitable materials are excavated. Remove surplus suitable materials from the job site as excavations are back-filled. Dispose of excess excavated material in a suitable, approved location.

3.08 SUBGRADE

- A. Compact the existing disturbed earth below subgrades which will support structures. Compact existing earth with a vibratory compactor, and maintain moisture content within + or - two (2%) percent of optimum moisture content during compaction. Compact existing earth to not less than ninety-five (95%) percent of the Modified Proctor Density, as determined by ASTM D1557.
- B. Do not construct foundations, footings, slabs, or piping on loose soil, mud, or other unsuitable soil.
- C. Fill excess cuts under foundations, footings, and slabs with structure foundation backfill.
- D. Fill excess cuts under piping with compacted pipe foundation bedding.

3.09 TEMPORARY PLUGS

- A. Prevent foreign matter from entering pipe while it is being installed.
- B. Do not place debris tools, clothing, or other material in this pipe.
- C. Close the open ends of pipe by watertight plugs when pipe laying is not in progress.
- D. Remove any earth or other material that enters pipe, lateral pipe, or appurtenances through any open end.
- E. Remove earth and other materials at no additional cost to the Owner.

3.10 BACKFILLING EXCAVATIONS UNDER PAVEMENTS, FOUNDATIONS, AND STRUCTURES

- A. Contractor shall employ an independent testing laboratory to perform field density tests to ensure proper compaction.
- B. Remove debris and other unsuitable materials from excavations before backfilling is started.
- C. Backfill excavations in areas to be paved with pipe bedding material. Place pipe bedding material in layers six (6) inches loose thickness. Compact each lift of backfill to not less than ninety-eight (98%) percent of the maximum dry density as determined in accordance with AASHTO T99, Method A (Std. Proctor). Compaction shall be by hand tamping or approved mechanical tamping devices, or in larger excavation by approved rollers.
- D. Backfill excavations and fill beneath footings or structures with pipe bedding material. Backfill directly over and around structures with pipe bedding material. Place backfill in lifts no greater than six (6) inches in loose depth. Backfill and fill shall be within + or - two (2%) percent optimum moisture content. Compact backfill and fill to not less than ninety-eight (98%) percent of the Modified Proctor Density, as determined by ASTM D1557.
- E. Provide additional material, if required, to complete backfill and fill. Additional backfill and fill material shall be provided at no additional cost to the Owner.
- F. Do not use the following materials for backfill:
 - 1. Unsuitable materials
 - 2. Materials which are too wet or too dry to be compacted to the densities specified in this Article.
- G. Do not place fill over wet or muddy subgrade.
- H. Place backfill and fill in a manner which will not overload foundations or structures. Place backfill and fill evenly on all sides of foundations and structures. Do not use equipment that will overload foundations or structures during filling or backfilling.
- I. Do all cutting, filling, and grading necessary to bring the entire area around foundations and outside of structures to the following subgrade levels:
 - 1. To finished grade for areas not to be paved with drives or walks.

3.11 BACKFILLING PIPING TRENCHES

EARTHWORK

- A. Do not backfill trenches and excavations until all utilities have been inspected by the Engineer and until all underground utilities and piping systems are installed in accordance with the requirements of the Specifications and the Drawings.
- B. Place and tamp bedding and backfill in a manner which will not damage pipe coating, wrapping, or encasement.
- C. Bedding procedures shall be as specified in the Section for the applicable pipe material.
- D. Place pipe backfill material in eight (8) inch layers from the top of bedding to depths as required for particular application. Compact pipe backfill material to the density required to allow backfill material over the pipe to be compacted to the density specified in this Article.
- E. Do not use the following materials for backfill:
 - 1. Unsuitable materials
 - 2. Materials which are too wet or dry to be compacted to the densities specified in this Article.
- F. Do not place fill over wet or muddy subgrade.
- G. Backfill trenches across paved roadways with pipe bedding material, compacting each lift to ninety-eight (98%) percent of the Modified Proctor Density. Backfill trenches across gravel roadways, driveways, utility crossings, and along driveways with pipe bedding material. Compact each lift of backfill to equivalent of not less than ninety (90%) percent of the Modified Proctor Density. Place backfill in six (6) inch loose lifts. Compaction shall be by hand tamping or approved mechanical tamping devices, or in larger excavations by approved rollers. Do not compact backfill by puddling.
- H. Backfill trenches not requiring pipe bedding material with suitable pipe cover material as required by the Engineers. Place and compact backfill to produce an adequate foundation for seeding. The top twelve (12) inches of backfill shall not contain stones or other objects larger than one (1) inch in maximum dimension. Mound backfill above finish grade to allow for settlement. Fill and restore any settlement of the backfill. Grade area to be restored to finish grade after settlement of backfill.

3.12 CLEANUP AND MAINTENANCE

- A. Cleanup the job site as backfilling is completed. Remove excess earth, rock, bedding, materials, and backfill materials. Remove unused piping materials, structure, components and appurtenances. Restore items moved, damaged, or destroyed during construction.

EARTHWORK

- B. Maintain the job site until the Work has been completed and accepted. Fill excavations, which settle when settlement is visible. Restore items damaged by construction or improper restoration.
- C. Control soil erosion, stream and drain pollution resulting from silt or soil runoff or any material from construction operations. Use silt fences, silt barriers and sedimentation pools as required. Submit plan to control soil erosion, stream and drain pollution before clearing site.

END OF SECTION

**SECTION 02260
EROSION AND SEDIMENT CONTROL**

PART 1 GENERAL

1.01 WORK INCLUDED

- A. Provide protection of the environment during the construction of this project to reduce soil erosion and siltation to the lowest reasonably achievable level.

1.02 GENERAL

- A. Exercise every reasonable precaution, throughout the life of the project, to prevent the eroding of soil and the silting of rivers, streams, lakes, reservoirs, other water impoundments, ground or roadway surfaces, or other property. Erosion control practices to be used for this project are shown on the drawings and are to conform to "Manual for Erosion and Sediment Control in SC".

PART 2 PRODUCTS

2.01 GRASSING

- A. Comply with Section 02101 - Civil Sitework.

2.02 SILT FENCE

- A. All posts to be self-fastener angle steel, 5' in length.
 - 1. Wooden posts are not acceptable.
- B. Woven wire shall conform to the requirements of ASTM A 116, Class I zinc coating for wire. Each woven square shall measure 6" x 6". The top and bottom wires shall be 10 gauge. All other wires shall be 12-1/2 gauge.
 - 1. Securely attach woven wire to posts with wire ties.
- C. Provide filter fabric meeting the requirements of the Manual for Erosion and Sediment Control in SC, Latest Edition.
 - 1. Limit splices in filter fabric using continuous rolls whenever possible.
 - 2. Whenever splices are necessary a minimum overlap of 18" is required and all splices must occur at a post so that the integrity of the fence is not compromised.
 - 3. Securely attach filter fabric to top of woven wire and at posts with wire ties.

EROSION AND SEDIMENT CONTROL

- D. Silt fences should be continuous and transverse to the flow. The silt fence should follow the contours of the site as closely as possible. Place the fence such that the water cannot runoff around the end of the fence.

2.03 OTHER MATERIAL

- A. Provide other material such as rock, rip-rap or erosion control matting as required to stabilize the site or meet the requirements as shown on the Drawings.

PART 3 EXECUTION

3.01 GENERAL

- A. Construct and maintain all erosion control measures until the substantial completion of the project.

3.02 TEMPORARY GRASSING

- A. Provide a temporary cover for erosion control on disturbed areas that will remain unstabilized for a period of more than 14 days in accordance with Section 02101.
- B. This practice applies to cleared areas, diversions, dams, temporary sediment basins, temporary road banks, and topsoil stockpiles where vegetation is needed for less than 1 year.
- C. Provide grassing on slope 5% or greater within 14 days of disturbance. Comply with Section 02101.

3.03 SILT FENCE

- A. Provide silt fence barrier where shown on the plans and on utility construction parallel to the disturbed trench where perpendicular sheet flow runoff occurs on disturbed areas with slopes greater than 4%.
- B. Place at the limits shown on the plans.
- C. Construct temporary sediment barriers of filter fabric, buried at the bottom, stretched and supported by posts and install below small disturbed areas as indicated on the drawings to retain sediment by reducing the flow velocity to allow sediment deposition.
- D. Space posts as indicated on the drawings.
- E. Remove sediment deposits prior to reaching one-half height of the fence.

EROSION AND SEDIMENT CONTROL

- F. Monitor site frequently and place additional silt fencing should evidence indicate that erosion is about to occur at locations other than those shown on plan.

3.04 MAINTENANCE

- A. Place all erosion control devices or measures prior to any land disturbing activity within the drainage area they are located.
- B. Inspect erosion control devices and clean or otherwise remove silt buildup as necessary once a week or 24-hours following a rain event of ≥ 0.1 ".

3.05 REMOVAL

- A. Remove temporary structures after protected areas have been stabilized.

END OF SECTION

**SECTION 02281
TERMITE CONTROL**

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract.

1.02 DESCRIPTION OF WORK

- A. Provide soil treatment for termite control under and around the new blower building.

1.03 QUALITY ASSURANCE

- A. In addition to requirements of these specifications, comply with manufacturer's instructions and recommendations for work, including preparation of substrate application.
- B. Engage a professional pest control operator, licensed in accordance with regulations of governing authorities for application of soil treatment solution

1.04 JOB CONDITIONS

- A. Restrictions: Do not apply soil treatment solution until excavating, filling and grading operations are completed, except as otherwise required in construction operations.
- B. To insure penetration, do not apply soil treatment to frozen or excessively wet soils or during inclement weather. Comply with handling and application instructions of the soil toxicant manufacturer.

1.05 SUBMITTALS

- A. Product Data: Submit manufacturer's technical data and application instructions, and EPA approve data.

1.06 SPECIFIC PRODUCT WARRANTY

- A. Furnish warranty certifying that applied soil poisoning treatment will prevent infestation of subterranean termites and that if subterranean termite activity is discovered during warranty period, Contractor will re-treat soil and repair or replace damage caused by termite infestation

TERMITE CONTROL

1. Provide warranty for a period of 5 years from date of treatment, signed by Applicator and Contractor.

PART 2 PRODUCTS

2.01 SOIL TREATMENT SOLUTION

- A. Use EPA registered emulsible insecticide for dilution with water, specially formulated to prevent infestation by termites. Fuel oil will not be permitted as a dilutant
- B. Use only soil treatment solutions which are not injurious to planting

END OF SECTION

**SECTION 02512
FABRIC UNDERLAY MATERIAL**

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Provide stabilization fabric underlay material on existing grade under paving as shown on the Drawings, as specified herein, and as needed for a complete and proper installation.
- B. Related work:
 - 1. Section 02515 - Roads and Driveways

1.2 SUBMITTALS

- A. Submittals shall be made in accordance with Section GENERAL REQUIREMENTS, and the requirements of this Section.
- B. Provide the following submittals:
 - 1. Product cut sheets for material.

PART 2 - PRODUCTS

2.1 PROPERTIES

- A. Provide fabric woven from isolactic polypropylene monofilaments, non-biodegradable, resistant to chemicals and treated to withstand exposure to ultraviolet degradation.
- B. Fabric shall have the following properties:

1.	Grab Tensile Strength	315 lb.
2.	Grab Elongation	15%
3.	Mullen Burst Strength	600 psi
4.	Trapezoid Tear Strength	120 lb.
5.	Apparent Opening Size (AOS)	.425 mm 40 (U.S. Sieve)
6.	Permitivity	0.05 Sec ⁻¹
7.	Flow Rate	4.0 gal/min/ft ²
8.	Thickness	25 mils
9.	Weight	6.0 oz./sq. yd.
10.	Ultraviolet Stability	70% @ 500 hours

FABRIC UNDERLAY MATERIAL

- C. Fabric underlay material shall be Mirafi 600X or approved equal.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Fabric underlay material shall be placed to the lines and grades shown on the Drawings. Material shall be placed smooth and free of excessive wrinkles with 12" minimum of overlap.

END OF SECTION

**SECTION 02515
ROADS AND DRIVEWAYS**

PART 1 GENERAL

1.01 WORK INCLUDED

- A. Work necessary to complete the roads and driveways, including asphalt paving, and drainage structures.

1.02 RELATED DOCUMENTS

- A. The work shall be performed in accordance with the "Standard Specifications" as prepared by the SC Department of Transportation, (hereafter referred to as the "STD. SPECS.") and any Special Provisions which supplement these specifications. In case of conflict with any part or parts of said Standard Specifications, the said Special Provisions shall take precedence and shall govern.

1.03 SUBMITTALS

- A. Submittals shall be made in accordance with the requirements of this Section.
- B. Provide the following submittals:
 - 1. Certification, test results, and source for asphalt concrete material.
 - 2. Product cut sheets for cast drainage structures and grating.

1.04 SYSTEM DESCRIPTION

- A. Paving: Designed for movement and parking of trucks up to thirty-thousand (30,000) Lbs.

1.05 QUALITY ASSURANCE

- A. The Contractor shall be responsible for providing third party independent testing of materials and placement, including compaction tests.

PART 2 PRODUCTS

2.01 PAVEMENT MATERIALS

- A. Asphalt concrete shall conform to Sections 401, 402 and 403 of the Standard Specifications.

ROADS AND DRIVEWAYS

- B. Aggregate and fillers shall meet the requirements of Section 305 of the Standard Specifications.
- C. The job-mix formula shall indicate the gradation of each of the aggregate constituents to be used in the mixture and shall establish the exact proportion of each constituent to be used to produce a combined gradation of aggregate within the appropriate limits stated above.

PART 3 EXECUTION

3.01 GRADING AND SUBGRADE

- A. Grading work shall be in accordance with Section 02101.

3.02 BASES AND SUB-BASES

- A. Construction of sub-base and base for paving shall comply with Section 305 of the "STD. SPECS."
- B. Provide four inches of base material.

3.03 PAVEMENT

- A. All asphalt pavement construction shall conform to Sections 401, 402 and 403 of the "STD. SPECS."
- B. Bituminous tack coat materials and placement shall comply with Section 401 of the "STD. SPECS."
- C. Provide two inches of Binder overlaid by two inches of Type B surface course.

3.04 MISCELLANEOUS CONCRETE

- A. Concrete driveway construction shall conform to Section 501 of the "STD. SPECS."
- B. Concrete sidewalk shall conform to the details on the Drawings.

3.05 BASE CONSTRUCTION

- A. Construct base course at the location and to the grades and cross sections shown on the Drawings.
- B. Once the drive area is at grade, the area shall be thoroughly proofrolled. Any soft or loose areas shall be undercut and replaced with compacted fill.
- C. The base shall be compacted to a minimum of 98 percent maximum dry density as determined by a Standard Proctor at a moisture content that is within 2 percentage points of the optimum moisture content.

3.06 ASPHALT PAVEMENT CONSTRUCTION

- A. Asphalt for prime coat shall not be applied when the ground temperature is lower than fifty (50) degrees F without permission of the Engineer. Asphalt concrete shall not be placed when the atmosphere temperature is lower than forty (40) degrees F nor during heavy rainfall nor when the surface upon which it is to be placed is thirty-two (32) degrees F or lower.
- B. Lay asphalt concrete over the base course to the compacted depth shown on the Drawings. The method of proportioning, mixing, transporting, laying, processing, rolling the material, and the standards of workmanship shall conform to the applicable requirements of the Standard Specifications. At no time shall the coarse aggregate segregate from the mix from hand spreading or raking of joints be scattered across the paved mat.
- C. Roll each lift of the asphalt concrete and compact to the density specified in the referenced Standard Specifications. Asphalt or asphalt stains, which are noticeable upon surfaces of concrete or materials, which will be exposed to view shall be promptly and completely removed.
- D. Where the asphalt pavement is to be connected with an existing roadway surface, the Contractor shall modify the existing roadway profile to produce a smooth riding connection between new and existing paving. Where it is necessary to remove existing asphalt surfaces, burn or chip the existing surface to provide a minimum 2 1/2-inch depth of asphalt concrete. The edges of meet line cuts shall be straight and vertical. Existing asphalt edges shall be painted with tack coat before placing new asphalt.
- E. The completed surface of the asphalt pavement shall be of uniform texture, smooth, uniform as to crown and grade, and free from defects of all kinds. The completed surface shall not vary more than 1/8-inch from the lower edge of a ten (10)-foot straightedge placed on the surface parallel to the centerline. The transverse slope shall not vary more than 1/4-inch in ten (10)-feet from the rate of transverse slope shown on the Drawings.

3.07 CULVERTS

- A. Place culverts and drainpipes at grade shown on the Drawings. Do not permit mud and foreign material to get into the pipe. After completion, completely flush or clean all parts of the system. Culvert entrances shall not be blocked by any mud or silt and ditch grades downstream of culverts shall not be greater than the pipe invert.

END OF SECTION

**SECTION 03300
CAST-IN-PLACE CONCRETE**

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract and Division 1 Specification Sections apply to this Section.

1.02 SUMMARY

- A. This Section specifies cast-in-place concrete, including formwork, reinforcing, mix design, placement procedures, and finishes.
- B. Cast-in-Place Concrete includes the Following:
 - 1. Foundations and Footings
 - 2. Slabs-on-Grade
 - 3. Foundation Walls
 - 4. Framed Floors and Columns
 - 5. Equipment Pads and Bases
 - 6. Fill for Masonry
 - 7. Concrete on Metal Deck

1.03 SUBMITTALS

- A. General: Submit the following according to Conditions of the Contract and Division 1 Specification Sections.
- B. Product data for proprietary materials and items, including reinforcement and forming accessories, admixtures, patching compounds, waterstops, joint systems, curing compounds, dry-shake finish materials, and others if requested by Engineer.
- C. Shop drawings for reinforcement detailing fabricating, bending, and placing concrete reinforcement. Comply with ACI 315 "Manual of Standard Practice for Detailing Reinforced Concrete Structures" showing bar schedules, stirrup spacing, bent bar diagrams, and arrangement of concrete reinforcement. Include special

CAST-IN-PLACE CONCRETE

reinforcing required for openings through concrete structures. Reproduction of contract drawings for use, as erection drawings will not be permitted.

- D. Shop drawings for formwork indicating fabrication and erection of forms for specific finished concrete surfaces. Show form construction including jointing special form joints or reveals, location and pattern of form tie placement, and other items that affect exposed concrete visually.
 - 1. Engineer's review is for general applications and features only. Designing formwork for structural stability and efficiency is Contractor's responsibility.
- E. Samples of materials as requested by Engineer, including names, sources, and descriptions.
- F. Laboratory test reports for concrete materials and mix design test.

1.04 QUALITY ASSURANCE

- A. Codes and Standards: Comply with provisions of the following codes, specifications, and standards, except where more stringent requirements are shown or specified:
 - 1. American Concrete Institute (ACI) 301, "Specifications for Structural Concrete for Buildings".
 - 2. ACI 318, "Building Code Requirements for Reinforced Concrete".
 - 3. Concrete Reinforcing Steel Institute (CRSI) "Manual of Standard Practice".
- B. Concrete Testing Service: Engage a testing agency acceptable to Engineer to perform material evaluation tests and to design concrete mixes.
- C. Materials and installed work may require testing and re-testing at any time during progress of Work. Tests, including re-testing of rejected materials for installed Work, shall be done at Contractor's expense.

PART 2 PRODUCTS

2.01 FORM MATERIALS

- A. Forms for Exposed Finish Concrete: Plywood, metal, metal-framed plywood faced, or other acceptable panel-type materials to provide continuous, straight, smooth, exposed surfaces. Furnish in largest practicable sizes to minimize number of joints and to conform to joint system shown on drawings.

CAST-IN-PLACE CONCRETE

1. Use overlaid plywood complying with U.S. Product Standard PS-1 "A-C or B-B High Density Overlaid Concrete Form", Class I.
- B. Forms for Unexposed Finish Concrete: Plywood, lumber, metal, or another acceptable material. Provide lumber dressed on at least two edges and one side for tight fit.
- C. Forms for Textured Finish Concrete: Units of face design, size, arrangement, and configuration to match Architect's control sample. Provide solid backing and form supports to ensure stability of textured form liners.
- D. Forms for Cylindrical Columns and Supports: Metal, glass-fiber-reinforced plastic, or paper or fiber tubes that will produce smooth surfaces without joint indications. Provide units with sufficient wall thickness to resist wet concrete loads without deformation.
- E. Pan-Type Forms: Glass-fiber-reinforced plastic or formed steel stiffened to support weight of placed concrete without deformation.
- F. Carton Forms: Biodegradable paper surface, treated for moisture-resistance, structurally sufficient to support weight of plastic concrete and other superimposed loads.
- G. Form Release Agent: Provide commercial formulation form release agent with a maximum of 350 g/L volatile organic compounds (VOCs) that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.
- H. Form Ties: Factory-fabricated, adjustable-length, removable or snap-off metal form ties designed to prevent form deflection and to prevent spalling of concrete upon removal. Provide units that will leave no metal closer than 1-1/2 inches (38 mm) to the plane of the exposed concrete surface.
 1. Provide ties that, when removed, will leave holes not larger than 1 inch (25 mm) in diameter in the concrete surface.

2.02 REINFORCING MATERIALS

- A. Reinforcing Bars: ASTM A 615 Grade 60 (ASTM A 615M Grade 400), deformed.
- B. Welded Wire Fabric: ASTM A 185, welded steel wire fabric.
- C. Supports for Reinforcement: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire fabric in place. Use wire bar type supports complying with CRSI Specifications.

CAST-IN-PLACE CONCRETE

1. For slabs on grade, use supports with sand plates or horizontal runners where base material will not support chair legs.
2. For exposed to view concrete surfaces where legs of supports are in contact with forms, provide supports with legs that are protected by plastic (CRSI, Class 1) or stainless steel (CRSI, Class 2).

2.03 CONCRETE MATERIALS

- A. Portland Cement: ASTM C 150, Type I.
1. Use one brand of cement throughout Project unless otherwise acceptable to Engineer.
- B. Fly Ash: ASTM C 618, Type F.
- C. Normal-Weight Aggregates: ASTM C 33 and as specified. Provide aggregates from a single source for exposed concrete.
1. For exposed exterior surfaces, do not use fine or coarse aggregates that contain substances that cause spalling.
 2. Local aggregates not complying with ASTM C 33 that have been shown to produce concrete of adequate strength and durability by special tests or actual service may be used when acceptable to Engineer.
- D. Water: Potable
- E. Fiber Reinforcement: Polypropylene fibers engineered and designed for secondary reinforcement of concrete slabs, complying with ASTM C 1116, Type III, not less than $\frac{3}{4}$ inch long.
1. Available Products: Subject to compliance with requirements, products that may be incorporated in the Work include, but are not limited to, the following:
 - a. Gilco Fibers, Cormix Construction Chemicals
 - b. Durafiber, Durafiber Corp.
 - c. Fiberstrand 100, Euclid Chemical Co.
 - d. Fibermesh, Fibermesh Co., Div. Synthetic Industries, Inc.
 - e. Forta, Forta Corp.
 - f. Grace Fibers, W.R. Grace & Co.
 - g. Polystrand, Metalcrete Industries
- F. Admixtures, General: Provide concrete admixtures that contain not more than 0.1 percent chloride ions.

CAST-IN-PLACE CONCRETE

- G. Air-Entraining Admixture: ASTM C 260, certified by manufacturer to be compatible with other required admixtures.
1. Add air-entraining admixture to all concrete at manufacturer's prescribed rate to achieve 4-6% air content at placement. Subject to compliance with requirements, products that may be incorporated in the Work include, but are not limited to, the following:
 - a. Air-Tite, Cormix Construction Chemicals
 - b. Air-Mix or Perma-Air, Euclid Chemical Co.
 - c. Darex AEA or Daravair, W.R. Grace & Co.
 - d. MB-VR or Micro-Air, Master Builders, Inc.
 - e. Sealtight AEA, W.R. Meadows, Inc.
 - f. Sika AER, Sika Corp.
- H. Water-Reducing Admixture: ASTM C 494, Type A.
1. Available Products: Subject to compliance with requirements, products that may be incorporated in the Work include, but are not limited to, the following:
 - a. Chemtard, ChemMasters Corp.
 - b. PSI N, Cormix Construction Chemicals
 - c. Eucon WR-75, Euclid Chemical Co.
 - d. WRDA, W.R. Grace & Co.
 - e. Pozzolith Normal or Polyheed, Master Builders, Inc.
 - f. Metco W.R., Metalcrete Industries
 - g. Prokrete-N, Prokrete Industries
 - h. Plastocrete 161, Sika Corp.
- I. High-Range Water-Reducing Admixture: ASTM C 494, Type F or Type G.
1. Available Products: Subject to compliance with requirements, products that may be incorporated in the Work include, but are not limited to, the following:
 - a. Super P, Anti-Hydro Co., Inc.
 - b. Cormix 200, Cormix Construction Chemicals
 - c. Eucon 37, Euclid Chemical Co.
 - d. WRDA 19 or Daracem, W.R. Grace & Co.
 - e. Rheobuild or Polyheed, Master Builders, Inc.
 - f. Superslump, Metalcrete Industries
 - g. PSPL, Prokrete Industries
 - h. Sikament 300, Sika Corp.
- J. Water-Reducing, Accelerating Admixture: ASTM C 494, Type E.

CAST-IN-PLACE CONCRETE

1. Available Products: Subject to compliance with requirements, products that may be incorporated in the Work include, but are not limited to, the following:
 - a. Q-Set, Conspec Marketing & Manufacturing Co.
 - b. Lubricon NCA, Cormix Construction Chemicals
 - c. Accelguard 80, Euclid Chemical Co.
 - d. Daraset, W.R. Grace & Co.
 - e. Pozzutec 20, Master Builders, Inc.
 - f. Accel-Set, Metalcrete Industries

K. Water-Reducing, Retarding Admixture: ASTM C 494, Type D.

1. Available Products: Subject to compliance with requirements, products that may be incorporated in the Work include, but are not limited to, the following:
 - a. PSI-R Plus, Cormix Construction Chemicals
 - b. Eucon Retarder 75, Euclid Chemical Co.
 - c. Daratard-17, W.R. Grace & Co.
 - d. Pozzolith R, Master Builders, Inc.
 - e. Protard, Prokrete Industries
 - f. Plastiment, Sika Corporation

2.04 RELATED MATERIALS

- A. Reglets: Where sheet flashing or bituminous membranes are terminated in reglets, provide reglets of not less than 0.0217 inch (0.46 mm) thick galvanized sheet steel. Fill reglet or cover face opening to prevent intrusion of concrete or debris.
- B. Dovetail Anchor Slots: Hot-dip galvanized sheet steel, not less than 0.0336 inch thick (0.76 mm) with bent tab anchors. Fill slot with temporary filler or cover face opening to prevent intrusion of concrete or debris.
- C. Waterstops: Provide flat, dumbbell-type or centerbulb-type waterstops at construction joints and other joints as indicated. Size to suit joints.
- D. Rubber Waterstops: Corps of Engineers CRD-C 513.
 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include, but are not limited to, the following:
 - a. The Burke Co.
 - b. Progress Unlimited.
 - c. Williams Products, Inc.

CAST-IN-PLACE CONCRETE

- E. Polyvinyl Chloride Waterstops: CRD-C 572.
1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include, but are not limited to, the following:
 - a. The Burke Co.
 - b. Greenstreak Plastic Products Co.
 - c. W.R. Meadows, Inc.
 - d. Progress Unlimited
 - e. Schlegel Corp.
 - f. Vinylex Corp.
- F. Sand Cushion: Clean, manufactured or natural sand.
- G. Vapor Retarder: Provide vapor retarder that is resistant to deterioration when tested according to ASTM E 154, as follows:
1. Polyethylene sheet not less than 8 mils (0.2 mm) thick.
 2. Water-resistant barrier consisting of heavy kraft papers laminated together with glass-fiber reinforcement and overcoated with black polyethylene on each side.
 - a. Product: Subject to compliance with requirements, provide Moistop by Fortifiber Corporation.
- H. Vapor Barrier: Pre-molded seven-ply membrane consisting of reinforced core and carrier sheet with fortified bitumen layers, protective weathercoating, and plastic antistick sheet. Water vapor transmission rate of 1 perm when tested according to ASTM E 96, Method B. Provide manufacturer's recommended mastics and gusset tape.
1. Product: Subject to compliance with requirements, provide Sealtight Pre-molded Membrane by W.R. Meadows, Inc.
- I. Nonslip Aggregate Finish: Provide fused aluminum oxide granules or crushed emery as the abrasive aggregate for a nonslip finish, with emery aggregate containing not less than 50 percent aluminum oxide and not less than 25 percent ferric oxide. Use material that is factory-graded, packaged, rustproof, nonglazing and unaffected by freezing, moisture, and cleaning materials.
- J. Colored Wear-Resistant Finish: Packaged dry combination of materials consisting of portland cement, graded quartz aggregate, coloring pigments, and plasticizing admixture. Use coloring pigments that are finely ground nonfading mineral oxides interground with cement. Color as selected by Architect from manufacture standards, unless otherwise indicated.

CAST-IN-PLACE CONCRETE

1. Available Products: Subject to compliance with requirements, products that may be incorporated in the Work include, but are not limited to, the following:
 - a. Conshake 600 Colortone, Conspec Marketing & Mfg. Co.
 - b. Floorcron, Cormix Construction Chemicals
 - c. Quartz Tuff, Dayton-Superior
 - d. Surfex, Euclid Chemical Co.
 - e. Colorundum, A.C. Horn, Inc.
 - f. Quartz Plate, L&M Construction Chemicals, Inc.
 - g. Colorcron, Master Builders, Inc.
 - h. Floor Quartz, Metalcrete Industries
 - i. Lithochrome Color Hardener, L.M. Scofield Co.
 - j. Harcol Redi-Mix, Sonneborn-Chemrex
 - k. Hard Top, Symons Corporation

- K. Absorptive Cover: Burlap cloth made from jute or kenaf, weighing approximately 9 oz/sq. yd. (305 g/sq. m), complying with AASHTO M 182, Class 2.

- L. Moisture-Retaining Cover: One of the following, complying with ASTM C 171.
 1. Waterproof Paper
 2. Polyethylene Film
 3. Polyethylene-Coated Burlap

- M. Liquid Membrane-Forming Curing Compound: Liquid-type membrane forming curing compound complying with ASTM C 309, Type I, Class A. Moisture loss not more than 0.55 kg/sq. m when applied at 200 sq. ft/gal (4.9 sq. m/L).
 1. Available Products: Subject to compliance with requirements, products that may be incorporated in the Work include, but are not limited to, the following:
 - a. A-H 3 Way Sealer, Anti-Hydro Co., Inc.
 - b. Spartan-Cote, The Burke Co.
 - c. Conspec #1, Conspec Marketing & Mfg. Co.
 - d. Sealco 309, Cormix Construction Chemicals
 - e. Day-Chem Cure and Seal, Dayton Superior Corporation
 - f. Eucocure, Euclid Chemical Co.
 - g. Horn Clear Seal, A.C. Horn, Inc.
 - h. L & M Cure R, L & M Construction Chemicals, Inc.
 - i. Masterkure, Master Builders, Inc.
 - j. CS-309, W.R. Meadows, Inc.
 - k. Seal-N-Kure, Metalcrete Industries

CAST-IN-PLACE CONCRETE

- l. Kure-N-Seal, Sonneborn Chemrex
 - m. Stontop CS2, Stonhard, Inc.
- N. Water-Based Acrylic Membrane Curing Compound: ASTM C 309, Type I, Class B.
 1. Provide material that has a maximum volatile organic compound (VOC) rating of 350 g/L.
 2. Available Products: Subject to compliance with requirements, products that may be incorporated in the Work include, but are not limited to, the following:
 - a. Highseal, Conspec Marketing and Mfg. Co.
 - b. Sealco - VOC, Cormix Construction Chemicals
 - c. Safe Cure and Seal, Dayton Superior Corp.
 - d. Aqua-Cure, Euclid Chemical Co.
 - e. Dress & Seal WB, L & M Construction Chemicals, Inc.
 - f. Masterkure 100W, Master Builders, Inc.
 - g. Vocomp-20, W.R. Meadows, Inc.
 - h. Metcure, Metalcrete Industries
 - i. Stontop CS1, Stonhard, Inc.
- O. Evaporation Control: Monomolecular film forming compound applied to exposed concrete slab surfaces for temporary protection from rapid moisture loss.
 1. Available Products: Subject to compliance with requirements, products that may be incorporated in the Work include, but are not limited to, the following:
 - a. Aquafilm, Conspec Marketing and Mfg. Co.
 - b. Eucobar, Euclid Chemical Co.
 - c. E-Con, L & M Construction Chemicals, Inc.
 - d. Confilm, Master Builders, Inc.
 - e. Waterhold, Metalcrete Industries
- P. Underlayment Compound: Free-flowing, self-leveling, pumpable, cement-based compound for applications from 1 inch (25 mm) thick to feathered edges.
 1. Available Products: Subject to compliance with requirements, products that may be incorporated in the Work include, but are not limited to, the following:
 - a. K-15, Ardex, Inc.
 - b. Self-Leveling Wear Topping, W.R. Bonsal Co.
 - c. Conflow, Conspec Marketing and Mfg. Co.
 - d. Corlevel, Cormix Construction Chemicals

CAST-IN-PLACE CONCRETE

- e. Level Layer II, Dayton Superior Corp.
 - f. Flo-Top, Euclid Chemical Co.
 - g. Gyp-Crete, Gyp-Crete Corp.
 - h. Levelex, L & M Construction Chemicals, Inc.
 - i. Underlayment 110, Master Builders, Inc.
 - j. Stoncrete UL1, Stonhard, Inc.
 - k. Concrete Top, Symons Corp.
 - l. Thoro Underlayment Self-Leveling, Thoro System Products
- Q. Bonding Agent: Polyvinyl acetate or acrylic base.
- 1. Available Products: Subject to compliance with requirements, products that may be incorporated in the Work include, but are not limited to, the following:
 - a. Aquafilm, Conspec Marketing and Mfg. Co.
 - b. Eucobar, Euclid Chemical Co.
 - c. E-Con, L & M Construction Chemicals, Inc.
 - d. Confilm, Master Builders, Inc.
 - e. Waterhold, Metalcrete Industries
- R. Underlayment Compound: Free-flowing, self-leveling, pumpable, cement-based compound for applications from 1 inch (25 mm) thick to feathered edges.
- 1. Available Products: Subject to compliance with requirements, products that may be incorporated in the Work include, but are not limited to, the following:
 - a. K-15, Ardex, Inc.
 - b. Self-Leveling Wear Topping, W.R. Bonsal Co.
 - c. Conflow, Conspec Marketing and Mfg. Co.
 - d. Corlevel, Cormix Construction Chemicals
 - e. Level Layer II, Dayton Superior Corp.
 - f. Flo-Top, Euclid Chemical Co.
 - g. Gyp-Crete, Gyp-Crete Corp.
 - h. Levelex, L & M Construction Chemicals, Inc.
 - i. Underlayment 110, Master Builders, Inc.
 - j. Stoncrete UL1, Stonhard, Inc.
 - k. Concrete Top, Symons Corp.
 - l. Thoro Underlayment Self-Leveling, Thoro System Products
- S. Bonding Agent: Polyvinyl acetate or acrylic base.
- 1. Available Products: Subject to compliance with requirements, products that may be incorporated in the Work include, but are not limited to, the following:

CAST-IN-PLACE CONCRETE

- a. Polyvinyl Acetate (Interior Only):
 - 1. Superior Concrete Bonder, Dayton Superior Corp.
 - 2. Euco Weld, Euclid Chemical Co.
 - 3. Weld-Crete, Larsen Products Corp.
 - 4. Everweld, L & M Construction Chemicals, Inc.
 - 5. Herculox, Metalcrete Industries
 - 6. Ready Bond, Symons Corp.

- b. Acrylic or Styrene Butadiene:
 - 1. Acrylic Bondcrete, The Burke Co.
 - 2. Strongbond, Conspec Marketing and Mfg. Co.
 - 3. Day-Chem Ad Bond, Dayton Superior Corp.
 - 4. SBR Latex, Euclid Chemical Co.
 - 5. Daraweld C, W.R. Grace & Co.
 - 6. Hornweld, A.C. Horn, Inc.
 - 7. Everbond, L & M Construction Chemicals, Inc.
 - 8. Acryl-Set, Master Builders Inc.
 - 9. Intralok, W.R. Meadows, Inc.
 - 10. Acrylpave, Metalcrete Industries
 - 11. Sonocrete, Sonneborn-Chemrex
 - 12. Stonlock LB2, Stonhard, Inc.
 - 13. Strong Bond, Symons Corp.

- T. Epoxy Adhesive: ASTM C 881, two-component material suitable for use on dry or damp surfaces. Provide material type, grade, and class to suit Project requirements.

CAST-IN-PLACE CONCRETE

1. Available Products: Subject to compliance with requirements, products that may be incorporated in the Work include, but are not limited to, the following:
 - a. Burke Epoxy M.V., The Burke Co.
 - b. Spec-Bond 100, Conspec Marketing and Mfg. Co.
 - c. Resi-Bond (J-58), Dayton Superior
 - d. Euco Epoxy System #452 or #620, Euclid Chemical Co.
 - e. Epoxitite Bonder 2390, A.C. Horn, Inc.
 - f. Epabond, L & M Construction Chemicals, Inc.
 - g. Concsive Standard Liquid, Master Builders, Inc.
 - h. Rezi-Weld 1000, W.R. Meadows, Inc.
 - i. Metco Hi-Mod Epoxy, Metalcrete Industries
 - j. Sikadur 32 Hi-Mod, Sika Corp.
 - k. Stonset LV5, Stonhard, Inc.
 - l. R-600 Series, Symons Corp.

2.05 PROPORTIONING AND DESIGNING MIXES

- A. Prepare design mixes for each type and strength of concrete by either laboratory trial batch or field experience methods as specified in ACI 301. For the trial batch method, use an independent testing agency acceptable to Architect for preparing and reporting proposed mix designs.
 1. Do not use the same testing agency for field quality control testing.
 2. Limit use of fly ash to not exceed 25 percent of cement content by weight.
- B. Submit written reports to Engineer of each proposed mix for each class of concrete at least 15 days prior to start of Work. Do not begin concrete production until proposed mix designs have been reviewed by Engineer.
- C. Design mixes to provide normal weight concrete as scheduled.
- D. Slump Limits: Proportion and design mixes to result in concrete slump at point of placement as follows:
 1. Ramps, Slabs, and Sloping Surfaces: Not more than 3 inches (75 mm).
 2. Reinforced Foundation Systems: Not less than 2 inches (50 mm) and not more than 4 inches (100 mm).
 3. Concrete Containing High-Range Water-Reducing Admixture (superplasticizer): Not more than 8 inches (200 mm) after adding admixture to site-verified 2-3 inch (50 - 75 mm) slump concrete.
 4. Other Concrete: Not more than 4 inches (100 mm).

CAST-IN-PLACE CONCRETE

- E. Adjustment to Concrete Mixes: Mix design adjustments may be requested by Contractor when characteristics of materials, job conditions, weather, test results or other circumstances warrant, as accepted by Engineer. Laboratory test data for revised mix design and strength results must be submitted to and accepted by Engineer before using in Work.
- F. Fiber Reinforcement: Add at manufacturer's recommended rate but not less than 1.5 lb/cu. yd. (0.9 kg/cu. m).

2.06 ADMIXTURES

- A. Use water-reducing admixture or high-range water-reducing admixture (superplasticizer) in concrete, as required, for placement and workability.
- B. Use accelerating admixture in concrete slabs placed at ambient temperatures below 50 deg F (10 deg C).
- C. Use high-range water-reducing admixture in pumped concrete, concrete for heavy use industrial slabs, architectural concrete, parking structure slabs, concrete required to be watertight, and concrete with water-cement ratios below 0.50.
- D. Use air-entraining admixture in exterior exposed concrete unless otherwise indicated. Add air-entraining admixture at manufacturer's prescribed rate to achieve 4-6% air content at point of placement.
- E. Use admixtures for water reduction and set accelerating or retarding in strict compliance with manufacturer's directions.

2.07 CONCRETE MIXING

- A. Ready-Mixed Concrete: Comply with requirements of ASTM C 94, and as specified.
 - 1. When air temperature is between 85 deg F (29 deg C) and 90 deg F (32 deg C), reduce mixing and delivery time from 1-1/2 hours to 75 minutes, and when air temperature is above 90 deg F (32 deg C), reduce mixing and delivery time to 60 minutes.

PART 3 EXECUTION

3.01 GENERAL

Coordinate the installation of joint materials, vapor retarder/barrier, and other related materials with placement of forms and reinforcing steel.

3.02 FORMS

- A. General: Design, erect, support, brace, and maintain formwork to support vertical, lateral, static, and dynamic loads that might be applied until concrete structure can support such loads. Construct formwork so concrete members and structures are of correct size, shape, alignment, elevation, and position. Maintain formwork construction tolerances and surface irregularities complying with the following ACI 347 limits:
 - 1. Provide Class A tolerances for concrete surfaces exposed to view.
 - 2. Provide Class C tolerances for other concrete surfaces.
- B. Construct forms to sizes, shapes, lines, and dimensions shown and to obtain accurate alignment, location, grades, level, and plumb work in finished structures. Provide for openings, offsets, sinkages, keyways, recesses, moldings, rustications, reglets, chamfers, blocking, screeds, bulkheads, anchorages and inserts, and other features required in the Work. Use selected materials to obtain required finishes. Solidly butt joints and provide backup at joints to prevent cement paste from leaking.
- C. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush plates or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces where slope is too steep to place concrete with bottom forms only. Kerf wood inserts for forming keyways, reglets, recesses, and the like for easy removal.
- D. Provide temporary openings for clean-outs and inspections where interior area of formwork is inaccessible before and during concrete placement. Securely brace temporary openings and set tightly to forms to prevent losing concrete mortar. Locate temporary openings in forms at inconspicuous locations.
- E. Chamfer exposed corners and edges as indicated, using wood, metal, PVC, or rubber chamfer strips fabricated to produce uniform smooth lines and tight edge joints.
- F. Provisions for Other Trades: Provide openings in concrete formwork to accommodate work of other trades. Determine size and location of openings, recesses, and chases from trades providing such items. Accurately place and securely support items built into forms.
- G. Cleaning and Tightening: Thoroughly clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, or other debris just before placing concrete. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.

3.03 VAPOR RETARDER/BARRIER INSTALLATION

- A. General: Place vapor retarder/barrier sheeting in position with longest dimension parallel with direction of pour.
- B. Lap joints 6 inches (150 mm) and seal with manufacturer's recommended mastic or pressure-sensitive tape.
 - 1. Cover vapor retarder/barrier with sand cushion and compact to depth indicated.

3.04 PLACING REINFORCEMENT

- A. General: Comply with Concrete Reinforcing Steel Institute's recommended practice for "placing Reinforcing Bars", for details and methods of reinforcement placement and supports and as specified.
 - 1. Avoiding cutting or puncturing vapor retarder/barrier during reinforcement placement and concreting operations. Repair damages before placing concrete.
- B. Clean reinforcement of loose rust and mill scale, earth, ice, and other materials that reduce or destroy bond with concrete.
- C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcing by metal chairs, runners, bolsters, spacers, and hangers, as approved by Engineer.
- D. Place reinforcement to maintain minimum coverages as indicated for concrete protection. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement operations. Set wire ties so ends are directed into concrete, not toward exposed concrete surfaces.
- E. Install welded wire fabric in lengths as long as practicable. Lap adjoining pieces at least one full mesh and lace splices with wire. Offset laps of adjoining widths to prevent continuous laps in either direction.

3.05 JOINTS

- A. Construction Joints: Locate and install construction joints so they do not impair strength or appearance of the structure, as acceptable to Engineer.
- B. Provide keyways at least 1-1/2 inches (38 mm) deep in construction joints in walls and slabs and between walls and footings. Bulkheads designed and accepted for this purpose may be used for slabs.

CAST-IN-PLACE CONCRETE

- C. Place construction joints perpendicular to main reinforcement. Continue reinforcement across construction joints except as indicated otherwise. Do not continue reinforcement through sides of strip placements.
- D. Use bonding agent on existing concrete surfaces that will be joined with fresh concrete.
- E. Waterstops: Provide waterstops in construction joints as indicated. Install waterstops to form continuous diaphragm in each joint. Support and protect exposed waterstops during progress of Work. Field-fabricate joints in waterstops according to manufacturer's printed instructions.
- F. Isolation Joints in Slabs-on-Grade: Construct isolation joints in slabs-on-grade at points of contact between slabs-on-grade and vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.
 - 1. Joint fillers and sealants are specified in Division 7 Section "Joint Sealants".
- G. Contraction (Control) Joints in Slabs-on-Grade: Construct contraction joints in slabs-on-grade to form panels of patterns as shown. Use saw cuts 1/8 inch (3 mm) wide by one-fourth of slab depth of inserts 1/4 inch (6 mm) wide by one-fourth of slab depth, unless otherwise indicated.
 - 1. Form contraction joints by inserting pre-molded plastic, hardboard, or fiberboard strip into fresh concrete until top surface of strip is flush with slab surface. Tool slab edges round on each side of insert. After concrete has cured, remove inserts and clean groove of loose debris.
 - 2. Contraction joints in unexposed floor slabs may be formed by saw cuts as soon as possible after slab finishing as may be safely done without dislodging aggregate.
 - 3. If joint pattern is not shown, provide joints not exceeding 15 ft. (4.5 m) in either direction and located to conform to bay spacing wherever possible (at column centerlines, half bays, third bays).
 - 4. Joint fillers and sealants are specified in Division 7 Section "Joint Sealants".

3.06 INSTALLING EMBEDDED ITEMS

- A. General: Set and build into formwork anchorage devices and other embedded items required for other work that is attached to or supported by cast-in-place concrete. Use setting drawings, diagrams, instructions, and directions provided by suppliers of items to be attached.
- B. Install reglets to receive top edge of foundation sheet waterproofing and to receive through-wall flashings in outer face of concrete frame at exterior walls, where flashing is shown at lintels, relieving angles, and other conditions.

- C. Install dovetail anchor slots in concrete structures as indicated on drawings.
- D. Forms for Slabs: Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and contours in finished surfaces. Provide and secure units to support screed strips using strike-off templates or compacting-type screeds.

3.07 PREPARING FORM SURFACES

- A. General: Coat contact surfaces of forms with an approved, nonresidual, low-VOC, form-coating compound before placing reinforcement.
- B. Do not allow excess form-coating material to accumulate in forms or come into contact with in-place concrete surfaces against which fresh concrete will be placed. Apply according to manufacturer's instructions.
 - 1. Coat steel forms with a nonstaining, rust-preventative material. Rust-stained steel formwork is not acceptable.

3.08 CONCRETE PLACEMENT

- A. Inspection: Before placing concrete, inspect and complete formwork installation, reinforcing steel, and items to be embedded or cast in. Notify other trades to permit installation of their work.
- B. General: Comply with ACI 304, "Guide for Measuring, Mixing, Transporting, and Placing Concrete", and as specified.
- C. Deposit concrete continuously or in layers of such thickness that no new concrete will be placed on concrete that has hardened sufficiently to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as specified. Deposit concrete to avoid segregation at its final location.
- D. Placing Concrete in Forms: Deposit concrete in forms in horizontal layers no deeper than 24 inches (600 mm) and in a manner to avoid inclined construction joints. Where placement consists of several layers, place each layer while preceding layer is still plastic to avoid cold joints.
 - 1. Consolidate placed concrete by mechanical vibrating equipment supplemented by hand spading, rodding, or tamping. Use equipment and procedures for consolidation of concrete complying with ACI 309.
 - 2. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations no farther than the visible effectiveness of the machine. Place vibrators to rapidly penetrate placed layer and at least 6 inches (150 mm) into preceding layer.

CAST-IN-PLACE CONCRETE

Do not insert vibrators into lower layers of concrete that have begun to set. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mix to segregate.

- E. Placing Concrete Slabs: Deposit and consolidate concrete slabs in a continuous operation, within limits of construction joints, until completing placement of a panel or section.
 - 1. Consolidate concrete during placement operations so that concrete is thoroughly worked around reinforcement, other embedded items and into corners.
 - 2. Bring slab surfaces to correct level with a straightedge and strike off. Use bull floats or darbies to smooth surface free of humps or hollows. Do not disturb slab surfaces prior to beginning finishing operations.
 - 3. Maintain reinforcing in proper position on chairs during concrete placement.
- F. Cold-Weather Placement: Comply with provisions of ACI 306 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
- G. When air temperature has fallen to or is expected to fall below 40 deg F (4 deg C), uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 deg F (10 deg C) and not more than 80 deg F (27 deg C) at point of placement.
 - 1. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
 - 2. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise accepted in mix designs.
- H. Hot-Weather Placement: When hot weather conditions exist that would impair quality and strength of concrete, place concrete complying with ACI 305 and as specified.
 - 1. Cool ingredients before mixing to maintain concrete temperature at time of placement to below 90 deg F (32 deg C). Mixing water may be chilled or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.

CAST-IN-PLACE CONCRETE

2. Cover reinforcing steel with water-soaked burlap if it becomes too hot, so that steel temperature will not exceed the ambient air temperature immediately before embedding in concrete.
3. Fog spray forms, reinforcing steel, and subgrade just before placing concrete. Keep subgrade moisture uniform without puddles or dry areas.
4. Use water-reducing retarding admixture when required by high temperatures, low humidity, or other adverse placing conditions, as acceptable to Engineer.

3.09 MONOLITHIC SLAB FINISHES

- A. Scratch Finish: Apply scratch finish to monolithic slab surfaces to receive concrete floor topping or mortar setting beds for tile, portland cement terrazzo, and other bonded applied cementitious finish flooring material, and where indicated.
 1. After placing slabs, finish surface to tolerances of F (F)15 (floor flatness) and F(L) 13 (floor levelness) measured according to ASTM E 1155 (ASTM E 1155M). Slope surfaces uniformly to drains where required. After leveling, roughen surface before final set with stiff brushes, brooms, or rakes.
- B. Float Finish: Apply float finish to monolithic slab surfaces to receive trowel finish and other finishes as specified; slab surfaces to be covered with membrane or elastic waterproofing, membrane or elastic roofing, or sand-bed terrazzo; and where indicated.
 1. After screeding, consolidating, and leveling concrete slabs, do not work surface until ready for floating. Begin floating, using float blades or float shoes only, when surface water has disappeared, or when concrete has stiffened sufficiently to permit operation of power-driven floats, or both. Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power units. Finish surfaces to tolerances of F(F) 18 (floor flatness) and F(L) 15 (floor levelness) measured according to ASTM E 1155 (ASTM E 1155M). Cut down high spots and fill low spots. Uniformly slope surfaces to drains. Immediately after leveling, refloat surface to a uniform, smooth, granular texture.
- C. Trowel Finish: Apply a trowel finish to monolithic slab surfaces exposed to view and slab surfaces to be covered with resilient flooring, carpet, ceramic or quarry tile, paint, or another thin film-finish coating system.
 1. After floating, begin first trowel-finish operation using a power-driven trowel. Begin final troweling when surface produces a ringing sound as trowel is moved over surface. Consolidate concrete surface by final hand-troweling operation, free of trowel marks, uniform in texture and

CAST-IN-PLACE CONCRETE

appearance, and finish surfaces to tolerances of F(F) 20 (floor flatness) and F(L) 17 (floor levelness) measured according to ASTM E 1155 (ASTM E 1155M). Grind smooth any surface defects that would telegraph through applied floor covering system.

- D. Trowel and Fine Broom Finish: Where ceramic or quarry tile is to be installed with thin-set mortar, apply a trowel finish as specified, then immediately follow by slightly scarifying the surface with a fine broom.
- E. Nonslip Broom Finish: Apply a nonslip broom finish to exterior concrete platforms, steps, and ramps, and elsewhere as indicated.
 - 1. Immediately after float finishing, slightly roughen concrete surface by brooming with fiber-bristle broom perpendicular to main traffic route. Coordinate required final finish with Engineer before application.
- F. Nonslip Aggregate Finish: Apply nonslip aggregate finish to concrete stair treads, platforms, ramps, sloped walks, and where indicated.
 - 1. After completing float finishing and before starting trowel finish uniformly spread dampened nonslip aggregate at a rate of 25 lb per 100 sq. ft. (12 kg/10sq. m) of surface. Tamp aggregate flush with surface using a steel trowel, but do not force below surface. After broadcasting and tamping, apply trowel finishing as specified.
 - 2. After curing, lightly work surface with a steel wire brush or an abrasive stone, and water to expose nonslip aggregate.
- G. Colored Wear-Resistant Finish: Apply a colored wear-resistant finish to monolithic slab surface indicated.
 - 1. Apply dry shake materials for the colored wear-resistant finish at a rate of 100 lb per 100 sq. ft. (49 kg/10 sq. m), unless a greater amount is recommended by material manufacturer.
 - 2. Cast a trial slab approximately 10 ft. (3 m) square to determine actual application rate, color, and finish, as acceptable to Engineer.
 - 3. Immediately following the first floating operation, uniformly distribute with mechanical spreader approximately two-thirds of the required weight of the dry shake material over the concrete surface and embed by power floating. Follow floating operation with second shake application, uniformly distributing remainder of dry shake material with overlapping applications to ensure uniform color and embed by power floating.
 - 4. After broadcasting and floating, apply a trowel finish as specified. Cure slab surface with a curing compound recommended by the dry shake

material manufacturer. Apply the curing compound immediately after the final finishing.

3.10 CONCRETE FINISH SCHEDULE

- A. Finish schedule: Unless otherwise indicated on the drawings, finish all concrete surfaces in accordance with the following schedule:
1. Form finish: Formed surfaces not ordinarily exposed to view, including:
 - a. Interior walls of open tanks below a line one foot lower than the lowest normal water level.
 - b. The underside of slabs not exposed to view.
 - c. Walls below grade.
 2. Cementitious coating: All formed surfaces exposed to view including:
 - a. Interior walls of tanks above a line one foot lower than the lowest normal water level.
 - b. The underside of slabs, soffits, etc. exposed to view.
 3. Float finish: Slab surfaces not exposed to view or not receiving an applied thin finish, including:
 - a. Bottom slabs of tanks or structures containing water sewage or other liquid.
 - b. Foundations not exposed to view.
 - c. Roof slabs to be covered with insulation and/or built-up roofing.
 4. Trowel finish: Interior slab surfaces exposed to view or to receive an applied thin film coating or floor finish, including:
 - a. Interior, indoor slabs and floors of buildings.
 - b. Surfaces on which mechanical equipment moves.
 - c. Floors receiving vinyl tile, resilient flooring, carpet, paint, etc.
 5. Broom finish: Exterior, outdoor slabs exposed to view including:
 - a. Outdoor floor slabs and walkways.
 - b. Other floors which may become wet or otherwise require a non-skid surface.
 - c. Sidewalks and concrete pavements.
 6. Scratch finish: Surfaces which are to receive a thick topping or additional concrete cast against them including:
 - a. Surfaces receiving concrete equipment pads.
 - b. Floors receiving concrete topping.
 - c. Construction joints not otherwise keyed.
 7. Edge finish: Exposed edges of slabs not receiving chamfer including:
 - a. Sidewalk edges and joints.
 - b. Pavement edges and joints.

- c. Other slab edges not chamfered.
- C. Finishing procedures:
- 1. Form finish:
 - a. Repair defective concrete.
 - b. Fill depressions deeper than 1/4".
 - c. Fill tie holes.
 - d. Remove fins exceeding 1/8" in height.
 - 2. Cementitious finish:
 - a. Patch all tie holes and defects and remove all fins.
 - b. Within one day of form removal, fill all bug holes, wet the surfaces and rub with carborundum brick until a uniform color and texture are produced; or
 - c. Dampen surfaces, brush apply a grout slurry consisting of 1 part portland cement to 1-1/2 parts sand, and rub the surface vigorously with a stone. Remove all excess grout.
 - d. Provide a two coat cement base waterproofing, sealing finish of Thoroseal and Thoroseal Plaster Mix as manufactured by Standard Dry Wall Products, Inc. or an approved equal.
 - 1) Patch all tie holes and defects and removal all fins, and clean surface of all dirt, laitance, grease, form treatments, curing compounds, etc.
 - 2) Key coat: Apply key coat of Thoroseal at a rate of two (2) lbs. per sq. yd. by fiber brush. Mix material using one part of Acryl 60 to three parts clean water. Should material start to drag during application, dampen surface with water. During hot weather periods, dampen surfaces with water prior to application of key coat material. Key coat shall be allowed to cure for five (5) days before applying finish coat.
 - 3) Apply a finish coat consisting of a four (4) to six (6) lbs. per sq. yd. application of Thoroseal Plaster Mix using steel trowel or spray gun. Color to be selected by the Owner. Mix dry material using one (1) part Acryl 60 to three (3) parts clean water. Firmly press the mix into all voids and level with a steel trowel. When surface is set so that it will not roll or lift, float it uniformly using a sponge float.
 - 3. Float finish:
 - a. Begin floating when the water sheen has disappeared and when the surface has stiffened sufficiently to permit the operation.
 - b. Cut down all high spots and fill all low spots and float the slab to a uniform sandy texture.
 - 4. Trowel finish:
 - a. Float finish as specified herein.
 - b. Power trowel to a smooth surface free of defects.
 - c. After the surface has hardened sufficiently, hand trowel until a ringing sound is produced as the trowel is moved over the concrete surface.
 - 5. Broom finish:
 - a. Float finish as specified herein.
 - b. Provide a scored texture by drawing a broom across the surface.
 - 6. Scratch surface:
 - a. Screed the surface to the proper elevations.
 - b. Roughen with rakes or stiff brushes.

7. Edge finish: Tool slab edges and joints with a 1/4" radius edging tool.

3.11 MISCELLANEOUS CONCRETE ITEMS

- A. Filling In: Fill in holes and openings left in concrete structures for passage of work by other trades, unless otherwise shown or directed, after work of other trades is in place. Mix, place, and cure concrete as specified to blend with in-place construction. Provide other miscellaneous concrete filling shown or required to complete Work.
- B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.
- C. Equipment Bases and Foundations: Provide machine and equipment bases and foundations as shown on drawings. Set anchor bolts for machines and equipment to template at correct elevations, complying with diagrams or templates of manufacturer furnishing machines and equipment.

3.12 CONCRETE CURING AND PROTECTION

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. In hot, dry, and windy weather protect concrete from rapid moisture loss before and during finishing operations with an evaporation-control material. Apply according to manufacturer's instructions after screeding and bull floating, but before power floating and troweling.
- B. Start initial curing as soon as free water has disappeared from concrete surface after placing and finishing. Weather permitting, keep continuously moist for not less than 7 days.
- C. Curing Methods: Cure concrete by curing compound, by moist curing, by moisture-retaining cover curing, or by combining these methods, as specified.
- D. Provide moisture curing by the following methods:
1. Keep concrete surface continuously wet by covering with water.
 2. Use continuous water-fog spray.
 3. Cover concrete surface with specified absorptive cover, thoroughly saturate cover with water, and keep continuously wet. Place absorptive cover to provide coverage of concrete surfaces and edges, with a 4 inch (100 mm) lap over adjacent absorptive covers.
- E. Provide moisture-retaining cover curing as follows:

CAST-IN-PLACE CONCRETE

1. Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width with sides and ends lapped at least 3 inches (75 mm) and sealed by waterproof tape or adhesive. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
- F. Apply curing compound on exposed interior slabs and on exterior slabs, walks, and curbs as follows:
1. Apply curing compound to concrete slabs as soon as final finishing operations are complete (within 2 hours and after surface water sheen has disappeared). Apply uniformly in continuous operation by power spray or roller according to manufacturer's directions. Recoat areas subjected to heavy rainfall within 3 hours after initial application. Maintain continuity of coating and repair damage during curing period.
 2. Use membrane curing compounds that will not affect surfaces to be covered with finish materials applied directly to concrete.
- G. Curing Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces, by moist curing with forms in place for the full curing period or until forms are removed. If forms are removed, continue curing by methods specified above, as applicable.
- H. Curing Unformed Surfaces: Cure unformed surfaces, including slabs, floor topping, and other flat surfaces, by applying the appropriate curing method.
1. Final cure concrete surfaces to receive finish flooring with a moisture-retaining cover, unless otherwise directed.

3.13 SHORES AND SUPPORTS

- A. General: Comply with ACI 347 for shoring and reshoring in multistory construction, and as specified.
- B. Extend shoring from ground to roof for Structures four stories or less, unless otherwise permitted.

3.14 REMOVING FORMS

- A. General: Formwork not supporting weight of concrete, such as sides of beams, walls, columns, and similar parts of the work, may be removed after cumulatively curing at not less than 50 deg F (10 deg C) for 24 hours after placing concrete, provided concrete is sufficiently hard to not be damaged by form-removal operations, and provided curing and protection operations are maintained.

CAST-IN-PLACE CONCRETE

- B. Formwork supporting weight of concrete, such as beam soffits, joists, slabs, and other structural elements, may not be removed in less than 14 days or until concrete has attained at least 75 percent of design minimum compressive strength at 28 days. Determine potential compressive strength of in-place concrete by testing field-cured specimens representative of concrete location or members.
- C. Form-facing material may be removed 4 days after placement only if shores and other vertical supports have been arranged to permit removal of form-facing material without loosening or disturbing shores and supports.

3.15 REUSING FORMS

- A. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material will not be acceptable for exposed surfaces. Apply new form-coating compound as specified for new formwork.
- B. When forms are extended for successive concrete placement, thoroughly clean surfaces, remove fins and laitance, and tighten forms to close joints. Align and secure joint to avoid offsets. Do not use patched forms for exposed concrete surfaces except as acceptable to Engineer.

3.16 CONCRETE SURFACE REPAIRS

- A. Patching Defective Areas: Repair and patch defective areas with cement mortar immediately after removing forms, when acceptable to Engineer.
- B. Mix dry-pack mortar, consisting of one part portland cement to 2-1/2 parts fine aggregate passing a No. 16 mesh (1.2 mm) sieve, using only enough water as required for handling and placing.
 - 1. Cut out honeycombs, rock pockets, voids over ¼ inch (6 mm) in any dimension, and holes left by tie rods and bolts down to solid concrete but in no case to a depth less than 1 inch (25 mm). Make edges of cuts perpendicular to the concrete surface. Thoroughly clean, dampen with water, and brush-coat the area to be patched with bonding agent. Place patching mortar before bonding agent has dried.
 - 2. For surfaces exposed to view, blend white portland cement and standard portland cement so that, when dry, patching mortar will match surrounding color. Provide test areas at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike-off slightly higher than surrounding surface.
- C. Repairing Formed Surfaces: Remove and replace concrete having defective surfaces if defects cannot be repaired to satisfaction of Architect. Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycomb,

CAST-IN-PLACE CONCRETE

rock pockets, fins and other projections on the surface, and stains and other discoloration's that cannot be removed by cleaning. Flush out form tie holes and fill with dry-pack mortar or precast cement cone plugs secured in place with bonding agent.

1. Repair concealed formed surfaces, where possible, containing defects that affect the concrete's durability. If defects cannot be repaired, remove and replace the concrete.
- D. Repairing Unformed Surfaces: Test unformed surfaces, such as monolithic slabs, for smoothness and verify surface tolerances specified for each surface and finish. Correct low and high areas as specified. Test unformed surfaces sloped to drain for trueness of slope and smoothness by using a template having the required slope.
1. Repair finished unformed surfaces containing defects that affect the concrete's durability. Surface defects include crazing and cracks in excess of 0.01 inch (0.25 mm) wide or that penetrate to the reinforcement or completely through non-reinforced sections regardless of width, spalling, popouts, honeycombs, rock pockets, and other objectionable conditions.
 2. Correct high areas in unformed surfaces by grinding after concrete has cured at least 14 days.
 3. Correct low areas in unformed surfaces during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete. Proprietary underlayment compounds may be used when acceptable to Engineer.
 4. Repair defective areas, except random cracks and single holes not exceeding 1 inch (25 mm) in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose reinforcing steel with at least $\frac{3}{4}$ inch (19 mm) clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials to provide concrete of same type or class as original concrete. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.
- E. Repair isolated random cracks and single holes 1 inch (25 mm) or less in diameter by dry-pack method. Groove top of cracks and cut out holes to sound concrete and clean of dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding compound. Place dry-pack before bonding agent has dried. Compact dry-pack mixture in place and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.

CAST-IN-PLACE CONCRETE

- F. Perform structural repairs with prior approval of Engineer for method and procedure, using specified epoxy adhesive and mortar.
- G. Repair methods not specified above may be used, subject to acceptance of Engineer.

3.17 QUALITY CONTROL TESTING DURING CONSTRUCTION

- A. Sampling and testing for quality control during concrete placement may include the following, as directed by Engineer.
 - 1. Sampling Fresh Concrete: ASTM C 172, except modified for slump to comply with ASTM C 94.
 - a. Slump: ASTM C 143; one test at point of discharge for each truckload of each type of concrete; additional tests when concrete consistency seems to have changed.
 - b. Air Content: ASTM C 173, volumetric method for lightweight or normal weight concrete; ASTM C 231, pressure method for normal weight concrete; one for each truck load of each type of air-entrained concrete.
 - c. Concrete Temperature: ASTM C 1064; one test hourly when air temperature is 40 deg F (4 deg C) and below, when 80 deg F (27 deg C) and above, and one test for each set of compressive-strength specimens.
 - d. Compression Test Specimen: ASTM C 31; one set of four standard cylinders for each compressive-strength test, unless otherwise directed. Mold and store cylinders for laboratory-cured test specimens except when field-cured test specimens are required.
 - e. Compressive-Strength Tests: ASTM C 39; one set for each day's pour exceeding 5 cu. yd. (4 cu. m) plus additional sets for each 50 cu. yd. (38 cu. m) more than the first 25 cu. yd. (19 cu. m) of each concrete class placed in any one day; one specimen tested at 7 days, two specimens tested at 28 days, and one specimen retained in reserve for later testing if required.
 - 2. When frequency of testing will provide fewer than five strength tests for a given class of concrete, conduct testing from at least five randomly selected batches or from each batch if fewer than five are used.
 - 3. When total quantity of a given class of concrete is less than 50 cu. yd. (38 cu. m), Engineer may waive strength testing if adequate evidence of satisfactory strength is provided.

CAST-IN-PLACE CONCRETE

4. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, evaluate current operations and provide corrective procedures for protecting and curing the in-place concrete.
 5. Strength level of concrete will be considered satisfactory if averages of sets of three consecutive strength test results equal or exceed specified compressive strength and no individual strength test result falls below specified compressive strength by more than 500 psi (3.4 Mpa).
- B. Test results will be reported in writing to Structural Engineer, ready-mix producer, and Contractor within 24 hours after tests. Reports of compressive strength tests shall contain the Project identification name and number, date of concrete placement, name of concrete testing service, concrete type and class, location of concrete batch in structure, design compressive strength at 28 days, concrete mix proportions and materials, compressive breaking strength, and type of break for both 7-day tests and 28 day tests.
- C. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted but shall not be used as the sole basis for acceptance or rejection.
- D. Additional Tests: The testing agency will make additional tests of in-place concrete when test results indicate specified concrete strengths and other characteristics have not been attained in the structure, as directed by Engineer. Testing agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42, or by other methods as directed.

END OF SECTION

SECTION 03410
PRECAST CONCRETE WETWELL

PART 1 - GENERAL

1.01 WORK INCLUDED

- A. Provide wetwell structure assembled from precast concrete, as indicated on the Drawings, as specified herein, and as needed for a complete and proper installation.

1.00 SUBMITTALS

- A. Product data: Within 30 calendar days after the Contractor has received the Owner's Notice to Proceed, submit:
 - 1. Materials list of items proposed to be provided under this Section.
 - 2. Manufacturer's certifications and laboratory test reports as required.
 - 3. Shop drawings showing complete information for fabrication and erection of the work of this Section including, but not necessarily limited to:
 - a. Erection procedures, lifting lugs, sequence of erection, and required handling equipment.
 - b. Layout, dimensions, and identification of each precast unit corresponding to the sequence and procedure of installation.
 - c. Details of inserts, connections, and joints, including accessories and construction at openings in the precast units.
 - d. Location and details of anchorage devices that are to be embedded in other construction.

PART 2 PRODUCTS

2.01 DESIGN STANDARDS

- A. Design in accordance with pertinent recommendations contained in:
 - 1. ACI 301.
 - 2. ACI 304.
 - 3. ACI 311.
 - 4. ACI 318.

PRECAST CONCRETE WETWELL

5. ACI 347.
 6. CRSI "Manual of Standard Practice".
 7. PCI 116.
 8. AASHTO standard specifications, minimum load rating: HS20.
- B. Comply with requirements of governmental agencies having jurisdiction.
- C. In the event of conflict between or among standards, the more stringent provision shall govern unless directed otherwise by the Engineer.
- D. Minimum design criteria, unless otherwise indicated on the drawings or specified herein:
1. Soil weight of 130 pcf.
 2. Soil angle of internal friction of 10°.
 3. Groundwater depth to top of wetwell.

2.02 COMPONENTS

- A. General:
1. Provide standard precast concrete shapes as required for a complete concrete wetwell structure, as indicated on the Drawings.
 2. Inside diameter and vertical laying lengths as shown on the contract drawings.
 3. Provide monolithically poured components with a minimum 28-day compressive strength of 5,000 psi as determined by Standard ASTM Test Procedures.
 4. Provide reinforcing steel as required by ASTM C478.
- B. Top:
1. Provide ASTM A416 steel strand lift loops as required for lifting and positioning during installation.
 2. Provide a 2" chamfer edge on all exposed edges above grade.
- C. Risers:

PRECAST CONCRETE WETWELL

1. Provide steps where laying length allows, unless otherwise indicated.
 2. Provide non-penetrating lift holes as required for lifting and positioning during installation.
- D. Base:
1. Provide base with extended bottom slab.
 - a. Minimum overhang, 12".
 2. For bases greater than 6' in diameter, provide ASTM A416 steel strand lift loops as required for lifting and positioning during installation.

2.03 JOINT SEALS

- A. Internal seals:
1. Comply with ASTM C990.
 2. Minimum diameter of 1".
 3. Minimum continuous length of 14' - 6".
- B. Exterior joint collar:
1. Install an exterior joint collar on all manhole joints.
 2. Provide a 12" wide band.
 - a. Provide an outer layer of polyethylene with an under layer of rubberized mastic reinforced with a woven polypropylene fabric.
 - b. Provide a peelable protective paper against the mastic that is removed when the collar is applied to the joint.
 - c. Design the collar so that when it is applied around the joint the ends overlap at least 6".
 3. Provide SealWrap Exterior Joint Sealer as manufactured by Mar-Mac Manufacturing Company or an approved equal.

PART 3 EXECUTION

3.01 SURFACE CONDITIONS

- A. Examine the areas and conditions under which work of this Section will be performed.

PRECAST CONCRETE WETWELL

1. Correct conditions detrimental to timely and proper completion of the Work before beginning.
- B. Provide shoring, pilings or temporary support as required for the protection of existing structures and utilities.
 1. Where sheet piling or other construction work is required, retain the services of a professional engineer licensed by the State of South Carolina and qualified to provide design services for the work.
- C. Protection of existing structures and utilities is the sole responsibility of the Contractor.

3.02 COORDINATION

- A. Coordinate work with the Owner to ensure continuous operation of existing utilities.
- B. Coordinate with other trades as required for timely completion of the work.

3.03 INSTALLATION

- A. Begin excavation only after all shoring, pilings and temporary supports are complete and all sediment and erosion control measures are in place.
- B. Lift and place all precast concrete components in accordance with the manufacturer's recommendations and the approved shop drawings.
- C. After placement of components with steel lifting loops, cut off lifting loops a minimum of 2" below the finished surface and patch hole with non-shrink grout.
- D. Interior joint sealant: Place rope seal in the keyway of all precast joints just prior to installation of the next concrete unit.
 1. Place seal in a clean, dry keyway.
- E. Install exterior joint collar.
 1. Follow manufacturer's recommendations.
 2. Clean surface.
 3. Remove the protective paper and place the band around the manhole, mastic side to the manhole and spanning the joint.

PRECAST CONCRETE WETWELL

4. Cover exposed strap with the closing flap.

END OF SECTION

SECTION 03800
LEAKAGE TESTING OF HYDRAULIC STRUCTURES

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Scope of Work: Provide testing of the following concrete hydraulic structures for leakage as specified herein, and as needed for a complete and proper installation.
 - 1. New Aeration Basin.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Provide water, piping and equipment necessary to test concrete structures for leakage.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Hydrostatically test reinforced concrete structures that are intended to contain water, wastewater or other liquids, to determine that they are watertight and free of detectable leaks.

3.2 INSPECTION AND TESTING

- A. Prior to testing, clean exposed surfaces by thorough hosing and remove the loosened matter and wash water from the structures.
- B. Conduct testing before backfill is placed against walls and after all concrete has attained the specified compressive strength.
- C. Fill hydraulic structures to be subjected to leakage tests with water to the normal liquid level line. Repair any running leaks that appear during filling before continuing. After the structure has been kept full for 48 hours, it will be assumed, for the purposes of the test, that the absorption of moisture by the concrete in the structure is complete. Then, close all valves and gates to the structure and measure the change in water surface each day for a five-day period.
- D. During the test period, examine all exposed portions of the structure and mark all visible leaks or damp spots. Such leaks or damp spots shall be repaired later. If

LEAKAGE TESTING OF HYDRAULIC STRUCTURES

the drop in water surface in a 24-hour period exceeds 1/10 of 1% of the normal volume of liquid contained in the structure, the leakage shall be considered excessive.

- E. If the leakage is excessive, drain the structure, repair leaks and damp spots and refill the structure and again test for leakage. Continue this process until the drop in water surface in a 24-hour period, with the structures full, is less than 1/10 of 1% of the volume of liquid in the structure.
- F. Repair all visible spots whether excessive or not.
- G. Repairs and additional tests shall be made by the Contractor at no additional cost to the Owner.
- H. Apply specified coatings only after acceptance of leakage testing by the Engineer.

END OF SECTION

SECTION 04810
UNIT MASONRY ASSEMBLIES

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract and Division 1 Specification Sections apply to this Section.

1.02 SUMMARY

- A. This Section includes Unit Masonry Assemblies consisting of the following:
 - 1. Architectural Concrete Masonry Units
 - 2. Standard Concrete Masonry Units
 - 3. Mortar and Grout
 - 4. Masonry Joint Reinforcement
 - 5. Ties and Anchors
 - 6. Embedded Flashing
 - 7. Miscellaneous Masonry Accessories
 - 8. Cavity-Wall Insulation
- B. Products furnished, but not installed, under this Section include the following:
 - 1. Cast-Stone Trim, furnished under Division 4, Section "Limestone".
 - 2. Steel Lintels and Shelf Angles for Unit Masonry, furnished under Division 5, Section "Metal Fabrications" or on Structural Drawings.
 - 3. Hollow-Metal Frames in Unit Masonry Openings, furnished under Division 8, Section Steel Doors and Frames.

1.03 SUBMITTALS

- A. Product Data: For each different masonry unit, accessory, and other manufactured product specified.
- B. Samples for Initial Selection: For the following:

UNIT MASONRY ASSEMBLIES

1. Unit masonry samples in small-scale form showing the full range of colors and textures available for each different exposed masonry unit required.
 2. Colored mortar samples showing the full range of colors available.
- C. Samples for Verification: For the following:
1. Full size units for each different exposed masonry unit required, showing the full range of exposed colors, textures, and dimensions to be expected in the completed construction.
 2. Colored mortar samples for each color required, showing the full range of colors expected in the finished construction. Make samples using the same sand and mortar ingredients to be used on Project.
 3. Weep holes/vents in color to match mortar color.
- D. Material Test Reports: From a qualified testing agency indicating and interpreting test results of the following for compliance with requirements indicated:
1. Each type of masonry unit required.
 - a. Include size variation data for brick, verifying the actual range of sizes falls within specified tolerances.
 2. Mortar complying with property requirements of ASTM C 270 BIA M1.
 3. Grout mixes complying with compressive strength requirements of ASTM C476. Include description of type and proportions of grout ingredients.
- E. Material Certificates: Signed by Manufacturers certifying that each of the following items complies with requirements:
1. Each type of masonry unit required.
 - a. Include size variation data for brick, verifying that actual range of sizes falls within specified tolerances.
 2. Each type and size of joint reinforcement.
 3. Each type and size of anchor, tie, and metal accessory.
- F. Cold Weather Procedures: Detailed description of methods, materials, and equipment to be used to comply with cold weather requirements.

1.04 QUALITY ASSURANCE

- A. Testing Agency Qualifications: An independent testing agency, acceptable to authorities having jurisdiction, qualified according to ASTM C 1093 to conduct the testing indicated, as documented according to ASTM E 548.
- B. Source Limitations for Masonry Units: Obtain exposed masonry units of a uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, through one source from a single manufacturer for each product required.
- C. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from one manufacturer for each cementitious component and from one source or producer for each aggregate.
- D. Fire Resistance Ratings: Where indicated, provide materials and construction identical to those of assemblies with fire resistance ratings determined per ASTM E 119 by a testing and inspecting agency, by equivalent concrete masonry thickness, or by another means, as acceptable to authorities having jurisdiction.
- E. Mockups: Before installing unit masonry, build mockups to verify selections made under sample Submittals and to demonstrate aesthetic effects and qualities of materials and execution. Build mockups to comply with the following requirements, using materials indicated for the completed Work:
 - 1. Locate mockups in the locations indicated or, if not indicated, as directed by Architect.
 - 2. Build mockups for the following types of masonry in sizes approximately 48 inches long by 48 inches high by full thickness, including face and backup wythes and accessories. Include a sealant-filled joint at least 16 inches long in each mockup.
 - a. Each type of exposed unit masonry construction including limestone.
 - b. Typical exterior wall with through-wall flashing installed for a 24 inch length in corner of mockup approximately 16 inches down from top of mockup, with a 12 inch length of flashing left exposed to view (omit masonry above half of flashing).
 - c. Typical exterior masonry veneer wall complete with metal studs, sheathing, veneer ties, flashing, and weep holes.
 - d. Typical interior unit masonry wall.
 - 3. Clean exposed faces of mockups with masonry cleaner as indicated.
 - 4. Notify Architect seven days in advance of dates and times when mockups will be constructed.

UNIT MASONRY ASSEMBLIES

5. Protect accepted mockups from the elements with weather resistant membrane.
 6. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
 7. Approval of mockups is for color, texture, and blending of masonry units; relationship of mortar and sealant colors to masonry unit colors; tooling of joints; and aesthetic qualities of workmanship.
 8. Demolish and remove mockups when directed.
- F. Pre-installation Conference: Conduct conference at Project Site to comply with requirements in Division 1, Section "Project Meetings".

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Store masonry units on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied.
1. Protect Type I concrete masonry units from moisture absorption so that, at the time of installation, the moisture content is not more than the maximum allowed at the time of delivery.
- B. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.
- C. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.
- D. Deliver pre-blended, dry mortar mix in moisture resistant containers designed for lifting and emptying into dispensing silo. Store pre-blended, dry mortar mix in delivery containers on elevated platforms, under cover, and in a dry location or in a metal dispensing silo with weatherproof cover.
1. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.06 PROJECT CONDITIONS

- A. Protection of Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.

UNIT MASONRY ASSEMBLIES

1. Extend cover a minimum of 24 inches down both sides and hold cover securely in place.
- B. Do not apply uniform floor or roof loads for at least 12 hours and concentrated loads for at least 3 days after building masonry walls or columns.
- C. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that come in contact with such masonry.
 1. Protect base of walls from rain-splashed mud and from mortar splatter by coverings spread on ground and over wall surface.
 2. Protect sills, ledges, and projections from mortar droppings.
 3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.
 4. Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt onto completed masonry.
- D. Cold Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.
 1. Cold Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F and above and will remain so until masonry has dried, but not less than 7 days after completing cleaning.
- E. Hot Weather Requirements: Protect unit masonry work when temperature and humidity conditions produce excessive evaporation of water from mortar and grout. Provide artificial shade and wind breaks and use cooled materials as required.
 1. When ambient temperature exceeds 100 deg F, or 90 deg F with a wind velocity greater than 8 mph, do not spread mortar beds more than 48 inches ahead of masonry. Set masonry units within one minute of spreading mortar.

PART 2 PRODUCTS

2.01 STANDARD CONCRETE MASONRY UNITS

- A. Provide standard weight hollow load-bearing concrete masonry units complying with ASTM C90, Grade N, Type I, in color "natural gray", with minimum average net compressive strength of 1900 psi.

UNIT MASONRY ASSEMBLIES

- B. Provide units having nominal dimensions of 16" long by 8" high by bed depth as shown on the drawings.
- C. Provide necessary shapes as indicated or otherwise required.

2.02 MORTAR AND GROUT MATERIALS

- A. Portland Cement: ASTM C 150, Type I or II, except Type III may be used for cold weather construction. Provide natural color or white cement as required to produce mortar color indicated.
 - B. Hydrated Lime: ASTM C 207, Type S.
 - C. Portland Cement-Lime Mix: Packaged blend of Portland Cement complying with ASTM C150, Type I or Type III, and hydrated lime complying with ASTM C 207.
 - D. Mortar Cement: ASTM C 1329.
 - E. Aggregate for Mortar: ASTM C 144; except for joints less than ¼ inch thick, use aggregate graded with 100 percent passing the No. 16 sieve.
 - F. Aggregate for Grout: ASTM C 404.
 - G. Cold Weather Admixture: Non-chloride, non-corrosive, accelerating admixture complying with ASTM C 494, Type C, and recommended by the manufacturer for use in masonry mortar of composition indicated.
 - H. Water: Potable.
 - I. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include the following:
 - Brick Type "A" mortar equal to Southern Grouts and Mortars #325 Koala.
 - Brick Type "B" mortar equal to Southern Grouts and Mortars #128 Mocha.
1. Mortar Cement:
 - a. Magnolia Superbond Mortar Cement; Blue Circle Cement.
 - b. Lafarge Mortar Cement; Lafarge Corporation.
 - c. Southern Grouts and Mortars, Inc.
 2. Mortar Pigments:
 - a. True Tone Mortar Colors; Davis Colors.
 - b. Centurion Pigments; Lafarge Corporation.

UNIT MASONRY ASSEMBLIES

- c. SGS Mortar Colors; Solomon Grind-Chem Services, Inc.
- d. Southern Grouts and Mortars, Inc.

3. Cold-Weather Admixture:

- a. Accelguard 80; Euclid Chemical Co.
- b. Morseled; W.R. Grace & Co., Construction Products Division.
- c. Trimix-NCA; Sonneborn, Div. of ChemRex, Inc.
- d. Southern Grouts and Mortars, Inc.

2.03 MASONRY JOINT REINFORCEMENT

A. General: ASTM A 951 and as follows:

Dur-O-Eye as manufactured by Dur-O-Wal, Inc. or approved equal for multiwythe wall locations.

- 1. Hot-dip galvanized, carbon-steel wire for both interior and exterior walls.
- 2. Wire Size for Side Rods: W1.7 or 0.148 inch diameter.
- 3. Wire Size for Cross Rods: W1.7 or 0.148 inch diameter.
- 4. Provide in lengths of not less than 10 feet, with prefabricated corner and tee units where indicated.

B. For single wythe masonry, provide either ladder or truss type with single pair of side rods and cross rods spaced not more than 16 inches o.c.

2.04 TIES AND ANCHORS, GENERAL

A. General: Provide ties and anchors, specified in subsequent articles, made from materials that comply with this Article, unless otherwise indicated.

B. Hot Dip Galvanized Carbon Steel Wire: ASTM A 82; with ASTM A 153, Class B-2 coating.

2.05 ADJUSTABLE ANCHORS FOR CONNECTING TO STEEL FRAME

A. General: Provide two-piece assemblies that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to plane of wall.

- 1. Anchor Section: Crimped ¼ inch diameter, hot dip galvanized steel wire anchor section for welding to steel.

UNIT MASONRY ASSEMBLIES

2. Tie Section: Triangular shaped wire tie, sized to extend within 1 inch of masonry face, made from 0.1875 inch diameter, hot dip galvanized steel wire.

D/A 213 or D/a 207 with 700-708 by Dur-O-Wal, Inc. or approved equal.

2.07 ANCHORS FOR CONNECTING TO CONCRETE

- A. General: Provide two-piece assemblies that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to plane of wall.

1. Anchor Section: Dovetail anchor section formed from 0.0528 inch thick, steel sheet, galvanized after fabrication.
2. Tie Section: Triangular shaped wire tie, sized to extend within 1 inch of masonry face, made from 0.1875 inch diameter, hot dip galvanized steel.

D/A 213 or D/A 207 with 700-708 by Dur-O-Wal, Inc. or approved equal may also be used with concrete attachment per manufacturer's recommendations.

2.08 ADJUSTABLE MASONRY-VENEER ANCHORS

- A. General: Provide two-piece assemblies that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to plane of wall, for attachment over sheathing to wood or metal studs, and as follows:

1. Structural Performance Characteristics: Capable of withstanding a 100-lbf load in both tension and compression without deforming or developing play in excess of 0.05 inch.

- B. Screw Attached, Masonry-Veneer Anchors: Units consisting of a wire tie section and a metal anchor section complying with the following requirements:

1. Anchor Section: Rib stiffened, sheet metal plate with screw holes top and bottom, 2-3/4 inches wide by 3 inches high; with projecting tabs having slotted holes for inserting vertical legs of wire tie specially formed to fit anchor section.
2. Anchor Section: Sheet metal plate with screw holes top and bottom and with raised rib-stiffened strap stamped into center to provide a slot between strap and plate for connection of wire tie.
 - a. Use Triangle ties D/A 700-708, by Dur-O-Wal, Inc. or approved equal.

UNIT MASONRY ASSEMBLIES

3. Wire Tie Section: Triangular shaped wire tie sized to extend at least halfway through veneer but with a least 5/8 inch cover on outside face.
 4. Fabricate wire tie sections from 0.1875 inch diameter, hot dip galvanized steel wire.
- C. Available Products: Subject to compliance with requirements, products that may be incorporated in the Work include, but are not limited to, the following:
1. Screw Attached, Masonry-Veneer Anchors:
 - a. D/A 213; Dur-O-Wal, Inc.
 - b. D/A 210 with D/A 700-708; Dur-O-Wal, Inc.
 2. Slip-in, Masonry Veneer Anchors:
 - a. Dur-O-Eye and Ladur-Eye; Dur-O-Wal, Inc.

2.09 MISCELLANEOUS ANCHORS

- A. Unit Type Inserts in Concrete: Cast iron or malleable iron inserts of type and size indicated.
- B. Dovetail Slots: Furnish dovetail slots with filler strips, of slot size indicated, fabricated from 0.0336 inch, galvanized steel sheet.
- C. Anchor Bolts: Steel bolts complying with ASTM A 307, Grade A; with ASTM A 563 hex nuts and, where indicated, flat washers; hot dip galvanized to comply with ASTM A 153, Class C; of diameter and length indicated and in the following configurations:
1. Headed Bolts
 2. Non-headed Bolts, Bent in Manner Indicated.
- D. Postinstalled Anchors: Anchors as described below, with capability to sustain, without failure, load imposed within factors of safety indicated, as determined by testing per ASTM E 488, conducted by a qualified independent testing agency.
1. Type: Chemical Anchors
 2. Type: Expansion Anchors
 3. Type: Undercut Anchors

UNIT MASONRY ASSEMBLIES

4. Corrosion Protection: Carbon Steel components zinc plated to comply with ASTM B 633, Class Fe/Zn 5 (5 microns) for Class SC 1 service condition (mild).
5. Corrosion Protection: Stainless Steel components complying with ASTM F 593 and ASTM F 594, Alloy Group 1 or 2 for bolts and nuts; ASTM A 666 or ASTM A 276, Type 304 or 316, for anchors.
6. For Postinstalled Anchors in Concrete: Capability to sustain, without failure, a load equal to four times the loads imposed.
7. For Postinstalled Anchors in Grouted Masonry Units: Capability to sustain, without failure, a load equal to six times the loads imposed.

2.10 CONCEALED FLASHING MATERIALS

- A. Vinyl Sheet Flashing: Flexible sheet flashing especially formulated from virgin polyvinyl chloride with plasticizers and other modifiers to remain flexible and waterproof in concealed masonry applications, black incolor and of thickness indicated below:
 1. Thickness: 20 mils.
- B. Adhesive for Flashings: Of type recommended by manufacturer of flashing material for use indicated.
- C. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 1. Vinyl Sheet Flashing:
 - a. "Vi-Seal Plastic Flashing"; Afco Products, Inc.
 - b. "BFG" Vinyl Water Barrier; B.F. Goodrich Co.
 - c. "Nuflex"; Sandell Manufacturing Co., Inc.
 - d. "Wascoseal"; York Manufacturing, Inc.

2.11 MISCELLANEOUS MASONRY ACCESSORIES

- A. Weepholes: Provide the following for weepholes:
 1. Weepholes: Provide fully open head joints at 2'-0" o.c. above all ledges, flashings and lintels.

2.12 CAVITY WALL INSULATION

- A. Extruded Polystyrene Board Insulation: Rigid, cellular, polystyrene thermal insulation with closed cells and integral high-density skin; formed by the

UNIT MASONRY ASSEMBLIES

expansion of polystyrene base resin in an extrusion process to comply with ASTM C 578, Type IV.

1. Available Products: Provide the following products or approved equal:

a. "Styrofoam Cavitymate Plus"; Dow Chemical Company.

B. Adhesive: Type recommended by insulation board manufacturer for application indicated.

2.13 MASONRY CLEANERS

A. Job-Mixed Detergent Solution: Solution of ½ cup dry measure tetrasodium polyphosphate and ½ cup dry measure laundry detergent dissolved in 1 gal. of water.

B. Do not use acid or cleaners containing acid.

2.14 MORTAR AND GROUT MIXES

A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water repellent agents, antifreeze compounds, or other admixtures, unless otherwise indicated.

1. Do not use calcium chloride in mortar or grout.

2. Add cold weather admixture (if used) at the same rate for all mortar, regardless of weather conditions, to ensure that mortar color is consistent.

B. Pre-Blended, Dry Mortar Mix: Furnish dry mortar ingredients in the form of a pre-blended mix. Measure quantities by weight to ensure accurate proportions, and thoroughly blend ingredients before delivering to Project Site.

C. Mortar for Unit Masonry: Comply with ASTM C 270 BIA M1, proportion Specification, for types of mortar required, unless otherwise noted.

1. Limit cementitious materials in mortar to portland cement, mortar cement, and lime.

2. For masonry below grade, in contact with earth, and where indicated, use Type M.

3. For exterior, above grade, load-bearing and non-load-bearing walls and parapet walls; for interior load-bearing walls; for interior non-load-bearing partitions; and for other applications where another type is not indicated, use Type N.

UNIT MASONRY ASSEMBLIES

- D. Grout for Unit Masonry: Comply with ASTM C 476.
 - 1. Use grout of type indicated or, if not otherwise indicated, of type (fine or course) that will comply with Table 5 of ACI 530.1/ASCE 6/TMS 602 for dimensions of grout spaces and pour height.
 - 2. Provide grout with a slump of 8 to 11 inches as measured according to ASTM C 143.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance.
 - 1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance.
 - 2. Verify that foundations are within tolerances specified.
 - 3. Proceed with installation only after unsatisfactory conditions have been corrected.
- B. Before installation, examine rough-in and built-in construction to verify actual locations of piping connections.

3.02 INSTALLATION, GENERAL

- A. Thickness: Build cavity and composite walls and other masonry construction to the full thickness shown. Build single-wythe walls to the actual widths of masonry units, using units of widths indicated.
- B. Build chases and recesses to accommodate items specified in this Section and in other Sections of the Specifications.
- C. Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match the construction immediately adjacent to the opening.
- D. Cut masonry units with motor-driven saws to provide clean, sharp, unchipped edges. Cut units as required to provide a continuous pattern and to fit adjoining construction. Where possible, use full size units without cutting. Allow units cut with water cooled saws to dry before placing, unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.

UNIT MASONRY ASSEMBLIES

- E. Select and arrange units for exposed unit masonry to produce a uniform blend of colors and textures.
 - 1. Mix units from several pallets or cubes as they are placed.

3.03 CONSTRUCTION TOLERANCES

- A. Comply with tolerances in ACI 530.1/ASCE 6/TMS 602 and the following:
- B. For conspicuous vertical lines, such as external corner, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than $\frac{1}{4}$ inch in 20 feet, nor $\frac{1}{2}$ inch maximum.
- C. For vertical alignment of exposed head joints, do not vary from plumb by more than $\frac{1}{4}$ inch in 10 feet, not $\frac{1}{2}$ inch maximum.
- D. For conspicuous horizontal lines, such as exposed lintels, sills, parapets, and reveals, do not vary from level by more than $\frac{1}{4}$ inch in 20 feet, nor $\frac{1}{2}$ inch maximum.
- E. For exposed bed joints, do not vary from thickness indicated by more than plus or minus $\frac{1}{8}$ inch, with a maximum thickness limit to $\frac{1}{2}$ inch. Do not vary from bed-joint thickness of adjacent courses by more than $\frac{1}{8}$ inch.
- F. For exposed head joints, do not vary from thickness indicated by more than plus or minus $\frac{1}{8}$ inch. Do not vary from adjacent bed-joint and head-joint thicknesses by more than $\frac{1}{8}$ inch.

3.04 LAYING MASONRY WALLS

- A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement type joints, returns, and offsets. Avoid using less than half size units, particularly at corner, jambs, and where possible, at other locations.
- B. Bond Pattern for Exposed Masonry: Lay exposed masonry in the following bond pattern; do not use units with less than nominal 4 inch horizontal face dimensions at corners of jambs.
 - 1. Interior exposed to view Concrete Masonry Units = Stack Bond.
 - 2. Brick = One half running bond with vertical joint in each course centered on units in courses above and below.
 - 3. Pattern Brick = As indicated on Drawings.

UNIT MASONRY ASSEMBLIES

- C. Lay concealed masonry with all units in a wythe in running bond or bonded by lapping not less than 2 inches. Bond and interlock each course of each wythe at corners. Do not use units with less than nominal 4 inch horizontal face dimensions at corners or jambs.
- D. Stopping and Resuming Work: In each course, rack back one-half- unit length for one-half running bond or one-third-unit length for one-third running bond; do not tooth. Clean exposed surfaces of set masonry, wet clay masonry units lightly if required, and remove loose masonry units and mortar before laying fresh masonry.
- E. Built-in Work: As construction progresses, build in items specified under this and other Section of the Specifications. Fill in solidly with masonry around built-in items.
- F. Fill space between hollow-metal frames and masonry solidly with mortar, unless otherwise indicated.
- G. Where built-in items are to be embedded in cores of hollow masonry units, place a layer of metal lath in the joint below and rod mortar or grout into core.
- H. Fill cores in hollow concrete masonry units with grout 24 inches under bearing plates, beams, lintels, posts, and similar items, unless otherwise indicated.
- I. Build non-load-bearing interior partitions full height of story to underside of solid floor or roof structure above, unless otherwise indicated,
 - 1. Install compressible filler in joint between top of partition and underside of structure above.
 - 2. At fire-rated partitions, install firestopping in joint between top of partition and underside of structure above.

3.05 MORTAR BEDDING AND JOINTING

- A. Lay hollow masonry units as follows:
 - 1. With full mortar coverage on horizontal and vertical face shells.
 - 2. Bed webs in mortar in starting course on footings and in all courses of piers, columns, and pilasters, and where adjacent to cells or cavities to be filled with grout.
 - 3. For starting course on footings where cells are not grouted, spread out full mortar bed, including areas under cells.

UNIT MASONRY ASSEMBLIES

- B. Lay solid brick-size masonry units with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and shove into place. Do not deeply furrow bed joints or slush head joints.
 - 1. At cavity walls, bevel beds away from cavity, to minimize mortar protrusions into cavity. As work progresses, trowel mortar fins protruding into cavity flat against the cavity face of the brick.
- C. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than the joint thickness, unless otherwise indicated.
- D. Cut joints flush for masonry walls to received plaster or other direct-applied finishes (other than paint) or if concealed, unless otherwise indicated,

3.06 CAVITIES

- A. Keep cavities clean of mortar droppings and other materials during construction. Strike joints facing cavities flush.
 - 1. Use wood strips temporarily placed in cavity to collect mortar drippings. As work progresses, remove strips, clean off mortar drippings, and replace in cavity.
- B. Installing Cavity Wall Insulation: Place small dabs of adhesive, spaced approximately 12 inches o.c. both ways, on inside face of insulation boards, or attach with plastic fasteners designed for this purpose. Fit courses of insulation between wall ties and other confining obstructions in cavity, with edges butted tightly both ways. Press units firmly against inside wythe of masonry or other construction as shown.
 - 1. Fill cracks and open gaps in insulation with crack sealer compatible with insulation and masonry.
- C. Tie Exterior wythe to back-up with continuous horizontal joint reinforcing, installed in mortar joints at not more than 16" o.c. vertically.
- D. Provide weep holes in exterior wythe of cavity wall located immediately above ledges and flashing, space 2'-0" o.c., unless otherwise indicated.

3.07 MASONRY JOINT REINFORCEMENT

- A. General: Provide continuous masonry joint reinforcement as indicated. Install entire length of longitudinal side rods in mortar with a minimum cover of 5/8 inch on exterior side of walls, 1/2 inch elsewhere. Lap reinforcement a minimum of 6 inches.
 - 1. Space reinforcement not more than 16 inches o.c.

UNIT MASONRY ASSEMBLIES

2. Space reinforcement not more than 8 inches o.c. in foundation walls and parapet walls.
3. Provide reinforcement not more than 8 inches above and below wall openings and extending 12 inches beyond openings.
 - a. Reinforcement above is in addition to continuous reinforcement.
- B. Cut or interrupt joint reinforcement at control and expansion joints, unless otherwise indicated.
- C. Provide continuity at corners and wall intersections by using prefabricated "L" and "T" sections. Cut and bend, reinforcing units as directed by manufacturer for continuity at returns, offsets, column fireproofing, pipe enclosures, and other special conditions.

3.08 ANCHORING MASONRY TO STRUCTURAL MEMBERS

- A. Anchor masonry to structural members where masonry abuts or faces structural members to comply with the following:
 1. Provide an open space not less than 1 inch in width between masonry and structural member, unless otherwise indicated. Keep open space free of mortar or other rigid materials.
 2. Anchor masonry to structural members with flexible anchors embedded in masonry joints and attached to structure.
 3. Space anchors as indicated, but not more than 24 inches o.c. vertically and 36 inches o.c. horizontally.

3.09 ANCHORING MASONRY VENEERS

- A. Anchor masonry veneers to concrete and masonry backup with masonry veneer anchors to comply with the following requirements:
 1. Fasten each anchor section to concrete and masonry backup with two metal fasteners of type indicated.
 2. Embed tie sections in masonry joints. Provide not less than 1 inch of air space between back of masonry veneer and face of sheathing.
 3. Locate anchor sections to allow maximum vertical differential movement of ties up and down.
 4. Space anchors as indicated, but not more than 16 inches o.c. vertically and 32 inches o.c. horizontally with not less than 1 anchor for each 3.5 sq. ft. of

UNIT MASONRY ASSEMBLIES

wall area. Install additional anchors within 12 inches of openings and at intervals, not exceeding 36 inches around perimeter.

3.10 LINTELS

- A. Install steel lintels where indicated.
- B. Provide minimum bearing of 8 inches at each jamb, unless otherwise indicated.

3.11 FLASHING, WEEP HOLES, AND VENTS

- A. General: Install embedded flashing and weep holes in masonry at shelf angles, lintels, ledges, other obstructions to downward flow of water in wall, and where indicated.
- B. Prepare masonry surfaces so they are smooth and free from projections that could puncture flashing. Unless otherwise indicated, place through-wall flashing on sloping bed of mortar and cover with mortar. Before covering with mortar, seal penetrations in flashing with adhesive, sealant, or tape as recommended by flashing manufacturer.
- C. Install flashing as follows:
 - 1. At masonry veneer walls, extend flashing from exterior face of veneer, through veneer, up face of sheathing at least 8 inches, and behind air-infiltration barrier or building paper.
 - 2. At lintels and shelf angles, extend flashing a minimum of 4 inches into masonry at each end. At heads and sills, extend flashing 4 inches at ends and turn flashing up not less than 2 inches to form a pan.
 - 3. Interlock end joints of ribbed sheet metal flashing by overlapping ribs not less than 1-1/2 inches or as recommended by flashing manufacturer, and seal lap with elastomeric sealant complying with requirements in Division 7, Section "Joint Sealants" for application indicated.
 - 4. Extend sheet metal flashing 1/2 inch beyond face of masonry at exterior and turn flashing down to form a drip.
- D. Install weep holes in the head joints in exterior wythes of the first course of masonry immediately above embedded flashing and as follows:
 - 1. Use open head joints to form weep holes.
 - 2. Space weep holes 32 inches o.c.

UNIT MASONRY ASSEMBLIES

- E. Install reglets and nailers for flashing and other related construction where they are shown to be built into masonry.

3.12 REPAIRING, POINTING, AND CLEANING

- A. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Install new units to match adjoining units; install in fresh mortar, pointed to eliminate evidence of replacement.
- B. Pointing: During the tooling of joints, enlarge voids and holes, except weep holes, and completely fill with mortar. Point up joints, including corners, openings, and adjacent construction, to provide a neat, uniform appearance. Prepare joints for sealant application.
- C. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.
- D. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:
 - 1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
 - 2. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of masonry.
 - 3. Clean brick by the bucket and brush hand cleaning method described in BIA Technical Notes No. 20, using job mixed detergent solution.
 - 4. Clean concrete masonry by cleaning method indicated in NCMA TEK 8-2 applicable to type of stain on exposed surfaces.

3.13 MASONRY WASTE DISPOSAL

- A. Recycling: Unless otherwise indicated, excess masonry materials are Contractor's property. At completion of unit masonry work, remove from Project Site.
- B. Disposal as Fill Material: Dispose of clean masonry waste, including broken masonry units, waste mortar, and excess or soil-contaminated sand, by crushing and mixing with fill material as fill is placed.
 - 1. Crush masonry waste to less than 4 inches in each dimension.

UNIT MASONRY ASSEMBLIES

2. Mix masonry waste with at least two parts of specified fill material for each part of masonry waste. Fill material is specified in Division 2, Section "Earthwork".
 3. Do not dispose of masonry waste as fill within 18 inches of finished grade.
- C. Excess Masonry Waste: Remove excess, clean masonry waste that cannot be used as fill, as described above, and other masonry waste, and legally dispose of off Owner's property.

END OF SECTION

**SECTION 05500
METAL FABRICATIONS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Work necessary to furnish and install, complete, fabricated metalwork and castings as shown or required to secure various parts together and provide a complete installation.

1.02 SUBMITTALS

- A. Submittals shall be made in accordance with the requirements of this Section.

PART 2 PRODUCTS

2.01 GENERAL

- A. Like Items of Materials: End products of one (1) manufacturer in order to achieve standardization for appearance, maintenance, and replacement.
- B. Lifting Lugs: Provide on equipment and equipment components weighing over one hundred (100) pounds.
- C. Furnish miscellaneous items:
 - 1. Miscellaneous metalwork and castings as shown, or as required to secure various parts together and provide a complete installation.
 - 2. Items specified herein are not intended to be all-inclusive. Provide metalwork and castings shown, specified, or which can reasonably be inferred as necessary to complete the Project.
- D. Unless otherwise indicated, materials shall meet the latest issue of ASTM Specifications as follows:

METAL FABRICATIONS

Item	ASTM Specification
Steel Shapes & Plates:	A36
Steel Pipe Columns:	A501 or A53, Type EDRS, Grade B
Structural Steel Tubing:	A500, Grade B
Stainless Steel:	
Bars & Shapes:	A276, Type 316
Steelplate, Sheet & Strip:	A167, Type 316
Bolts:	A193, Type 316, B8MN, B8M2, or B8M3
Nuts:	A194, Type 316, B8MN, B8M2, or B8M3
Aluminum, Structural Shapes & Plates:	Alloy 6061-T6, meeting referenced Specifications and ASTM Sections found in Aluminum Association current Construction Manual Series
Connection Bolts for Steel Members; Use Hardened Washers Under Head & Nut:	A325-N, F436 (Washers)
Anchor Bolts & Nuts:	
Stainless:	A193, Type 316
Connection Bolts for Wood Members:	
Dry Environment:	A307 Uncoated
Wet Use or Exterior Use:	A307 w/ A153 Galvanizing
Connection Bolts for Aluminum	Stainless Steel
Cast Iron:	A48, Class 30

2.02 ANCHOR BOLTS

- A. 316 L stainless steel.

2.03 STAINLESS STEEL FASTENERS LUBRICANT (ANTISEIZING)

- A. Provide for stainless steel nuts and machined bolts, anchor bolts, concrete anchors, and all other threaded fasteners.
- B. Lubricant shall contain substantial amounts of molybdenum disulfide, graphite, mica, talc, or copper as manufactured by:
 - 1. Loc Tite Company, Permatex.
 - 2. Or equal.

2.04 ANCHORING SYSTEMS FOR CONCRETE

- A. Wedge Anchors:
 - 1. One hundred (100%) percent 316 stainless steel.
 - 2. Do not provide for submerged conditions.
 - 3. Sizes: As shown.
 - 4. Manufacturer:
 - a. ITT Phillips Drill Division, Michigan City, IN.
 - b. Hilti, Inc., Stamford, CT., Hilti Super Kwik-Bolt, stud type.
 - c. Wej-It Corporation, Broomfield, CT., Wej-It.
 - d. Molly Division of Emhart Corporation, Temple, PA, Parabolt Concrete Anchors.
- B. Expansion Anchors:
 - 1. Self-drilling anchors, snap-off type or flush type.
 - 2. Provide anchors for use with hot-dipped galvanized bolts.
 - 3. Non-drilling Anchors: Flush type for use with bolt or stud type with projecting threaded stud.
 - 4. Provide in dry areas only where future corrosion is not a problem unless expansion anchors are 316 stainless steel.
 - 5. In wet or damp areas, provide wedge anchors as specified, or in submerged conditions, adhesive anchors as specified.
 - 6. 316 stainless steel expansion anchors may be provided as defined for stainless wedge anchors.

7. Manufacturer:
 - a. ITT Phillips Drill Division, Michigan City, IN.
 - b. Hilti, Inc., Stamford, CT, Hilti HDI Drop-In anchors.

C. Epoxy Anchors:

1. Provide for anchoring metal components at or below a point one (1) foot six (6) inches above maximum water surface elevation in water-holding structures or buried in earth conditions.
2. Anchor Rod: 316 stainless steel threaded rod free of grease, oil, or other deleterious material with a forty-five (45°) degree chisel point.
3. Epoxy Adhesives:
 - a. Meet ASTM C881, Type 1, Grade 3, Class A, B, or C.
 - b. Two (2) component, one hundred (100%) percent solids, nonsag, paste, insensitive to moisture, designed to be used in adverse freeze/thaw environments and gray in color.
 - c. Cure Temperature, Pot Life, and Workability: Compatible for intended use and environmental conditions.
4. Mixed Epoxy Adhesive:
 - a. Nonsag paste consistency with ability to remain in a one (1) inch diameter overhead drilled hole without runout, holding the following properties:
 - 1) Slant Shear Strength, ASTM C881/882, No Failure In Bond Line, Dry/Moist Conditions: Five-thousand (5,000) psi.
 - b. Compressed Strength, ASTM D695: Fourteen thousand (14,000) psi minimum.
 - c. Tensile Strength, ASTM D695: Four thousand five-hundred (4,500) psi.
 - d. Heat Deflection Temperature, ASTM D648: One hundred thirty-five (135°) degrees F, minimum.
5. Epoxy Adhesive Packaging:

METAL FABRICATIONS

- a. Disposable, self-contained cartridge system, capable of dispensing both epoxy components in the proper mixing ratio and fit into a manually or pneumatically operating caulking gun.
 - b. Dispense components through a mixing nozzle that thoroughly mixes components and places epoxy at base of pre-drilled hole.
 - c. Mixing Nozzles: Disposable, manufactured in several sizes to accommodate size of anchor rods.
 - d. Cartridge Markings: Include manufacturer's name, batch number, mix ratio by volume, product expiration date, ANSI hazard classification, and appropriate ANSI handling precautions.
6. Manufacturers:
- a. Adhesives Technology Corporation, 21850 88th Place South, Kent, WA., 98031, Anchor-It Fastening Systems, HS 200 Epoxy Resin.
 - b. Or equal.

2.05 SHOP PAINTING

- A. Clean ferrous metal items not galvanized and apply shop coat of metal primer and finish paint. See related Sections for Finish Coat. Finish Coat Color to be selected by Owner

PART 3 EXECUTION

3.01 FABRICATION

- A. General:
 1. Exposed Surfaces Finish: Smooth, sharp, well-defined lines.
 2. Provide necessary rabbets, lugs, and brackets so Work can be assembled in neat, substantial manner.
 3. Conceal fastenings where practical.
 4. Drill metalwork and countersink holes as required for attaching hardware or other materials.
 5. Fabricate materials as specified.
 6. Weld connections, except where bolting is directed.

METAL FABRICATIONS

7. Methods of fabrication not otherwise specified or shown shall be adequate for stresses as approved.
8. Grind exposed edges of welds smooth on walkways, guardrails, handrails, stairways, channel door frames, steel column bases, and where shown.
9. Round sharp edges to 1/8-inch minimum radius. Grind burrs, jagged edges, and surface defects smooth.

B. Aluminum:

1. Fabricate as shown, and in accordance with the Aluminum Association Standards and manufacturer's recommendations.
2. Grind smooth sheared edges exposed in finished Work.

3.02 WELDING

A. General:

1. Meet codes for Arc and Gas Welding in Building Construction of the AWS and AISC for techniques of welding employed, appearance, quality of welds made, and the methods of correcting defective Work.
2. Welding Surfaces: Free from loose scale, rust, grease, paint, and other foreign material, except mill scale which will withstand vigorous wire brushing may remain.
3. A light film of linseed oil may likewise be disregarded.
4. Do not weld when temperature of base metal is lower than zero (0°) degrees F.
5. Finished members shall be true to line and free from twists.
6. Prepare welds and adjacent areas such that there is:
 - a. No undercutting or reverse ridges on the weld bead.
 - b. No weld spatter on or adjacent to the weld or any other area to be painted.
 - c. No sharp peaks or ridges along the weld bead.
7. Grind embedded pieces of electrode or wire flush with adjacent surface of weld bead.

C. Aluminum:

METAL FABRICATIONS

1. Weld with Gas Metal Arc (MIG) or Gas Tungsten Arc (TIG) processes in accordance with manufacturer's written instructions as approved, and in accordance with recommendations of the American Welding Society contained in the Welding Handbook, as last revised.
2. Grind smooth all exposed aluminum welds.

3.03 INSTALLATION OF FABRICATED METALWORK

A. General:

1. Install in accordance with shop Drawings, the Drawings, and these Specifications.
2. Install fabricated metalwork plumb or level as applicable.
3. Complete installations shall be rigid, substantial, and neat in appearance.
4. Erect structural steel in accordance with applicable portions or AISC Code of Standard Practice, except as modified.
5. Install commercially manufactured products in accordance with manufacturer's recommendations as approved.

B. Aluminum:

1. Erection: In accordance with the Aluminum Association.
2. Do not remove mill markings from concealed surfaces.
3. Remove inked or painted identification marks on exposed surfaces not otherwise coated after installed material has been inspected and approved.

3.04 ANCHOR BOLTS

- A. Accurately locate and hold anchor bolts in place with templates at the time concrete is placed.

3.05 CONCRETE ANCHORS

- A. Do not begin installation until concrete or masonry receiving anchors has attained design strength.
- B. Do not install an anchor closer than six (6) times its diameter to either an edge of concrete or masonry, or to another anchor, unless specifically shown otherwise.

METAL FABRICATIONS

- C. Install in accordance with manufacturer's written instructions. Use manufacturer's recommended drills and equipment.
- D. Epoxy Anchors: Do not install when temperature of concrete is below thirty-five (35°) degrees F.

3.06 STAINLESS STEEL FASTENERS LUBRICANT (ANTISEIZING)

- A. Apply specified antiseizing lubricant to threads prior to making up connections.

3.07 ACCESS COVERS

- A. Accurately position prior to placing concrete, such that covers are flush with floor surface.
- B. Protect from damage resulting from concrete placement. Thoroughly clean exposed surfaces of concrete spillage to obtain a clean, uniform appearance.

3.08 ELECTROLYTIC PROTECTION

- A. Aluminum:
 - 1. Where in contact with dissimilar metals, or in contact with or embedded in masonry or concrete, protect surfaces with bituminous paint.
 - 2. Allow paint to dry before installation of the materials.
 - 3. Protect painted surfaces during installation.
 - 4. Should coating become marred, prepare and touch up per paint manufacturer's written instructions.

3.09 FIELD PAINTING

- A. Prepare surfaces and apply primer in accordance with paint manufacturer's printed directions as approved, and as specified in **Section 09900 PAINTING**, utilizing appropriate painting system.

3.10 MANUFACTURERS' SERVICES

- A. Epoxy Anchors: Conduct job site training of Contractor's personnel for proper installation, handling, and storage of epoxy adhesive system. Schedule training sessions with Engineer.

END OF SECTION

**SECTION 05521
ALUMINUM PIPE AND TUBE RAILINGS**

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Provide all handrailing and other associated miscellaneous work as indicated, specified or as needed to provide a complete and proper installation.

1.2 QUALITY ASSURANCE

- A. Referenced manufacturer is the Thompson Fabricating Company of Tarrant, Alabama and is named to establish standards of quality. Equal products of other manufacturers and fabricators complying with these specifications may be provided, as approved by the Engineer.
- B. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

1.3 SUBMITTALS

- A. Comply with pertinent provisions of Section 01001.
- B. Product data: Within 30 calendar days after receiving the Owner's Notice to Proceed, submit:
 - 1. Materials list of items proposed to be provided under this Section.
 - 2. Manufacturer's specifications and other data needed to prove compliance with the specified requirements.
 - 3. Shop drawings showing location of all railings, fabrication and anchorage methods, splices, and attachments.
- C. Samples: Provide a sample of handrail components including base, top and intermediate connections with specified finish.

1.4 PRODUCT HANDLING

- A. All aluminum pipe to be packed and shipped in individual plastic film to protect the anodized finish.
- B. Store out of contact with ground or concrete.

ALUMINUM PIPE AND TUBE RAILINGS

PART 2 - PRODUCTS

2.1 GENERAL

- A. Maximum post spacing is not to exceed 6'-0" on center.
- B. Posts to be evenly spaced throughout entire run.
- C. Provide a clearance of not less than 3 inches between the handrail and any other object.
- D. Provide railings shop assembled in lengths not to exceed 24' from components and pipe mechanically fastened together using stainless steel hardware.
 - 1. Do not use fittings that are glued or pop-riveted.
 - 2. Provided rounded 90 degree elbows on end posts.
- E. Posts to top or side mounted to all structures and stair stringers, as indicated on the drawings.
- F. Materials:
 - 1. Provide stainless steel fasteners.
 - 2. Provide one piece internally threaded tubular inserts with a minimum tensile strength of 85,000 psi to receive fasteners.
 - 3. Provide internal line-up members at joints to provide a continuous, uniform surface the entire length.
 - 4. Provide cast aluminum wall and base flanges with rounded edges and corners.
 - 5. Provide cast aluminum fittings.
 - 6. Rail ends to be looped between the top and intermediate railing utilizing 90 degree smooth radius bends.

2.2 WORKMANSHIP

- A. Finishes and machined faces to be true to line, level and plumb.
- B. Workmanship and finish to be equal to the best practices of modern shops for the respective work.

ALUMINUM PIPE AND TUBE RAILINGS

1. Exposed surfaces to have smooth finish and sharp, well defined lines and arises.
2. Sections to be well formed to shape and size with sharp lines and angles.
3. Curved work to be sprung evenly to curves.
4. Metal work to be countersunk properly to receive hardware and provided with the proper bevels and clearance.
5. Cutting to be done by shearing or sawing.
6. Holes for bolts and screws to be drilled.
7. Conceal fastenings where practicable.

2.3 ANCHORAGE

A. General:

1. Provide as indicated, or as necessary for securing work in place and anchoring equipment in place.
2. Sizes and spacing of anchor bolts not indicated to be as required for the intended purpose.

B. Anchor bolts: Provide bolts, nuts and washers all from Type 316 series stainless steel.

C. Expansion anchors:

1. Use stud type with one-piece wrap around expansion sleeve.
2. Provide complete unit manufactured from 316 series stainless steel.
3. Acceptable products: Phillips "Wedge-Anchors," Ramset "Trubolt Stud Anchors," or Hilti "Kwik-Bolt".

2.4 TOE PLATE

A. Provide a toe plate on all handrails where indicated on the plans and in the following locations:

1. Elevated railing four (4) feet above a finished floor.

ALUMINUM PIPE AND TUBE RAILINGS

2. Railing adjacent to open tanks.
 - B. Provide 4" high, minimum 1/8" thick, reinforced heavy duty extruded toe plate, Thompson Fabricating Company or approved equal.
 - C. Attach to posts with stainless steel or anodized aluminum straps and 1/4" stainless steel machine bolts.

2.5 TWO LINE GUARD RAILING

- A. Provide two line guard railing where indicated on the drawings.
- B. Design railing system in accordance with all applicable requirements stipulated by the Occupational Safety and Health Act of 1970 or latest revision.
- C. Posts and railings to be 6105-T5 aluminum with a minimum of 1-1/2" in diameter schedule 40 pipe.

2.6 FINISH

- A. Aluminum:
 1. All components to have clear satin anodized finish, thickness of 0.7 mil minimum, complying with Aluminum Association M10-C22-A41 (215-R1).
 2. Surface to be in contact with concrete or dissimilar metals to be coated with a zinc chromate or asphaltic finish.
 3. Completed railings to be free of mill finish and racking marks.

PART 3 - EXECUTION

3.1 GENERAL

- A. Install all items such that the system is plumb, square and level as intended and as shown on the Drawings.
- B. Install dummy posts at the end of each run and where the rail changes direction.
- C. Manufacturer to provide all required templates for system mounting.
- D. Tighten all fasteners to sufficient torque to completely eliminate play at connections and attachments.

ALUMINUM PIPE AND TUBE RAILINGS

3.2 RIGIDITY

- A. Posts to be single unspliced length.
- B. Lower rails to be a single, unspliced length between posts.
- C. Top rails to be continuous wherever possible and attached to a minimum of three posts.
- D. Tighten all fasteners so that completed railing is rigid and free of play at joints and attachments.

3.3 INSTALLATION

- A. Install in conformance with the approved shop drawings.
- B. Cut all pipe squarely using a tubing cutter.
 - 1. Cuts to be free from burrs.
 - 2. Protect finish during cutting.
- C. The gap at joints are not to exceed 1/32".
- D. Provide drainage for all exterior systems:
 - 1. When bends or elbows occur at low points, drill 1/4" diameter hole at lowest point.
 - 2. Posts mounted in concrete to have 1/4" diameter weep hole drilled approximately one inch above slab level.
- E. Provide expansion joints in top rail on 30' maximum centers.
 - 1. Determine expansion joint gap using the following formula:

GAP (in) = 0.000013 x (105-T) x Number of inches between expansion joints.
Where T equals ambient temperature at time of installation. (Degrees F).

END OF SECTION

**SECTION 05530
ALUMINUM GRATING AND STAIR TREADS**

PART 1 GENERAL

1.01 WORK INCLUDED

- A. This Section covers the Work necessary to furnish and install, complete, the fabricated grating, grating supports, and stair treads specified herein.

1.02 GENERAL

- A. Like items provided hereunder shall be the end products of one manufacturer in order to achieve standardization for appearance, maintenance, and replacement.
- B. See CONDITIONS OF THE CONTRACT and Section 01001 GENERAL REQUIREMENTS, which contain information and requirements that apply to the Work specified herein and are mandatory for the Project.

1.03 SUBMITTALS

- A. Submittals shall be made in accordance with paragraph SUBMITTALS in Section 01001 GENERAL REQUIREMENTS. In addition, the following specific information shall be provided:
 - 1. Product Data:
 - a. Catalog information and catalog cuts.
 - b. Manufacturer's Specifications, to include coatings.
 - c. Special handling and storage requirements.
 - d. Installation instructions.
 - 2. Shop Drawings:
 - a. Grating: Show dimensions, weight, and size, and location of connections to adjacent grating, supports, and other Work.
 - b. Grating Anchorage: Show structural calculations and details of anchorage to supports to prevent displacement.
 - c. Grating Supports: Show dimensions, weight, size, location, and anchorage to supporting structure.

ALUMINUM GRATING AND STAIR TREADS

3. Quality Control Submittals:
 - a. Factory test reports.
 - b. Manufacturer's certification of compliance for specified products.
 - c. Fire Retardant: Independent laboratory test report of testing conducted on exact type of grating proposed and dated within two (2) years of submittal date (not a resin test report).
 - d. Manufacturer's report that swaged crossbars, if on grating, meet the requirements of these Specifications.

1.04 QUALITY ASSURANCE

A. Regulatory Requirements:

1. Fabrication, installation, standard clearances, banding and tolerances as follows:
 - a. Metal Bar Type Grating: In accordance with general recommendations of Metal Bar Grating Manual as published by National Association of Architectural Metal Manufacturers (NAAMM).
 - b. Aluminum: In accordance with the Aluminum Association Standards.

PART 2 PRODUCTS

2.01 GENERAL

- A. The use of the manufacturer's name and model or catalog number is for the purpose of establishing the standard of quality and general configuration desired only. Other manufacturers will be considered in accordance with the GENERAL CONDITIONS.

2.02 MATERIALS

- A. Meeting the following ASTM Specifications:
 1. Stainless Steel:
 - a. Bolts: A193, Type 316.
 - b. Nuts: A194, Type 316.
 - c. Bars and Shapes: A276, Type 316.

ALUMINUM GRATING AND STAIR TREADS

d. Plate, Sheet, Strip: A167, Type 316.

1. Grating material to be 6063-T6 aluminum alloy with mill finish.
2. Anchor Bolts and Nuts:
 - a. Stainless: A193, Type 316.

2.03 DESIGN AND FABRICATION

- A. Meet minimum dimensional requirements as shown or as specified.
- B. Field measure areas to receive grating, verify dimensions of new fabricated supports, and fabricate to dimension required for specified clearances.
- C. Section Length: Sufficient to prevent its falling down through clear opening when oriented in the span direction when one (1) end is touching either the concrete or the vertical leg of grating support.
- D. Minimum depth of grating: 1-1/4".
- E. Minimum bearing of main bars on each support and end clearance of installed grating sections: as specified under Article QUALITY ASSURANCE hereinbefore.
- F. Metal Cross Bar Spacing: Two (2) inch maximum, unless otherwise shown or specified.
- G. Cross Bars:
 1. Flush with top of main bar and extend downward a minimum of 50% of the main bar depth.
 2. Swaged Cross Bars:
 - a. Within 1/4 inch of top of grating with 1/2 inch minimum vertical dimension after swaging, and minimum before swaging dimension of 5/16 inch square.
 - b. Cross Bar Dimension after Swaging: Minimum 1/8 inch wider than the opening at minimum of two corners at each side of each square opening at each side of each square opening in main bar.
 - c. Tightly fit main bars and cross bars allowing no differential movement.
- H. Do not use weld type cross bars.

ALUMINUM GRATING AND STAIR TREADS

- I. Banding:
 - 1. Same material as grating.
 - 2. Band grating edges and openings in grating as specified under Article QUALITY ASSURANCE herein.
- J. Metals for Embedment or Seat Angles for Partial Embedment. Concrete: Type 316 stainless steel, unless otherwise specified.

2.04 GRATING ACCESSORIES

- A. Anchor bolts, bolts, inserts, threaded anchor studs, wedge anchors, expansion anchors, adhesive anchors and as necessary for anchorage of grating to supports:
 - 1. Stainless Steel Type 316 or as otherwise specified under grating type.
 - 2. Fastener Capability: Firmly secure grating section to supports.
 - 3. Fastener Clip(s) and Bolt(s): In accordance with grating manufacturer's recommendations, except minimum of four fasteners per grating section and removable from grating walkway surface.
 - 4. Provide stainless steel Type 316 threaded anchor studs, as fasteners for grating attachment to metal supports either not embedded or partially embedded in concrete, manufactured by:
 - a. Nelson Studs Welding Company, Lorain, OH.
 - b. Omark Industries, KSM Fastenings System Division, Seattle, WA, or Portland, OR.

2.05 GRATING SUPPORTS

- A. Seat angles and beams where shown.
- B. Material for aluminum grating supports shall be as herein specified or as shown on the Drawings.
- C. Coordinate dimensions and fabrication with grating to be supported.

2.06 FOOT TRAFFIC GRATING

- A. Uniform Service Load: One-hundred (100) psf minimum, unless otherwise shown.
- B. Maximum Deflection: $\frac{1}{4}$ inch, unless otherwise shown.

ALUMINUM GRATING AND STAIR TREADS

- C. Banding: 3/16 inch minimum.
- D. Aluminum Bar Type Grating:
 - 1. Press-locked rectangular design, as manufactured by:
 - a. IKG/Borden, Clark, NJ, IKG/Borden Type F.
 - b. Or equal.
 - 2. Swage locked grating, rectangular bar type, as manufactured by:
 - a. IKG/Borden, Clark, NJ, IKG/Borden Type FS.
 - b. Seidelhuber Metal Products, Inc., San Carlos, CA.
- E. Stair Treads:
 - 1. Material and Type: Same as grating material and grading type as provided for connecting walkway or work surface.
 - 2. Nosings: Nonslip, abrasive on each tread along one long edge.
 - 3. Carrier Plate or Angle: Provide at each end for connection to stair stringers.
 - 4. Dimensions:
 - a. Length: As shown.
 - b. Width: As shown or manufacturer's standard as close as possible to width as shown.
 - 5. Manufacturers: Same as for grating.

2.07 FABRICATION

- A. General:
 - 1. Exposed Surfaces: Smooth finish and sharp, well-defined lines.
 - 2. Provide necessary rabbets, lugs, and brackets so Work can be assembled in a neat, substantial manner.
 - 3. Conceal fastenings where practical.
 - 4. Drill metalwork and countersink holes as required for attaching hardware or other materials.
 - 5. Weld Connections: Not permitted on grating except at banding bars.

ALUMINUM GRATING AND STAIR TREADS

- B. Aluminum:
 - 1. Fabricate as shown and in accordance with manufacturer's recommendations as approved.
 - 2. Grind smooth sheared edges exposed in the finished Work.
 - 3. Swage cross bars, if used, with equipment strong enough to deform cross bars as specified herein.
 - 4. Eliminate any loose cross bar intersections on swaged grating.
- C. Footing Traffic Grating: Any single grating section, individual plank, or plank assembly shall not be less than one foot six-inches or greater than four feet in width or weigh more than 100 pounds.

PART 3 EXECUTION

3.01 PREPARATION

- A. Electrolytic Protection:
 - 1. Where aluminum will be in contact with dissimilar metals, than stainless steel, or it is to be embedded in masonry or concrete, protect surfaces with bituminous paint.
 - 2. Allow paint to dry before installation of the material.
 - 3. Protect painted surfaces during installation.
 - 4. Should coating become marred, prepare and touch up surface per paint manufacturer's instructions.

3.02 INSTALLATION

- A. Provide equipment for lifting and placing as necessary.
- B. Install in accordance with approved shop drawings, and as shown and specified.
- C. Install plumb or level as applicable in locations as shown.
- D. Anchor grating securely to supports to prevent displacement from traffic impact.
- E. Completed Installation: Rigid and neat in appearance.
- F. Commercially Manufactured Products;

ALUMINUM GRATING AND STAIR TREADS

1. Install in accordance with manufacturer's recommendations as approved.
 2. Secure grating to support members with fasteners.
 3. Welding is not permitted.
 4. Fasteners: Field locate and install.
 5. Permit each grating section or plank style grating assembly to be easily removed and replaced.
- G. Clearance between Ends of Grating Sections and Vertical Surfaces of Supports or Concrete Walls: Not to exceed those hereinbefore specified.
- H. Replace grating sections not meeting specified or detailed dimensional requirements.

END OF SECTION

**SECTION 07210
BUILDING INSULATION**

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Specification Sections, apply to this Section.

1.02 SUMMARY

- A. This Section includes the following:
 - 1. Unit Masonry Insulation.
 - 2. Roof Insulation.
 - 3. Fiberglass Batt Insulation.

1.03 SUBMITTALS

- A. General: submit each item in this Article according to the Conditions of the Contract and other applicable Specification Sections.
- B. Product Data for each type of insulation product specified and installation instructions for each type of insulation and vapor retarder material required.
- C. Product test reports from and based on tests performed by a qualified independent testing agency evidencing compliance of insulation products with specified requirements including those for thermal resistance, fire-test-response characteristics, water vapor transmission, water absorption, and other properties, based on comprehensive testing of current products.
- D. Shop Drawings: For Nailable Roof Deck System, furnish 1/4" scale layout drawings indicating placement of all decking. Layout drawings shall include details of connections and joints.

1.04 QUALITY ASSURANCE

- A. Single-Source Responsibility for Insulation Products: Obtain each type of building insulation from a single source with resources to provide products complying with requirements indicated without delaying the Work.
- B. Fire-Test-Response Characteristics: Provide insulation and related materials with the fire-test-response characteristics indicated on Drawings or specified

BUILDING INSULATION

elsewhere in this Section as determined by testing identical products per test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify materials with appropriate markings of applicable testing and inspecting agency.

1. Surface Burning Characteristics: ASTM E 84
2. Fire-Resistance Ratings: ASTM E 119
3. Combustion Characteristics: ASTM E 136

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Protect insulation materials from physical damage and from deterioration by moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturers written instructions for handling, storing, and protecting during installation.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide insulation products by one of the following:
 1. Glass-Fiber Insulation:
 - a. Certain Teed Corporation
 - b. Knauf Fiber Glass GmbH
 - c. Owens-Corning Fiberglass Corporation
 - d. Schuller International, Inc.
 2. Styrofoam Board Insulation: Owens-Corning or approved equal. $\frac{3}{4}$ " overall thickness. Comply with manufacturer's recommendations for installation over masonry units.

2.02 INSULATING MATERIALS

- A. Unit Masonry Insulation:
 1. Fill ungrouted cells of masonry with foamed in place two component thermal insulation.
 2. Insulation shall be a Class A material with an R-value of 4.9 per inch.
 3. Provide masonry insulation as manufactured by Core-Fill 500 as manufactured by Tailored Chemical Products, Hickory, NC or acceptable equal.

BUILDING INSULATION

- B. Roof Insulation:
1. Provide a minimum of 1.5" extruded polystyrene insulation.
 2. Provide a minimum of two staggered layers, unless otherwise indicated. Provide tapered insulation where roof structure does not slope.
 3. Roof insulation shall be approved by roofing manufacturer in accordance with the requirements of the roofing warranty.
 4. Roof insulation shall meet the requirements of a UL Class A and FM Class 1 roof. Insulation shall have an aged R-value of 5 per inch.
 5. Secure insulation as required by the roofing manufacturer to resist roof required windload.
 6. Provide 1/2" thick roof recovery board above roof insulation, USG Securrock Glass-Mat Roof Board or equal.
- C. Fiberglass batt insulation:
1. 4" thick kraft faced glass fiber batts with an insulation only value or R-11.
 2. 6" thick kraft faced glass fiber batts with an insulation only value or R-19.
 3. 8" thick kraft faced glass fiber batts with an insulation only value or R-25.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements of Sections in which substrates and related work are specified and to determine if other conditions affecting performance of insulation are satisfactory. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.02 INSTALLATION, GENERAL

- A. Clean substrates of substances harmful to insulation's or vapor retarders, including removing projections capable of puncturing vapor retarders or that interfere with insulation attachment.

3.03 INSTALLATION, GENERAL

- A. Comply with insulation manufacturers written instructions applicable to products and application indicated.

BUILDING INSULATION

- B. Install insulation that is undamaged, dry, unsoiled, and has not been exposed at any time to ice and snow.
- C. Extend insulation in thickness indicated to envelop entire area to be insulated.
- D. Apply single layer of insulation to produce thickness indicated.

3.04 INSTALLATION OF GENERAL BUILDING INSULATION

- A. Set vapor-retarder-faced units with vapor retarder to warm side of construction, unless otherwise indicated. Do not obstruct ventilation spaces, except for firestopping.
- B. Install mineral-fiber blankets in cavities formed by framing members according to the following requirements:
 - 1. Use blanket widths and lengths that fill cavities formed by framing members. Where more than one length is required to fill cavity, provide lengths that will produce a snug fit between ends.
 - 2. Place blankets in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.
- C. The insulation placed above ceiling shall provide an "R" factor rating of 30 (R30 value). Insulation may be batts or loose.
- D. Hollow cells of masonry units in exterior walls shall be filled with materials such as vermiculite or other granular material that will flow freely through the cells and provide some insulating value.

3.05 INSTALLATION OF ROOF DECK SYSTEM

- A. Require installer to examine substrates and conditions under which insulation work is to be performed. Obtain Installer's written report, listing conditions detrimental to performance of work in this section. Do not proceed with installation of insulation until unsatisfactory conditions have been corrected.
- B. Apply decking to substrate by method indicated, complying with manufacturer's recommendations. Where decking abuts masonry wall construction, provide 1/2" or larger expansion space, filled with mineral wool. On sloping supports, install panels from bottom to top.

3.06 PROTECTION

- A. General: Protect installed insulation and vapor retarders from damage due to harmful weather exposures, physical abuse, and other causes. Provide

BUILDING INSULATION

temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

END OF SECTION

SECTION 07540
SINGLE PLY MEMBRANE ROOFING

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Provide single ply membrane roofing where indicated on the Drawings, as specified herein, and as needed for a complete and proper installation.
- B. Related work:
 - 1. Documents affecting work of this Section include, but are not necessarily limited to, Sections in Division 1 of these Specifications.
 - 2. Section 07620 - Sheet Metal Flashing and Trim.

1.2 QUALITY ASSURANCE

- A. Referenced manufacturer is Sarnafil Inc., and basis of design is Sarnafil G410-15 feltback, 59 mil thermoplastic membrane with fiberglass reinforcement and a factory applied 9 oz. geotextile felt backing. Products of other manufacturer's may be provided upon approval by the Engineer.
- B. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.
- C. Use a subcontractor approved in writing by the manufacturer of the approved roofing system.

1.3 SUBMITTALS

- A. Comply with pertinent provisions of Section 01001.
- B. Product data: Within 35 calendar days after the Contractor has received the Owner's Notice to Proceed, submit:
 - 1. Materials list of items proposed to be provided under this Section.
 - 2. Manufacturer's specifications and other data needed to prove compliance with the specified requirements.

SINGLE PLY MEMBRANE ROOFING

3. Manufacturer's recommended installation procedures which, when approved by the Engineer, will become the basis for accepting or rejecting actual installation procedures used on the Work.

1.4 PRODUCT HANDLING

A. Storage of materials:

1. Stand roll goods on end, and store on a clean floor to keep ends of rolls free from foreign matter.
2. Store roofing materials in a dry place, on raised platforms, and cover with waterproof tarpaulins, inside or in closed vans, protected from the sun and the weather.
3. Store cartons, insulation, and drums of asphalt on raised level platforms, and protect them from weather with waterproof tarpaulins.
4. Store solvents, emulsions, and coatings in a cool, dry area.
5. Keep lids tightly sealed on all emulsions, cut back adhesives and flashing cements.

1.5 WARRANTY

- A. Furnish to the Engineer a fifteen (15) year written Manufacturer's Warranty covering materials and workmanship for the entire roofing system, including repair and replacement of roofing components which are deemed faulty or in disrepair during the warranty period. Such items shall be repaired at no cost to the Owner. Cover both labor and materials necessary to effect watertightness, including that required to repair roof leaks caused by standing water, defective material or workmanship.

PART 2 - PRODUCTS

2.01 MEMBRANE

- A. Membrane shall conform to ASTM D4434-96 (or latest revision), "Standard for Polyvinyl Chloride Sheet Roofing". Classification: Type II, Grade I.
- B. Color of Membrane
 1. White with a Solar Reflectance Index of 78 or greater.

SINGLE PLY MEMBRANE ROOFING

2.02 FLASHING MATERIALS

- A. Provide flashing approved for use with the manufacturer's system warranty and in accordance with manufacturer's details.

2.03 INSULATION/OVERLAYMENT/RECOVER BOARD

- A. Provide in accordance with Section 07210.

2.04 UNDERLAYMENTS

- A. Provide Dens-Deck, a siliconized gypsum, fire-tested hard board with glass mat facers or equal.

2.05 VAPOR BARRIER

- A. Two layers of bituminous vapor retarder as recommended by manufacturer.

2.06 ATTACHMENT COMPONENTS

- A. Membrane and Underlayment Adhesive
 - 1. Use manufacturer's recommended adhesives for materials and substrates to be fastened.
- B. Insulation Board Adhesive
 - 1. Type III hot asphalt or other adhesive recommended by manufacturer.
- C. Fasteners
 - 1. Use manufacturer's recommended fasteners for materials and substrates to be fastened.

2.07 MISCELLANEOUS ACCESSORIES

- A. Provide all accessories recommended by the manufacturer to provide a watertight system.

2.08 RELATED MATERIALS

- A. Wood Nailer
 - 1. Treated wood nailers shall be installed at the perimeter of the entire roof and around such other roof projections and penetrations as specified on the Drawings. Thickness of nailers must match the insulation thickness to achieve a smooth transition. Wood nailers shall be treated and be #2 quality or better lumber. Creosote, CCA, or asphalt-treated wood is not acceptable.

PART 3 - EXECUTION

3.01 SURFACE PREPARATION

- A. Surface joints shall be 1/4" or less in width. Repair all joints wider than 1/4" with approved joint filler before proceeding with installation.
- B. Vents and all other projections through the roof shall be secured in position before roofing is commenced.

3.02 INSTALLATION

- A. Roofing shall be furnished and installed in compliance with U.L. Class "A" requirements. Manufacturer's instructions for the installation of such roofing system shall be strictly adhered to. All accessories necessary to complete the installation shall be provided.
- B. The roofing shall be applied and finished in one area in a continuous operation. Care shall be taken to insure that water does not flow beneath any completed sections of roof. Loose edges of membrane shall be temporarily sealed with an approved night seal when the weather is threatening. When work is resumed, the sheet shall be pulled free before continuing installation.
- C. Roofing and flashing installation at the junction of all parapet walls, curbs, and other roof openings shall be in accordance with the roof membrane manufacturer's standard details unless shown otherwise on the Drawings. Typical details of all actual roof conditions shall be submitted for approval prior to membrane installation.

3.03 WOOD NAILER INSTALLATION

- A. Install continuous wood nailers at the perimeter of the entire roof and around roof projections and penetrations as shown on the Drawings.
- B. Nailers shall be anchored to resist a minimum force of 300 pounds per linear foot in any direction. Individual nailer lengths shall not be less than 3 feet long. Nailer fastener spacing shall be at 12 inches on center. Fasteners shall be staggered 1/3 the nailer width and installed within 6 inches of each end. Two fasteners shall be installed at ends of nailer lengths. Nailer attachment shall meet this requirement and that of the current Factory Mutual Loss Prevention Data Sheet 1-49.
- C. Thickness shall be as required to match substrate or insulation height to allow a smooth transition.

3.04 VAPOR BARRIER INSTALLATION

- A. Conduct moisture and adhesion tests in accordance with industry guidelines. If test requirements are met, prime the deck with asphalt primer, let dry and then

SINGLE PLY MEMBRANE ROOFING

adhere a base sheet with full mopping of Type III hot asphalt at a minimum rate of 25 lbs per 100 square feet. Install a second ply in the same manner and then seal with an asphalt glaze coat. The base sheet and asphalt shall be installed in accordance with the manufacturer's instructions. The new insulation board shall be attached with additional Type III hot asphalt or by mechanical fasteners to the roof deck.

3.05 INSULATION INSTALLATION

- A. Insulation shall be installed according to insulation manufacturer's instructions.
- B. Insulation shall be neatly cut to fit around penetrations and projections.
- C. Install tapered insulation in accordance with insulation manufacturer's shop drawings.
- D. Do not install more insulation board than can be covered by the roofing membrane by the end of the day or the onset of inclement weather.

3.06 MEMBRANE INSTALLATION

- A. Inspect the surface of insulation prior to installation of the roof membrane. The substrate shall be clean, dry, free from debris and smooth with no surface roughness or contamination. Broken, delaminated, wet or damaged insulation boards shall be removed and replaced.
- B. Apply adhesive and membrane in strict accordance to roofing manufacturer's instructions and recommendations. Membrane shall be applied with no air pockets or wrinkles.
- C. Mechanically fasten roof system 4-0" from all roof edges along the entire perimeter using Sarnabar fastened 12" o.c. and with a welded cover strip.

3.07 HOT-AIR WELDING OF SEAM OVERLAPS

- A. Welding: All seams shall be hot-air welded. Seam overlaps should be 3" wide when automatic machine welding and 4" wide when hand welding, except for certain details. All membrane to be welded shall be clean and dry. Welding shall be accomplished in strict accordance with manufacturer's recommendations.
- B. Quality control of welded seams: Applicator shall check all welded seams for continuity using a rounded screwdriver. Visible evidence that welding is proceeding correctly is smoke during the welding operation, shiny membrane surfaces, and an uninterrupted flow of dark grey material from the underside of the top membrane. On-site evaluation of welded seams shall be made daily by the applicator including taking one-inch wide cross-section samples of welded seams. Correct welds display failure from shearing of the membrane prior to

SINGLE PLY MEMBRANE ROOFING

separation of the weld. Each test cut shall be patched by the applicator at no extra cost to the Owner.

3.08 MEMBRANE FLASHINGS

- A. All flashings shall be installed concurrently with the roof membrane as the job progresses. No temporary flashings shall be allowed without the prior written approval of the Engineer and roof manufacturer. If any water is allowed to enter under the newly completed roofing, the affected area shall be removed and replaced at no expense to the Owner. Flashing shall be adhered to compatible, dry, smooth, and solvent-resistant surfaces. Apply flashing in strict accordance with the manufacturer's instructions.
- B. All flashings shall extend a minimum of 8" above the roof level.
- C. All flashing membranes shall be consistently adhered to substrates. All interior and exterior corners and miters shall be cut and hot-air welded into place. Not bitumen shall be in contact with the membrane.

3.09 METAL FLASHINGS

- A. Metal details, fabrication practices and installation methods shall conform to the applicable requirements of the following:
 - 1. Factory Mutual Loss Prevention Data Sheet 1-49 (latest issue).
 - 2. Sheet Metal and Air Conditioning Contractors National Association, Inc. (SMACNA)-latest issue.
- B. Complete all metal work in conjunction with roofing and flashings so that a watertight condition exists daily.
- C. Metal shall be installed to provide adequate resistance to bending to allow for normal thermal expansion and contraction.
- D. Metal joints shall be watertight.
- E. Metal flashings shall be securely fastened into solid wood blocking. Fasteners shall penetrate the wood nailer a minimum of 1".
- F. Hook strips shall extend past wood nailers over wall surfaces by 1-1/2" minimum and shall be securely sealed from air entry.

END OF SECTION

SECTION 07620
SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.01 DESCRIPTION

- A. Work included: Provide sheet metal flashing and trim as indicated, specified, or as necessary to prevent water penetration through the exterior shell of the building and to provide a complete and proper installation.

1.02 QUALITY ASSURANCE

- A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

1.03 SUBMITTALS

- A. Comply with pertinent provisions of Sections in Division 1 of these Specifications.
- B. Product data:
 - 1. Materials list of items proposed to be provided under this Section.
 - 2. Manufacturer's specifications and other data needed to prove compliance with the specified requirements.
 - 3. Shop drawings in sufficient detail to show fabrication, installation, anchorage, and interface of the work of this Section with the work of adjacent trades.

PART 2 - PRODUCTS

2.01 MATERIALS AND GAUGES

- A. Provide the highest quality and gauge commensurate with the referenced standards.

2.02 ALUMINUM SNAP-ON COPING

- A. Provide snap-on coping as manufactured by the W.P. Hickman Company or equal.
- B. Fabricate coping from 0.050" aluminum sheet in 10'0" lengths.

SHEET METAL FLASHING AND TRIM

- C. Provide concealed aluminum joint covers, 20-gauge galvanized steel cleats, coping chairs, and construction adhesive as required by the coping manufacturer.

2.03 FASTENERS

- A. Provide color coordinated stainless steel.

2.04 GUTTERS AND DOWNSPOUTS

- A. Fabricate scupper boxes, collector boxes, downspouts, and all associated trim to sizes and dimensions shown. All material to be 0.050" aluminum.

2.05 FINISHES

- A. Finish all gravel stops, copings, gutters and downspouts and other aluminum trim exposed to view with a Kynar 500 Polyvinylidene Fluoride finish. The finish shall be a two-coat system consisting of a primer and a finish coat. The color shall be as selected by the Owner.
- B. Fasteners to be color coordinated stainless steel.

PART 3 - EXECUTION

3.01 INSPECTION AND PREPARATION

- A. Verify that substrates are smooth and clean to extent needed for sheet metal work.
- B. Verify that reglets, nails, cants, and blocking, to receive sheet metal are installed and free of concrete and soil.
- C. Before installing sheet metal, verify shapes and dimensions of surface to be covered.

3.02 INSTALLATION

- A. General:
 - 1. Install work watertight, without waves, warps, buckles, fastening stresses or distortion, allowing for expansion and contraction.
 - 2. Hem exposed edges.
- B. Coping:
 - 1. Secure cleat in place with construction adhesive or as otherwise recommended by the manufacturer.

SHEET METAL FLASHING AND TRIM

2. Center gutter chair on cleat, install concealed joint cover and snap coping into place.
 3. Provide factory welded miters at corners.
- C. Gutters and downspouts:
1. Install scupper boxes, collector boxes, and downspouts as recommended by the manufacturer with all brackets, clamps, straps and supports as necessary for a complete installation.
 2. Use color coordinated stainless steel fasteners.
 3. Downspout joints shall be 1" minimum telescoping lap joints.
 4. Provide gutter support brackets and gutter straps at 2'6" on center in a manner to provide for slope to downspout.
 5. Provide downspout straps or support brackets at 6'0" minimum spacing with at least two per downspout.

END OF SECTION

**SECTION 07920
JOINT SEALANTS**

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract and Division 1 Specification Sections apply to this Section.

1.02 SUMMARY

- A. This Section includes sealants for the following applications, including those specified by reference to this Section.

- B. This Section includes sealants for the following applications:

- 1. Exterior joints in the following vertical surfaces and nontraffic horizontal surfaces:

- a. Control and expansion joints in cast-in-place concrete.
- b. Control and expansion joints in unit masonry.
- c. Joints between different materials listed above.
- d. Perimeter joints between materials listed above and frames of doors and windows.
- e. Control and expansion joints in ceiling and overhead surfaces.
- f. Other joints as indicated.

- 2. Interior joints in the following vertical surfaces and horizontal nontraffic surfaces:

- a. Control and expansion joints on exposed interior surfaces of exterior walls.
- b. Perimeter joints of exterior openings where indicated.
- c. Tile control and expansion joints.
- d. Vertical control joints on exposed surfaces of interior unit masonry and concrete walls and partitions.
- e. Perimeter joints between interior wall surfaces and frames of interior doors, windows, and elevator entrances.
- f. Joints between plumbing fixtures, adjoining walls, floors, and counters.
- g. Other joints as indicated.

- 3. Interior joints in the following horizontal traffic surfaces:

- a. Control and expansion joints in cast-in-place concrete slabs.
- b. Control and expansion joints in tile flooring.

- c. Other joints as indicated.
- C. Related Sections include the following:
 - 1. Division 4 Section "Unit Masonry" for masonry control and expansion joint fillers and gaskets.
 - 2. Division 8 Section "Glazing" for glazing sealants.

1.03 PERFORMANCE REQUIREMENTS

- A. Provide elastomeric joint sealants that establish and maintain watertight and airtight continuous joint seals without staining or deteriorating joint substrates.
- B. Provide joint sealants for interior applications that establish and maintain airtight and water-resistant continuous joint seals without staining or deteriorating joint substrates.

1.04 SUBMITTALS

- A. Product Data: For each joint-sealant product indicated.
- B. Samples for Initial Selection: Manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.
- C. Samples for Verification: If requested by the architect or engineer, install joint sealants in 48-inch long segments in actual field application for verification of color and installation.
- D. Product Certificates: Signed by manufacturers of joint sealants certifying that products furnished comply with requirements and are suitable for the use indicated.
- E. Compatibility and Adhesion Test Reports: From sealant manufacturer indicating the following:
 - 1. Materials forming joint substrates and joint-sealant backings have been tested for compatibility and adhesion with joint sealants.
 - 2. Interpretation of test results and written recommendations for primers and substrate preparation needed for adhesion.
- F. Product Test Reports: From a qualified testing agency indicating sealants comply with requirements, based on comprehensive testing of current product formulations.
- G. Warranties: Special warranties specified in this Section.

1.05 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer who has specialized in installing joint sealants similar in material, design, and extent to those indicated for this Project and whose work has resulted in joint-sealant installations with a record of successful in-service performance.
- B. Source Limitations: Obtain each type of joint sealant through one source from a single manufacturer.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to project site in original unopened containers or bundles with labels indicating manufacturer, product name and designation, color, expiration date, pot life, curing time, and mixing instructions for multicomponent materials.
- B. Store and handle materials in compliance with manufacturer's written instructions to prevent their deterioration or damage due to moisture, high or low temperatures, contaminants, or other causes.

1.07 PROJECT CONDITIONS

- A. Environmental Limitations: Do not proceed with installation of joint sealants under the following conditions:
 - 1. When ambient and substrate temperature conditions are outside limits permitted by joint sealant manufacturer.
 - 2. When ambient and substrate temperature conditions are outside limits permitted by joint sealant manufacturer or are below 40 degree F.
 - 3. When joint substrates are wet.
- B. Joint-Width Conditions: Do not proceed with installation of joint sealants where joint widths are less than those allowed by joint sealant manufacturer for applications indicated.
- C. Joint-Substrate Conditions: Do not proceed with installation of joint sealants until contaminants capable of interfering with adhesion are removed from joint substrates.

1.08 WARRANTY

- A. General Warranty: Special warranties specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.
- B. Special Installer's Warranty: Written warranty, signed by Installer agreeing to repair or replace elastomeric joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
 - 1. Warranty Period: Two years from date of Substantial Completion.
- C. Special Manufacturer's Warranty: Written warranty, signed by elastomeric sealant manufacturer agreeing to furnish elastomeric joint sealants to repair or replace those that do not comply with performance and other requirements specified in this Section within specified warranty period.
 - 1. Warranty Period: 20 years from date of Substantial Completion.
- D. Special warranties specified in this Article exclude deterioration or failure of elastomeric joint sealants from the following:
 - 1. Movement of the structure resulting in stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression caused by structural settlement or errors attributable to design or construction.
 - 2. Disintegration of joint substrates from natural causes exceeding design specifications.
 - 3. Mechanical damage caused by individuals, tools, or other outside agents.
 - 4. Changes in sealant appearance caused by accumulation of dirt or other atmospheric contaminants.

PART 2 PRODUCTS

2.01 PRODUCTS AND MANUFACTURERS

- A. Products: Subject to compliance with requirements, provide one of the products indicated for each type in the sealant schedules at the end of Part 3.

2.02 MATERIALS, GENERAL

- A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
- B. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range for this characteristic.

2.03 ELASTOMERIC JOINT SEALANTS

- A. Elastomeric Sealant Standard: Comply with ASTM C 920 and other requirements indicated for each liquid-applied chemically curing sealant in the Elastomeric Joint-Sealant Schedule at the end of Part 3, including those referencing ASTM C 920 classifications for type, grade, class, and uses.
- B. Additional Movement Capability: Where additional movement capability is specified in the Elastomeric Joint-sealant Schedule, provide products with the capability, when tested for adhesion and cohesion under maximum cyclic movement per ASTM C 719, to withstand the specified percentage change in the joint width existing at the time of installation and remain in compliance with other requirements of ASTM C 920 for uses indicated.
- C. Continuous-Immersion-Test-Response Characteristics: Where Elastomeric sealants will be immersed continuously in water, provide products that have undergone testing according to ASTM C 1247, and have not failed in adhesion or cohesion when tested with substrates indicated for Project.

2.04 LATEX JOINT SEALANTS

- A. Latex Sealant Standard: Comply with ASTM C 834 for each product of this description indicated in the Latex Joint-Sealant Schedule at the end of Part 3.

2.05 PREFORMED JOINT SEALANTS

- A. Preformed Foam Sealants: For each product of this description indicated in the Preformed Joint-Sealant Schedule at the end of Part 3, provide manufacturer's standard preformed, precompressed, impregnated, open-cell foam sealant manufactured from high-density urethane foam impregnated with a nondrying, water-repellent agent; factory produced in precompressed sizes and in roll or stick form to fit joint widths indicated and to develop a watertight and airtight seal when compressed to the degree specified by manufacturer; and complying with the following:

JOINT SEALANTS

1. Properties: Permanently elastic, mildew resistant, nonmigratory, nonstaining, and compatible with joint substrates and other joint sealants.
 2. Density: Manufacturer's standard not less than 8 lb./cu. ft.
- B. Backing: Pressure-sensitive adhesive, factory applied to one side with protective wrapping.

2.06 JOINT-SEALANT BACKING

- A. General: Provide sealant backings of material and type that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.
- B. Cylindrical Sealant Backings: ASTM C 1330, of type indicated below and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance:
1. Type C: Closed-cell material with a surface skin.
- C. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint where such adhesion would result in sealant failure. Provide self-adhesive tape where applicable.

2.07 MISCELLANEOUS MATERIALS

- A. Primer: Material recommended by joint sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.
- B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants with joint substrates.
- C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint sealant manufacturer's written instructions and the following requirements:
 - 1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
 - 2. Clean porous joint substrate surfaces by brushing, grinding, blast cleaning, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining from above cleaning operations by vacuuming or blowing out joints with oil-free compressed air. Porous joint surfaces include the following:
 - a. Concrete
 - b. Masonry
 - c. Unglazed surfaces of ceramic tile
 - 3. Remove laitance and form-release agents from concrete.
 - 4. Clean nonporous surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants.
 - a. Metal
 - b. Glass
 - c. Glazed Surfaces of Ceramic Tile

- B. Joint Priming: Prime joint substrates where recommended in writing by joint sealant manufacturer, based on preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.
- C. Masking Tape: Use masking tape where required to prevent contact of sealant with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.03 INSTALLATION OF JOINT SEALANTS

- A. General: Comply with joint sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.
- B. Sealant Installation Standard: Comply with recommendations of ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.
- C. Install sealant backings of type indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
 - 1. Do not leave gaps between ends of sealant backings.
 - 2. Do not stretch, twist, puncture, or tear sealant backings.
 - 3. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.
- D. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and back of joints.
- E. Install sealants by proven techniques to comply with the following and at the same time backings are installed:
 - 1. Place sealants so they directly contact and fully wet joint substrates.
 - 2. Completely fill recesses provided for each joint configuration.
 - 3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

JOINT SEALANTS

- F. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.
1. Remove excess sealants from surfaces adjacent to joint.
 2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
 3. Provide concave joint configuration per Figure 5A in ASTM C 1193, unless otherwise indicated.
- G. Installation of Preformed Foam Sealants: Install each length of sealant immediately after removing protective wrapping, taking care not to pull or stretch material, to produce seal continuity at ends, turns, and intersections of joints. For applications at low ambient temperatures where expansion of sealant requires acceleration to produce seal, apply heat to sealant to comply with sealant manufacturer's written instructions.

3.04 CLEANING

- A. Clean off excess sealants or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

3.05 PROTECTION

- A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from the original work.

3.06 ELASTOMERIC JOINT-SEALANT SCHEDULE

- A. Multicomponent Nonsag Urethane Sealant: Where joint sealants of this type are indicated, provide products complying with the following:
1. Products: Provide one of the following:
 - a. Chem-Calk 500; Bostik Inc.
 - b. Dymeric; Tremco
 - c. Vulkem 922; Mameco International

JOINT SEALANTS

- d. NP 2; Sonneborn Building Products Div., ChemRex Inc.
 - e. Dynatrol II; Pecora Corp.
 - 2. Type and Grade: M (multicomponent) and NS (nonsag).
 - 3. Class: 25
 - 4. Use Related to Exposure: NT (nontraffic).
 - 5. Applications
- B. Multicomponent Pourable Urethane Sealant: Provide products complying with the following:
- 1. Products: Provide one of the following:
 - a. Chem-Calk 550; Bostik Inc.
 - b. Vulkem 245; Mameco International
 - c. Pourthane; W.R. Meadows, Inc.
 - d. NR-200 Urexpam; Pecora Corporation
 - e. SL 2; Sonneborn Building Products Div., ChemRex Inc.
 - f. THC-900; Tremco
 - 2. Type and Grade: M (multicomponent) and P (pourable).
 - 3. Class: 25
 - 4. Uses Related to Exposure: T (traffic).
 - 5. Applications: For traffic use at joints in concrete slabs.
- C. Single-Component Pourable Urethane Sealant: Provide products complying with the following:
- 1. Products: Provide one of the following:
 - a. Chem-Calk 950; Bostik Inc.
 - b. Vulkem 45; Mameco International
 - c. NR-201; Pecora Corporation
 - d. SL 1; Sonneborn Building Products Div., ChemRex Inc.
 - 2. Type and Grade: S (single component) and P (pourable).
 - 3. Class: 25
 - 4. Uses Related to Exposure: T (traffic).

JOINT SEALANTS

5. Applications: For traffic use at joints in concrete slabs.

3.07 LATEX JOINT-SEALANT SCHEDULE

- A. Latex Sealant: Where joint sealants of this type are indicated, provide products complying with the following:
 1. Products: Provide one of the following:
 - a. Chem-Calk 600; Bostik Inc.
 - b. AC-20; Pecora Corporation
 - c. Sonolac; Sonneborn Building Products Div., ChemRex, Inc.
 - d. Tremflex 834; Tremco

3.08 PREFORMED JOINT-SEALANT SCHEDULE

- A. Preformed Foam Sealant: Where joint sealants of this type are indicated, provide products complying with the following:
 1. Products: Provide one of the following:
 - a. Emseal 25V; Emseal Joint Systems, Ltd.
 - b. Emseal Greyflex; Emseal Joint Systems, Ltd.
 - c. Polytite B; Polytite Manufacturing Corporation
 - d. Polytite Standard; Polytite Manufacturing Corporation
 - e. Blocoband BF; Salamander Industrial Products Inc.
 - f. Blocoband HF; Salamander Industrial Products Inc.
 - g. Wilseal 600; Sealform, Ltd.

END OF SECTION

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SECTION 08332
ALUMINUM ROLLING SERVICE DOORS

PART 1 - GENERAL

1.1 SCOPE OF WORK

- A. Provide insulated aluminum rolling service doors where shown on the Drawings, as specified herein, and as needed for a complete and proper installation.
- B. Furnish doors as shown in the Door Schedule on the Drawings.

1.2 QUALITY ASSURANCE

- A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.
- B. Acceptable products: "Weatherbar" door as manufactured by the Cookson Company. Equal products of other manufacturers may be provided upon approval by the Engineer and in compliance with the Bid Form

1.3 SUBMITTALS

- A. Product data:
 - 1. Materials list of items proposed to be provided under this Section.
 - 2. Manufacturer's specifications and other data needed to prove compliance with the specified requirements.
 - 3. Shop drawings in sufficient detail to show fabrication, installation, anchorage, operators and controllers, and interface of the work of this Section with the work of adjacent trades.
 - 4. Manufacturer's recommended installation procedures which, when approved by the Engineer, will become the basis for accepting or rejecting actual installation procedures used on the Work.
- C. Samples: Two (2) 4-inch pieces of door slat.

ALUMINUM ROLLING SERVICE DOORS

1.4 WARRANTY

- A. Door(s) shall be guaranteed for a period of two (2) years against defects in workmanship and materials.

PART 2 - PRODUCTS

2.1 OVERHEAD COILING DOORS

- A. Provide standard roll-up service doors of the dimensions and arrangements shown on the Drawings, and with the following attributes:
 - 1. Design wind load: Provide and comply with Minimum wind load pressure design for the project location as required by ASCE-7 and IBC, latest editions, 20 psf minimum.
 - 2. Curtain: Interlocking flat faced interior and exterior slats fabricated from minimum 20 gauge strip aluminum.
 - a. Provide a minimum of 13/16" insulation between interior and exterior slats.
 - b. Provide continuous endlocks.
 - c. Reinforce bottom slat with two aluminum angles not less than 3/16" thick.
 - d. Provide windlocks on all doors over 14' wide and when required by design load.
 - e. Slats to be removable without removing entire curtain section.
 - f. Curtain slats shall be free from indentations.
 - 3. Guides:
 - a. Consist of two (2) aluminum angles and one (1) Type 304L stainless steel wall angle bolted together with 3/8" Type 304L stainless steel fasteners.
 - b. Provide an extruded vinyl snap-on weather stripping continuously along the exterior leg.
 - c. Provide continuous Type 304L stainless steel wall angles fastened to the surrounding structure with minimum 1/2" stainless steel fasteners at 36" on center.
 - 4. Brackets: Fabricate from Type 304L stainless steel plate not less than 1/4" thick.
 - a. Bolt to wall angle with minimum 1/2" Type 304 stainless steel fasteners.
 - 5. Barrel:
 - a. Provide minimum of 6" diameter steel tubing.

ALUMINUM ROLLING SERVICE DOORS

- b. Design to limit maximum deflection to 0.03" per ft. of opening width.
 - c. Support the load of the barrel and curtain by two grease sealed ball bearings.
 - d. Provide oil tempered torsion springs capable of correcting counter-balancing weight of curtain.
 - e. Provide an exterior wheel for adjusting springs.
 - f. Provide one (1) coat of bronze rust inhibiting prime paint.
6. Hood: Fabricate from 0.040" aluminum (minimum), formed to fit curvature of the brackets.
- a. Reinforce with rolled flanges at top and bottom.
 - b. Provide waterproof, neoprene hood baffle to minimize air seepage.
7. Weather stripping:
- a. Provide neoprene around all edges, including hood baffle, astragal, and guide weather strip at end of slats on door exterior.
 - b. Provide astragal on footpiece of extruded aluminum with tubular neoprene seal.
 - c. Provide wool pile weather strip on interior of door slats.
8. Design for a minimum of 25 operating cycles per day.
9. Finish:
- a. Curtain: Class 1 clear anodized finish, 0.7 mil. thick in accordance with 12C22 A41.
 - b. Hood: Phosphate treatment and manufacturer's standard baked acrylic primer.
 - c. Other exposed steel surfaces: Hot-dipped galvanized, minimum 3 ounces of zinc per sq. ft.

2.2 OPERATORS

A. Chain and gear operator:

1. Provide an endless Type 316 stainless steel chain with maximum pull of 30 lbs. to operate.
2. Provide precision cast iron reduction gears.
3. Provide a Type 316 stainless steel chain lock and attach to guide rails.

ALUMINUM ROLLING SERVICE DOORS

2.3 OTHER MATERIALS

- A. Provide other materials, not specifically described but required for a complete and proper installation, as selected by the Contractor subject to the approval of the Engineer.

PART 3 - EXECUTION

3.1 SURFACE CONDITIONS

- A. Examine the areas and conditions under which work of this Section will be performed. Correct conditions detrimental to timely and proper completion of the Work. Do not proceed until unsatisfactory conditions are corrected.

3.2 INSTALLATION

- A. Coordinate with other trades, Owner, and Engineer to ensure provisions are made for the locations of the electric motor operator, emergency chain, control station, and other relevant parts that interface with the work of this Section.
- B. Install the work of this Section in strict accordance with the original design, the approved Shop Drawings, and the manufacturer's recommended installation procedures, anchoring all components firmly into position for long life under hard use.
- C. Upon completion of the installation, put all items through at least ten operating cycles. Make required adjustments and assure that components are in optimum operating condition.

3.3 OPERATION

- A. Doors shall raise and lower equally on each side of door.
- B. Doors shall not require greasing of the slats and guides for proper operation.

END OF SECTION

**SECTION 08400
ALUMINUM DOORS & FRAMES**

PART 1 - GENERAL

1.01 SCOPE OF WORK

- A. Provide aluminum doors and aluminum door frames which are not specifically described in other Sections of these Specifications, where shown on the Drawings, as specified herein, and as needed for a complete and proper installation.

1.02 SUBMITTALS

- A. Submit for review, shop drawings showing the following:
 - 1. Materials list of items proposed to be provided under this Section.
 - 2. Manufacturer's specifications and other data needed to prove compliance with the specified requirements.
 - 3. Shop Drawings showing details of each frame type, elevations of door designs, details of openings, and details of construction, installation and anchorage.
 - 4. Show door swings as LH, RH, LHR or RHR.
 - 5. Manufacturer's recommended installation procedures which, when approved by the Engineer, will become the basis for accepting or rejecting actual installation procedures used on the Work.

1.03 QUALITY ASSURANCE

- A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.
- B. Referenced manufacturer is Cline Aluminum Doors, Inc. of West Bradenton, Florida and is named to establish standards of quality. Products by other manufacturers may be provided upon approval by the Engineer.
- C. Unless specifically otherwise approved by the Engineer, provide all products of this Section from a single manufacturer.

1.04 WARRANTY

- A. The CONTRACTOR shall guarantee all materials and equipment furnished and WORK performed for a period of one (1) year from the date of SUBSTANTIAL COMPLETION.
- B. The manufacturer is to provide a 10-year warranty against defect in workmanship and materials, including warping, rotting, decaying and bowing.
- C. The manufacturer is to provide a 10-year warranty against the finish fading.

1.05 DELIVERY, STORAGE, HANDLING

- A. All equipment shall be crated to protect it against damage during shipment.
- B. All parts shall be properly protected so that no damage or deterioration will occur during a prolonged delay from time of shipment until unit installation is completed and the units and equipment are ready for operation.

PART 2 - PRODUCTS

2.01 ALUMINUM DOORS

- A. Materials:
 - 1. Provide full flush design, in dimensions and types shown on the Drawings.
 - 2. Face skins to be smooth 5005-H14 stretcher leveled aluminum alloy.
 - a. Provide 0.125" inch skin thickness with a minimum tensile strength of 22,000 psi.
 - b. Facings to be bonded edge-to-edge to one-piece glass-reinforced polypropylene backer.
 - c. Bonding agent to be commercial bonding adhesive with a strength buildup of 350 psi.
 - 3. Provide continuous nonspecific hardware reinforcement with full internal perimeter aluminum tube measuring 1- 3/8" x 4- 1/4" x 1- 1/8".
 - 4. Provide an organic based marine grade honeycomb core with high compression strength of 94.8 psi.
 - 5. Provide internal framing members mechanically joined with #10 stainless steel threaded.

ALUMINUM DOORS & FRAMES

6. Provide a one-piece 0.085-inch oil tempered hardboard the full width and height of the door.
 - a. Pegboard or non-tempered hardboard not accepted.
 7. Provide wall thickness of 0.050 for beads and trim.
 - a. Lock stile door edge constructed of 6063-T5 extruded aluminum alloy with special beveled edge cap design and integral wool-pile weather stripping to be provided.
 - b. Hinge stile to be prepared for standard template 4.5" x 4.5" butt hinges.
 8. Top and bottom edging to be a beveled aluminum extrusion of 6063-T5 alloy in a channel shape of 0.125" throughout.
 9. Provide 0.1875-inch hinge and strike plate mounted in integral channel with no expose fasteners.
 10. Sealants to be fully compatible with all other materials and non-staining.
 - a. Sealants to meet or exceed TT-S-001-657, ASTM C834-76 and TT-S-001-54A.
 11. Reinforce doors for hardware with minimum 1/4" aluminum alloy.
 - a. Provide true mortise for hinges.
 12. Louvers where indicated are to be extruded aluminum blade type construction, 0.062" thickness.
 - a. Louver blades should be inverted "Y" type
 - b. Provide exterior doors with aluminum insect screen.
 - 1) Insect screen should be 14-18 mesh, 0.011-inch diameter Alclad aluminum set in a 0.050 inch extruded frame.
 13. For double leaf door, provide continuous astragal on active leaf with pile weather-stripping.
 14. Provide removable transom on doors with stacked panels.
 15. Where stacked panels are shown on the plans, provide 1" thick insulated panels with facing equal to the doors.
 16. All fasteners to be 18-8 stainless steel.
- B. Fabrication:
1. Provide monolithic facings with no pieces or lap joints, butt joints, lock joints, or any other type of manufactured joint.

ALUMINUM DOORS & FRAMES

2. Make all cutouts from the solid sheet without distorted edges.
3. Provide sufficient size facing so that it will be concealed under the door edging a minimum of 1/2".
4. The honeycomb core shall be fully expanded and set by heat at temperatures necessary for full performance requirements.
5. All laminating shall be done under controlled production conditions.
6. Metering of adhesive, uniform bonding pressure and mechanically sized components shall be representative of continuous processing that is capable of bonding a homogenous sandwich.
7. The completed sandwich shall be a structural laminate which shall meet or exceed the U. S. Forest Products Laboratory HHFA Delamination Test, as done in compliance with ASTM D1037-60T, Accelerated Aging Cycle.
8. Overall door tolerance shall be plus or minus 1/16".
9. Extrusion tolerances shall be as set by the American Aluminum Manufacturer's Association.
10. Provide snap-in type glazing stops with vinyl inserts.
11. Cut all edging to proper door size.
12. Die notch and hinge edging to receive top and bottom edging.
 - a. Provide clearance for hardware.
13. Apply edging to door with adhesive.
 - a. Edging to be non-removable and watertight.

2.02 ALUMINUM FRAMES

A. Materials:

1. Provide 6063-T5 extruded aluminum alloy frames, .125" wall thickness, of the types and dimensions shown on the Drawings.
2. Provide minimum 1/4" aluminum hardware reinforcement for hinges, lock strikes and closures.
3. Provide 1/2" wide door stops.

ALUMINUM DOORS & FRAMES

4. Punch three silencer holes in latch jamb of single frames and one silencer hole per leaf in head jamb of double frames.
5. Provide dust boxes over strikes and protection for tapped holes.
6. Provide adjustable, aluminum, clip-angle type jamb anchors, not less than 1/4" thick, securely attached to the bottom of each jamb.
7. On removable transom panels, provide door stop and panel stop.
8. Unless otherwise shown, provide 6" wide open back applied stop frame.

2.03 FINISH

- A. Provide Class 1 anodized finish, 0.7 mil coating, in accordance with AAM 12C22 A42.
- B. Color to be selected by the Owner.
- C. Provide one coat of coal tar epoxy on unexposed portion of door frames.

2.04 FINISH HARDWARE

- A. Secure templates from the finish hardware supplier and accurately install, or make provision for, all finish hardware at the factory.

2.05 GLASS AND GLAZING

- A. Use clear sheet glass, flat drawn, Type I, tempered, "B" quality, unless otherwise indicated.
- B. Use 3/16" thick glass for half panels and not less than 1/4" glass for full panels.

PART 3 - EXECUTION

3.01 SURFACE CONDITIONS

- A. Examine the areas and conditions under which work of this Section will be performed. Correct conditions detrimental to timely and proper completion of the Work. Do not proceed until unsatisfactory conditions are corrected.

3.02 INSTALLATION

- A. Placing frames:
 1. Place frames after completion of all masonry, painting and finish work.

ALUMINUM DOORS & FRAMES

2. Set frames accurately into position, plumbed, aligned, and braced securely until permanent anchors are set.
 3. Protect frames from mortar, concrete and paint splatter.
 4. After wall construction is completed, remove temporary braces and spreaders, leaving surfaces smooth and undamaged.
 5. Anchor bottom of frames to floors with expansion bolts and power fasteners.
 6. At in-place construction, set frames and build wall anchors into adjacent walls or secure to adjacent construction with machine screws and suitable anchorage devices. Provide "Z" fillers at each screw hole.
- B. Hanging doors:
1. Provide metal doors in locations as required.
 2. Install all finish hardware and adjust as necessary for proper operation.
 3. Protect doors from mortar, concrete and paint splatter.

3.03 ADJUST AND CLEAN

- A. Final adjustments:
1. Check and readjust operating finish hardware items in hollow metal work just prior to final inspection.
 2. Leave work in complete and proper operating condition.
 3. Remove defective work and replace with work complying with the specified requirements.

END OF SECTION

**SECTION 08421
ALUMINUM FLOOR HATCHES**

PART 1 GENERAL

1.01 WORK INCLUDED

- A. This section covers the work necessary to furnish, install, and complete the floor hatches specified herein.

1.02 GENERAL

- A. Like items of materials provided hereunder shall be the end products of one manufacturer in order to achieve standardization for appearance, maintenance, and replacement.
- B. See CONDITIONS OF THE CONTRACT and Section GENERAL REQUIREMENTS, which contain information and requirements that apply to the work specified herein and are mandatory for this project.

PART 2 PRODUCTS

2.01 GENERAL

- A. The use of a manufacturer's name and model or catalog number is for the purpose of establishing the standard of quality and general configuration desired only. Products of other manufacturers will be considered in accordance with the General Conditions.
- B. Unless otherwise indicated, all materials shall conform to the latest issue of the following ASTM Specifications:

<u>Item</u>	<u>ASTM Specification</u>
Anchor Bolts & Nuts:	
Carbon Steel	A 307 or A 36
Stainless	A 193, Type 316
Galvanized Steel Bolts & Nuts	A 153, Zinc Coating for A 307 or A 36
Flat Washers (Unhardened)	F 844, Use A 153 for Zinc Coating
Threaded Bars	A 36
Connection Bolts for Aluminum	A 2024-T4; or use appropriate stainless steel

2.02 FLOOR HATCH

- A. Provide pre-assembled floor doors and hatches where indicated on plans.
- B. Cover:
 - 1. Provide reinforced cover to support a minimum live load of 300 psf with a maximum deflection of 1/150th of the span.
 - 2. Where H-20 rated cover is indicated on drawings, provide reinforced cover to support AASHTO H-20 wheel load with a maximum deflection of 1/150th of the span.
 - 3. Provide dimensions as indicated.
 - 4. Provide single or double leaf cover as indicated.
 - 5. Provide 1/4" aluminum diamond plate pattern.
 - 6. Provide hold open arm to automatically lock cover in the open position.
 - 7. Provide smooth and easy controlled operation throughout entire arc of opening and closing.
- C. Frame:
 - 1. Provide 1/4" extruded aluminum channel frame with bend down anchor tabs around the perimeter.
 - 2. Mechanically attach a continuous EPDM gasket to the aluminum frame to create a barrier around the entire perimeter of the cover to reduce the amount of dirt and debris allowed to enter the channel frame.
- D. Hinges:
 - 1. Provide heavy forged aluminum hinges specifically designed for horizontal installation and pivot so the cover does not protrude into the channel frame.
 - 2. Provide a minimum 1/4" diameter Type 316 stainless steel pin.
 - 3. Bolt to the cover with tamperproof Type 316 stainless steel lock bolts and bolt to the frame with Type 316 stainless steel bolts and locknuts.
- E. Drain coupling: Provide a 1-1/2" drain coupling located in the front corner of the channel frame.

ALUMINUM FLOOR HATCHES

- F. Lifting mechanism:
1. Provide required number and size of compression spring operators enclosed in telescopic tubes to provide smooth, easy, and controlled cover operation throughout the entire arc of opening and act as a check in retarding downward motion of the cover when closing.
 2. Upper tube to be the outer tube to prevent accumulation of moisture, grit and debris inside the lower tube assembly.
 3. Interlock lower tube with a flanged support shoe fastened to a formed 1/4" gusset support plate.
 4. Provide stainless steel springs.
 5. Construct spring tubes with reinforced nylon 6/6 based engineered composite material.
- G. Handle:
1. Provide a removable exterior turn/lift handle with a spring-loaded ball detent to open the cover. Protect latch release by a flush, gasketed, removable screw plug.
 2. Provide a Type 316 stainless steel snap lock with fixed handle mounted to the underside of the cover.
- H. Provide a recessed padlock hasp.
- I. All hardware to be 316 stainless steel.
- J. Finish: Provide mill finish aluminum with bituminous coating applied to the exterior of the frame.
- K. Where hatch covers a confined space, providing OSHA approved lettering on the top of the hatch stating "Confined Space Do Not Enter Without a Permit".
- L. Provide 3/16" Type 316 stainless steel safety chain or nylon coated stainless steel wire rope.
- M. Warranty: Provide 25-year manufacturer's warranty.
- N. Acceptable products: Halliday W2S Series as manufactured by Halliday Products, Inc. of Orlando, Florida.
- O. Provide protective grating panel.

ALUMINUM FLOOR HATCHES

1. Provide hinged aluminum grating panels in access hatch openings to provide protection against fall through accidents when the access hatch is open.
2. Provide aluminum grating panels constructed from aluminum "I" bar construction.
 - a. Orange powder coating finish.
 - b. Rated for a minimum load rating of 300 lbs per sq. ft.
3. Provide positive latch to hold safety grate open when in the open position.
4. Provide lockable safety grates.
5. Provide spring assisted lifting handle.
6. Provide with 316 stainless steel mounting hardware.
7. Attach access hatch safety grate to concrete below access hatch frame.
8. For openings greater than 53" wide, provide two panels.

2.03 PREPARATION FOR SHIPMENT

- A. Insofar as is practical, the items provided hereunder shall be factory assembled. The parts and assemblies that are of necessity shipped unassembled, shall be packaged and clearly tagged in a manner that will protect the materials from damage, and facilitate the identification and final assembly in the field.

PART 3 EXECUTION

3.01 GENERAL

- A. Workmanship and finish of all metalwork specified under this section shall be the highest grade and equal to the best practice of modern shops for the respective work. Exposed surfaces shall have smooth finish and sharp, well-defined lines. Provide all necessary rabbets, lugs, and brackets so that the work can be assembled in a neat, substantial manner. Conceal fastenings where practical. Drill metalwork and countersink holes as required for attaching hardware or other materials. Fabricate materials as specified. Weld connections, except where bolting is directed. Items requiring special fabrication methods are mentioned herein. Fabrication of all other items shall be of equal quality. Methods of fabrication not otherwise specified or shown shall be adequate for the stresses and as directed by the Engineer.

ALUMINUM FLOOR HATCHES

- B. Grind all exposed edges of welds smooth. All sharp edges shall be rounded to a 1/8-inch minimum radius; all burrs, jagged edges, and surface defects shall be ground smooth.
- C. Welds and adjacent areas shall be prepared such that there is (1) no undercutting or reverse ridges on the weld bead, (2) no weld spatter on or adjacent to the weld or any other area to be painted, and (3) no sharp peaks or ridges along the weld bead. All embedded pieces of electrode or wire shall be ground flush with the adjacent surface of the weld bead.
 - 1. Aluminum: Fabricate aluminum as shown, and in accordance with the Aluminum Association Standards and the manufacturer's recommendations as approved. Grind smooth sheared edges exposed in the finished work.

3.02 WELDING

- A. The technique of welding employed, appearance, quality of welds made, and the methods of correcting defective work shall conform to codes for Arc and Gas Welding in Building Construction of the AWS and AISC. Surfaces to be welded shall be free from loose scale, rust, grease, paint, and other foreign material, except that mill scale which will withstand vigorous wire brushing may remain. A light film of linseed oil may likewise be disregarded. No welding shall be done when the temperature of the base metal is lower than zero degrees F. Finished members shall be true to line and free from twists.
- B. All welding operators shall be qualified in accordance with the requirements of current AWS Standard Qualification Procedure D1.1, Chapter 5, and welders of structural and reinforcing steel shall be certified for all positions of welding in accordance with such procedure. Qualification tests shall be run by a recognized testing laboratory at the Contractor's expense.
- C. All welding operators shall be subject to examination for re-qualification using the equipment, materials, and electrodes employed in the execution of the Contract work. Such re-qualification, if ordered by the Engineer, shall be done at the expense of the Contractor.
 - 1. Aluminum: Aluminum shall be welded with Gas Metal Arc (MIG) or Gas Tungsten Arc (TIG) processes in accordance with the manufacturer's recommendations as approved, and in accordance with the recommendations of the American Welding Society contained in the Welding Handbook, as last revised. Grind smooth all exposed aluminum welds.

3.03 INSTALLATION OF FABRICATED METALWORK

- A. Install in accordance with the shop drawings, the Drawings, and these Specifications. Perform field welding and erection work by skilled mechanics.

ALUMINUM FLOOR HATCHES

Install fabricated metalwork plumb or level as applicable. The completed installations shall, in all cases, be rigid, substantial, and neat in appearance. Erect structural steel in accordance with the applicable portions of AISC Code of Standard Practice, except as modified. Install commercially manufactured products in accordance with manufacturer's recommendations as approved.

- B. Aluminum: Erection of aluminum shall be in accordance with the Aluminum Association. Mill markings shall not be removed from concealed surfaces. Exposed surfaces not otherwise coated shall have the inked or painted identification marks removed after the material has been inspected and approved by the Engineer.

3.04 ANCHOR BOLTS

- A. All anchor bolts shall be accurately located and held in place with templates at the time the concrete is poured.

3.05 CONCRETE ANCHORS

- A. Installation shall not begin until the concrete or masonry receiving the anchors has attained its design strength. An anchor shall not be installed closer than six times its diameter to either an edge of the concrete or masonry, or to another anchor, unless specifically detailed otherwise on the Drawings. Install in strict conformance with manufacturer's written instructions. Use manufacturer's recommended drills and equipment.
- B. Epoxy Anchors: Do not install when temperature of concrete is below 35 degrees F or above 110 degrees F.

END OF SECTION

**SECTION 08505
ALUMINUM WINDOWS**

PART 1 - GENERAL

1.01 SCOPE OF WORK

- A. Provide aluminum windows which are not specifically described in other Sections of these Specifications, where shown on the Drawings, as specified herein, and as needed for a complete and proper installation.

1.02 SUBMITTALS

- A. Submit for review, shop drawings showing the following:
 - 1. Materials list of items proposed to be provided under this Section.
 - 2. Manufacturer's specifications and other data needed to prove compliance with the specified requirements.
 - 3. Shop Drawings showing manufacturer's standard details with recommendations for installation.
 - 4. Manufacturer's recommended installation procedures which, when approved by the Engineer, will become the basis for accepting or rejecting actual installation procedures used on the Work.
 - 5. Color samples.

1.03 QUALITY ASSURANCE

- A. Window Unit Manufacturers: Peerless Products, Inc., EFCO Corporation, Three Rivers Aluminum Company, or equal.

1.04 WARRANTY

- A. The CONTRACTOR shall guarantee all materials and equipment furnished and WORK performed for a period of one year from the date of SUBSTANTIAL COMPLETION.

1.05 DELIVERY, STORAGE, HANDLING

- A. All equipment shall be crated to protect it against damage during shipment.

- B. All parts shall be properly protected so that no damage or deterioration will occur during a prolonged delay from time of shipment until unit installation is completed and the units and equipment are ready for operation.

PART 2 - PRODUCTS

2.1 ALUMINUM WINDOWS

- A. Provide fixed aluminum windows of the dimensions shown on the Drawings, complete and with anchors of the types needed for the installation.
- B. Materials:
 - 1. Use aluminum alloy 6063-T5 with tensile strength of not less than 22,000 psi for principal window members, including mounting.
 - 2. Extruded mainframe members to have a minimum thickness of 1/8" with overall depth not less than two (2) inches.
 - 3. Use 1/8" thick tubular members for all intermediate mutin or meeting rail members.
 - 4. Operating ventilator members to be 3/16" thick (minimum) tubular sections.
 - 4. No hardware or fasteners shall violate the barrier.
- C. Construction:
 - 1. Combined depth of frame and ventilator shall be 2".
 - 2. All joinery of electrical frame members shall be closely fitted, double screwed with stainless steel screws, or by welding.
 - 3. Operating ventilators to have all four corners mitered closely fitted, double screwed with stainless steel screws and cold-welded.
 - 4. Ventilators to have double polyvinyl weather stripping around the entire perimeter with the exception of the exterior sill leg of the opening vent.
 - 5. Projected ventilators to be supported on heavy stainless steel four bar concealed Anderberg hinges.
 - 6. Provide sash members designed for inside glazing with extruded glazing bead of the snap-in type requiring no exposed screws.
 - a. Provide capability of accepting glass up to 1" thickness.

- F. Window classification and testing:
1. Provide heavy commercial grade, and except as otherwise specified, units complying with the requirements of AAMA classification P-A3 HP90.
 2. Air infiltration: At test pressure of 6.24 psf, air infiltration shall not exceed .003 CFM of CL, or .018 CFM of CL at a test pressure of 9.00 psf. Perform all tests in accordance with ASTM E 283.
 3. Water presentation: There shall be no leakage of water into the interior side of the windows when subjected to a test pressure of 9.00 psf when tested in accordance with ASTM E 331.
 4. Structural performance: Provide window members of adequate strength to meet the requirements of at least 90 when tested in accordance with ASTM E 330.
 5. Thermal performance: Units to have a "U" value of not more than 0.52 (BTU/hr./sq. ft./deg. F) when tested in accordance with ASTM C 236, and a Condensation Resistance Factor of no less than 57 when tested in accordance with AAMA 1502.7.
- G. Finish:
1. Provide Class 1 anodized finish, 0.7 mil coating, in accordance with AAM 12C22 A42.
 2. Color to be selected by the Owner.

PART 3 - EXECUTION

3.01 EXAMINATION AND PREPARATION

- A. Verify that rough openings are correctly sized and located.
- B. Prepare opening to permit correct installation of frame and achieve continuity of air and vapor barrier seal.

3.02 INSTALLATION

- A. Install frames, glazing, hardware and flashings in accordance with manufacturer's instructions.
- B. Use anchorage devices to securely attach frames to structure.

ALUMINUM WINDOWS

- C. Align assembly plumb and level, free of warp or twist. Maintain assembly dimensional tolerances, aligning with adjacent work.
- D. Coordinate attachment and seal of air and vapor barrier materials. Pack fibrous insulation of shim spaces at perimeter of assembly to maintain continuity of thermal barrier.
- E. Install perimeter type sealant, backing materials, and installation requirements in accordance with manufacturer's instructions.

END OF SECTION

**SECTION 08710
FINISH HARDWARE**

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. Work included:

1. Furnish finish hardware required to complete the Work as shown on the Drawings and as specified herein.
2. Furnish trim attachments and fastenings, specified or otherwise required, for proper and complete installation.
3. Deliver to the job site those items of finish hardware scheduled to be installed at the job site.

1.02 SUBMITTALS

A. Submit for review, shop drawings showing the following:

1. Materials list of items proposed to be provided under this Section.
 - a. Approval of this list by the Engineer will not relieve the Contractor of the responsibility to provide all finish hardware items required for the Work, even though such required items may not have been shown on the approved list.

B. Templates: In a timely manner to assure orderly progress of the Work, deliver templates or physical samples of the approved finish hardware items to pertinent manufacturers of interfacing items such as doors and frames.

1.03 QUALITY ASSURANCE

A. Referenced hardware listed herein is from the following catalogs:

1. Locksets and cylinders - Corbin Russwin.
2. Butts - Stanley Works.
3. Thresholds and weather-stripping - Pemko.
4. Closers - Norton.
5. Overhead holders - Glynn Johnson.

FINISH HARDWARE

6. Surface bolts, flush bolts, door and wall stops, silencers, and kick, push and pull plates - H. B. Ives.
- B. Comparable hardware of other manufacturers will be acceptable, provided a complete list is submitted for approval by the Engineer.

1.04 WARRANTY

- A. The CONTRACTOR shall guarantee all materials and equipment furnished and WORK performed for a period of one year from the date of SUBSTANTIAL COMPLETION.

1.05 DELIVERY, STORAGE, HANDLING

- A. All equipment shall be crated to protect it against damage during shipment.
- B. All parts shall be properly protected so that no damage or deterioration will occur during a prolonged delay from time of shipment until unit installation is completed and the units and equipment are ready for operation.

PART 2 - PRODUCTS

2.01 GENERAL

- A. Fasteners:
 1. Furnish necessary screws, bolts, and other fasteners of suitable size and type to anchor the hardware in position for long life under hard use in accordance with the hardware manufacturer.
 - a. Anchor bolts to be Type 316 stainless steel.
 2. Provide fasteners which harmonize with the hardware as to finish and material.
 - a. Fasteners to be aluminum or stainless steel.

2.02 MASTER KEYING

- A. Provide all locks equipped with an interchangeable core, removable by the Owner's master (control) key.
- B. Master key all permanent (security) cores to the Owner's grand master keyed system as directed by the Owner.
- C. Cores to have a figure eight face and six-pin tumbler locking core.
- D. All locks shipped to the Contractor shall have temporary construction cores with two control keys and three master keys.

FINISH HARDWARE

- E. Upon completion of all items on final "punch list" and as final act in turning the project over to the Owner:
 - 1. In the presence of the Owner's representative, replace all temporary cores with the master keyed permanent cores.
 - 2. Provide Owner with no less than:
 - a. Four master keys.
 - b. Six keys for each different set of locks.

2.03 FINISH

- A. Unless otherwise indicated, all hardware shall have below finish:
US32D satin stainless steel

2.04 OTHER MATERIALS

- A. Provide other materials, not specifically described but required for a complete and proper installation, as selected by the Contractor subject to the approval of the Engineer.
- B. Provide adequate mounting hardware to install closure on interior of buildings.

PART 3 - EXECUTION

3.01 LOCATION

- A. Hardware on hinged doors shall be located as follows, unless otherwise indicated:
 - 1. Locks - Knobs shall be installed at the same height, approximately 37" above the finish floor, throughout the buildings.
 - 2. Hinges - Locate as follows:
 - a. Top Hinge: Not over 9-3/4" from the inside of frame rabbet at head to center of hinge.
 - b. Bottom Hinge: Not over 10-3/8" from finished floor to center of hinge.
 - c. Center Hinge: Midway between top and bottom hinges.

3.02 FINISH HARDWARE SCHEDULE

- A. Furnish the following hardware groups in the amounts indicated on the Drawings.
 - 1. Hardware Set #1 - (Double leaf doors, building entrance, opening to outside)

Each pair of doors to have:

FINISH HARDWARE

6 each Butts - FBB199 - 4-1/2 x 4-1/2 - US32D - NRP
2 each Flush Bolts - 458-B26D
1 each Closer - 7500SS - AL - SN (less arm) (Active Leaf)
1 each Closer Arm (w/stop/holder) 6870T-8 SRI x 689
1 each Lockset - ML 2024 - ASM - 630 CT6
1 each O.H. Holder - Series 79H-S3 (Inactive Leaf)
1 each Threshold - 181AS x Length Required
1 set Weatherstrip - 315CR x Length Required
1 each Astragal - 355CP x Length required (Active Leaf)
1 each Dummy Trim - ML2070-ASM 630

2. Hardware Set #2 - (Interior double leaf doors, any hand)

Each pair of doors to have:

6 each Butts - FBB199 - 4-1/2 x 4-1/2 - US32D
2 each Flush Bolts - 458-B26D
1 each Latch Set - ML 2024 - ASM - 630 CT6
2 each Silencers - 20
1 each Closer - 7500SS - AL-SN (less arm) (Active Leaf Only)
1 each Closer Arm (w/stop/holder) 6870T-8 SRI x 689
1 each O.H. Holder - Series 79H-S3 (Inactive Leaf)
1 each Dummy Trim - ML 2070-ASM 630

3. Hardware Set #3 - (Building entrance doors, opening to outside)

Each door to have:

3 each Butts - FBB199 - 4-1/2 x 4-1/2 - US32D - NRP
1 each Closer - 7500SS - AL - SN (less arm)
1 each Closer Arm (w/stop/holder) 6870T-8 SRI x 689
1 each Lockset - ML 2024 - ASM 630 CT6
1 each Threshold - 181AS x Length Required
1 set Weatherstrip - 315 CR x Length Required
1 each Floorstop w/Holder - 446 B26D
3 each Silencers - 20

4. Hardware Set #4 - (Coiling doors)

All hardware by door supplier.

END OF SECTION

**SECTION 09900
PAINTING**

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. This Section includes surface preparation and field painting of the following:
 - 1. Exposed exterior items and surfaces.
 - 2. Exposed interior items and surfaces.
 - 3. Surface preparation, priming, and finish coats specified in this Section are in addition to shop priming and surface treatment specified in other Sections.
- B. Paint exposed surfaces, except where the paint schedules indicate that a surface or material is not to be painted or is to remain natural. If the paint schedules do not specifically mention an item or a surface, paint the item or surface the same as similar adjacent materials or surfaces whether or not schedules indicate colors. If the schedules do not indicate color or finish, the Engineer or Owner will select from standard colors and finishes available.
 - 1. Painting includes field painting of exposed bare and covered pipes and ducts (including color coding), hangers, exposed steel and iron work, and primed metal surfaces of mechanical and electrical equipment.
- C. Do not paint prefinished items, concealed surfaces, finished metal surfaces, operating parts, and labels.
 - 1. Prefinished items include the following factory-finished components:
 - a. Finished mechanical and electrical equipment.
 - b. Light fixtures.
 - c. Distribution cabinets.
 - 2. Concealed surfaces include walls or ceilings in the following generally inaccessible spaces:
 - 3. Finished metal surfaces include the following:

- a. Anodized aluminum.
- 4. Operating parts include moving parts of operating equipment and the following:
 - a. Valve and damper operators.
 - b. Linkages.
 - c. Sensing devices.
 - d. Motor and fan shafts.
- 5. Labels: Do not paint over Underwriters Laboratories (UL), Factory Mutual (FM), or other code-required labels or equipment name, identification, performance rating, or nomenclature plates.
- D. Alternates: Refer to Division 1 Section "Alternates" for description of Work in this Section affected by alternates.

1.03 DEFINITIONS

- A. General: Standard Coating Terms defined in ASTM D 16 apply to this Section.
 - 1. Eggshell refers to low-sheen finish with a gloss range between 5 and 20 when measured at a 60-degree meter.
 - 2. Satin refers to low-sheen finish with a gloss range between 15 and 35 when measured at a 60-degree meter.
 - 3. Semigloss refers to medium-sheen finish with a gloss range between 30 and 65 when measured at a 60-degree meter.
 - 4. Full gloss refers to high-sheen finish with a gloss range more than 65 when measured at a 60-degree meter.

1.04 SUBMITTALS

- A. Product Data: For each paint system specified. Include block fillers and primers.
 - 1. Material List: Provide an inclusive list of required coating materials. Indicate each material and cross-reference specific coating, finish system, and application. Identify each material by manufacturer's catalog number and general classification.
 - 2. Manufacturer's Information: Provide manufacturer's technical information, including label analysis and instructions for handling, storing, and applying each coating material proposed for use.
- B. Samples for Verification: Of each color and material to be applied, with texture to simulate actual conditions, on representative Samples of the actual substrate.

1. Provide stepped Samples, defining each separate coat, including block fillers and primers. Use representative colors when preparing Samples for review. Resubmit until required sheen, color, and texture are achieved.
2. Provide a list of materials and applications for each coat of each sample. Label each sample for location and application.

1.05 QUALITY ASSURANCE

- A. Applicator Qualifications: Engage an experienced applicator who has completed painting system applications similar in material and extent to that indicated for this Project with a record of successful in-service performance.
- B. Source Limitations: Obtain block fillers, primers, and undercoat materials for each coating system from the same manufacturer as the finish coats.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to the Project Site in manufacturer's original, unopened packages and containers bearing manufacturer's name and label, and the following information:
 1. Product name or title of material.
 2. Product description (generic classification or binder type).
 3. Manufacturer's stock number and date of manufacture.
 4. Contents by volume, for pigment and vehicle constituents.
 5. Thinning instructions.
 6. Application instructions.
 7. Color name and number.
 8. VOC content.
- B. Store materials not in use in tightly covered containers in a well-ventilated area at a minimum ambient temperature of 45 deg F. Maintain containers used in storage in a clean condition, free of foreign materials and residue.
 1. Protect from freezing. Keep storage area neat and orderly. Remove oily rags and waste daily. Take necessary measures to ensure that workers and work areas are protected from fire and health hazards resulting from handling, mixing, and application.

1.07 PROJECT CONDITIONS

- A. Apply water-based paints only when the temperature of surfaces to be painted and surrounding air temperatures are between 50 and 90 deg F.
- B. Apply solvent-thinned paints only when the temperature of surfaces to be painted and surrounding air temperatures are between 45 and 95 deg F.
- C. Do not apply paint in snow, rain, fog, or mist; or when the relative humidity exceeds 85 percent; or at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.
 - 1. Painting may continue during inclement weather if surfaces and areas to be painted are enclosed and heated within temperature limits specified by manufacturer during application and drying periods.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Products: Subject to compliance with requirements, provide one of the products in the paint schedules.
- B. Manufacturers Names: The following manufacturers are referred to in the paint schedules by use of shortened versions of their names, which are shown in parentheses:
 - 1. Devoe & Raynolds Co. (Devoe).
 - 2. Fuller-O'Brien Paints (Fuller).
 - 3. Glidden Co. (The) (Glidden).
 - 4. Benjamin Moore & Co. (Moore).
 - 5. PPG Industries, Inc. (PPG).
 - 6. Pratt & Lambert, Inc. (P & L).
 - 7. Sherwin-Williams Co. (S-W).
 - 8. Induron Protective Coatings
- C. Pipe Labels:
 - 1. Manufacturers:

- a. W.H. Brady Co., Milwaukee, WI.
- b. Seton Nameplate Corp., New Haven, CT.

2.02 PAINT MATERIALS, GENERAL

- A. **Material Compatibility:** Provide block fillers, primers, undercoats, and finish-coat materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.
- B. **Material Quality:** Provide manufacturer's best-quality paint material of the various coating types specified. Paint-material containers not displaying manufacturer's product identification will not be acceptable.
 - 1. **Proprietary Names:** Use of manufacturer's proprietary product names to designate colors or materials is not intended to imply that products named are required to be used to the exclusion of equivalent products of other manufacturers. Furnish manufacturer's material data and certificates of performance for proposed substitutions.
- C. **Colors:** Provide custom colors of the finished paint as indicated on the Room Finish Schedule and Legend and the Piping Schedule in Section PIPING AND ACCESSORIES.

PART 3 EXECUTION

3.01 EXAMINATION

- A. **Examine substrates, areas, and conditions, with the Applicator present, under which painting will be performed for compliance with paint application requirements.**
 - 1. Do not begin to apply paint until unsatisfactory conditions have been corrected and surfaces receiving paint are thoroughly dry.
 - 2. Start of painting will be construed as the Applicator's acceptance of surfaces and conditions within a particular area.
- B. **Coordination of Work:** Review other Sections in which primers are provided to ensure compatibility of the total system for various substrates. On request, furnish information on characteristics of finish materials to ensure use of compatible primers.
 - 1. Notify the Engineer about anticipated problems using the materials specified over substrates primed by others.

3.02 PREPARATION

- A. General: Remove hardware and hardware accessories, plates, machined surfaces, lighting fixtures, and similar items already installed that are not to be painted. If removal is impractical or impossible because of the size or weight of the item, provide surface-applied protection before surface preparation and painting.
 - 1. After completing painting operations in each space or area, reinstall items removed using workers skilled in the trades involved.

- B. Cleaning: Before applying paint or other surface treatments, clean the substrates of substances that could impair the bond of the various coatings. Remove oil and grease before cleaning.
 - 1. Schedule cleaning and painting so dust and other contaminants from the cleaning process will not fall on wet, newly painted surfaces.

- C. Surface Preparation: Clean and prepare surfaces to be painted according to manufacturer's written instructions for each particular substrate condition and as specified.
 - 1. Provide barrier coats over incompatible primers or remove and reprime.
 - 2. Cementitious Materials: Prepare concrete, concrete masonry block, cement plaster, and mineral-fiber-reinforced cement panel surfaces to be painted. Remove efflorescence, chalk, dust, dirt, grease, oils, and release agents. Roughen as required to remove glaze. If hardeners or sealers have been used to improve curing, use mechanical methods of surface preparation.
 - a. Use abrasive blast-cleaning methods if recommended by paint manufacturer.
 - b. Determine alkalinity and moisture content of surfaces by performing appropriate tests. If surfaces are sufficiently alkaline to cause the finish paint to blister and burn, correct this condition before application. Do not paint surfaces where moisture content exceeds that permitted in manufacturer's written instructions.
 - 3. Wood: Clean surfaces of dirt, oil, and other foreign substances with scrapers, mineral spirits, and sandpaper, as required. Sand surfaces exposed to view smooth and dust off.
 - a. Scrape and clean small, dry, seasoned knots, and apply a thin coat of white shellac or other recommended knot sealer before applying primer. After priming, fill holes and imperfections in finish surfaces with putty or plastic wood filler. Sand smooth when dried.

PAINTING

- b. Prime, stain, or seal wood to be painted immediately on delivery. Prime edges, ends, faces, undersides, and backsides of wood, including cabinets, counters, cases, and paneling.
 - c. Backprime paneling on interior partitions where masonry, plaster, or other wet wall construction occurs on backside.
 - d. Seal tops, bottoms, and cutouts of unprimed wood doors with a heavy coat of varnish or sealer immediately on delivery.
4. Ferrous Metals: Clean ungalvanized ferrous-metal surfaces that have not been shop coated; remove oil, grease, dirt, loose mill scale, and other foreign substances. Use solvent or mechanical cleaning methods that comply with the Steel Structures Painting Council's (SSPC) recommendations.
 - a. Touch up bare areas and shop-applied prime coats that have been damaged. Wire-brush, clean with solvents recommended by paint manufacturer, and touch up with the same primer as the shop coat.
 5. Galvanized Surfaces: Clean galvanized surfaces with nonpetroleum-based solvents so surface is free of oil and surface contaminants. Remove pretreatment from galvanized sheet metal fabricated from coil stock by mechanical methods.
- D. Materials Preparation: Mix and prepare paint materials according to manufacturer's written instructions.
1. Maintain containers used in mixing and applying paint in a clean condition, free of foreign materials and residue.
 2. Stir material before application to produce a mixture of uniform density. Stir as required during application. Do not stir surface film into material. If necessary, remove surface film and strain material before using.
 3. Use only thinners approved by paint manufacturer and only within recommended limits.

3.03 APPLICATION

- A. General: Apply paint according to manufacturer's written instructions. Use applicators and techniques best suited for substrate and type of material being applied.
1. Paint colors, surface treatments, and finishes are indicated in the schedules.

PAINTING

2. Do not paint over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions detrimental to formation of a durable paint film.
 3. Provide finish coats that are compatible with primers used.
 4. The term "exposed surfaces" includes areas visible when permanent or built-in fixtures, convector covers, covers for finned-tube radiation, grilles, and similar components are in place. Extend coatings in these areas, as required, to maintain the system integrity and provide desired protection.
 5. Paint surfaces behind movable equipment and furniture the same as similar exposed surfaces. Before the final installation of equipment, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
 6. Paint interior surfaces of ducts with a flat, nonspecular black paint where visible through registers or grilles.
 7. Paint back sides of access panels and removable or hinged covers to match exposed surfaces.
 8. Finish exterior doors on tops, bottoms, and side edges the same as exterior faces.
 9. Finish interior of wall and base cabinets and similar field-finished casework to match exterior.
 10. Sand lightly between each succeeding enamel or varnish coat.
- B. Scheduling Painting: Apply first coat to surfaces that have been cleaned, pretreated, or otherwise prepared for painting as soon as practicable after preparation and before subsequent surface deterioration.
1. The number of coats and the film thickness required are the same regardless of application method. Do not apply succeeding coats until the previous coat has cured as recommended by the manufacturer. If sanding is required to produce a smooth, even surface according to manufacturer's written instructions, sand between applications.
 2. Omit primer on metal surfaces that have been shop primed and touchup painted.
 3. If undercoats, stains, or other conditions show through final coat of paint, apply additional coats until paint film is of uniform finish, color, and appearance. Give special attention to ensure edges, corners, crevices, welds, and exposed fasteners receive a dry film thickness equivalent to that of flat surfaces.

PAINTING

4. Allow sufficient time between successive coats to permit proper drying. Do not recoat surfaces until paint has dried to where it feels firm, does not deform or feel sticky under moderate thumb pressure, and where application of another coat of paint does not cause the undercoat to lift or lose adhesion.
- C. Application Procedures: Apply paints and coatings by brush, roller, spray, or other applicators according to manufacturer's written instructions.
1. Brushes: Use brushes best suited for the type of material applied. Use brush of appropriate size for the surface or item being painted.
 2. Rollers: Use rollers of carpet, velvet back, or high-pile sheep's wool as recommended by the manufacturer for the material and texture required.
 3. Spray Equipment: Use airless spray equipment with orifice size as recommended by the manufacturer for the material and texture required.
- D. Minimum Coating Thickness: Apply paint materials no thinner than manufacturer's recommended spreading rate. Provide the total dry film thickness of the entire system as recommended by the manufacturer.
- E. Mechanical and Electrical Work: Painting of mechanical and electrical work is limited to items exposed in equipment rooms and in occupied spaces.
- F. Mechanical items to be painted include, excluding PVC, stainless steel or aluminum, the following:
1. Piping, pipe hangers, and supports.
 2. Heat Exchangers
 3. Tanks
 4. Ductwork
 5. Insulation
 6. Motors and mechanical equipment.
 7. Accessory items.
- G. Electrical items to be painted include, excluding PVC, stainless steel or Aluminum, the following:
1. Conduit and fittings.
 2. Switchgear.

3. Panelboards.
- H. Prime Coats: Before applying finish coats, apply a prime coat of material, as recommended by the manufacturer, to material that is required to be painted or finished and that has not been prime coated by others. Recoat primed and sealed surfaces where evidence of suction spots or unsealed areas in first coat appears, to ensure a finish coat with no burn through or other defects due to insufficient sealing.
- I. Pigmented (Opaque) Finishes: Completely cover surfaces as necessary to provide a smooth, opaque surface of uniform finish, color, appearance, and coverage. Cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections will not be acceptable.
- J. Stipple Enamel Finish: Roll and redistribute paint to an even and fine texture. Leave no evidence of rolling, such as laps, irregularity in texture, skid marks, or other surface imperfections.
- K. Completed Work: Match approved samples for color, texture, and coverage. Remove, refinish, or repaint work not complying with requirements.
- L. Pipe Identification Painting:
1. Color code nonsubmerged metal and plastic piping except electrical conduit. Paint fittings and valves the same color as pipe.
 2. Piping Color Coding: Suggested colors are shown on the Piping Schedule. The Owner shall make final color selections. Provide colors selected by the Owner at no additional cost.

Water Lines

Raw	Olive Green
Settled or clarified	Aqua
Finished or potable	Dark Blue
Non-potable or reclaimed	Safety Red

Chemical Lines

Alum or primary coagulant	Orange
Chlorine (gas and solution)	Yellow
Fluoride	Light blue with red band
Lime slurry	Light green
Polymers or coagulant aids	Orange with green band

Waste Lines

Backwash waste	Light brown
Sewer (sanitary or other)	Dark gray

Drains Black

Other

Other lines Light gray

- 3. On exposed stainless-steel piping, identification labels applied to each exposed run of pipe as specified herein.
- 4. Pipe Supports: Pipe supports shall be painted the same color as the piping they support.

M. Piping Labels:

- 1. Identification labels shall bear full piping system name as specified in the Piping Schedule above.
- 2. Install separate flow directional arrows with each label.
- 3. Include black lettering on OSHA safety yellow self-adhesive vinyl or vinyl cloth.
- 4. Lettering Height: Meet ANSI A13.1.
- 5. Label and Adhesive: Long lasting, resistant to moisture, oils, solvents, and weathering, meeting OSHA requirements.
- 6. Locate labels at connections to equipment, valves, or branch fittings, at wall boundaries, and at intervals along piping not greater than 18 feet on center, with at least one label applied to each exposed run of pipe.

3.04 FIELD QUALITY CONTROL

- A. Apply coatings in accordance with manufacturer's printed data sheets. Allow sufficient time between coats to insure complete curing of previously applied coatings.
- B. Dry Film Thickness Testing:
 - 1. Check each coat for correct millage. Do not take DFT measurements until coatings have cured a minimum of eight (8) hours.
 - 2. After repaired and recoated areas have cured sufficiently, final tests will be conducted by the Engineer, measuring coating thickness, as specified in mils, with a magnetic type dry film thickness gauge as specified per SSPC-PA2. The Contractor shall furnish the gauge.

PAINTING

3. Test finish coats (except zinc primers, galvanized, and elastomeric coatings in excess of 25.0 mils MDFT), for holidays and discontinuities using a low voltage, wet sponge holiday detector (Tinker & Rasor M-1 or equal) per manufacturer's instructions. Contractor shall furnish the holiday detector.
4. Testing of finish coats in excess of 25.0 mils MDFT, where required, shall be done using a high voltage holiday detector (Tinker & Rasor Model AP or equal) per manufacturer's instructions. Contractor shall furnish the holiday detector.

C. Damaged Coatings, Pinholes, and Holidays:

1. Feather edges and repair in accordance with manufacturer's recommendations.
2. Repair fusion bonded coatings as recommended by original applicator. Applicator shall provide liquid repair kits for this purpose as recommended by coating manufacturer.
3. Apply finish coats, including touch-up and damage-repair coats, in a manner which will present a uniform texture and color-matched appearance.

D. Unsatisfactory Application:

1. If an item has improper finish color or insufficient film thickness, clean and recoat the surface with specified paint material to obtain specified color and coverage. Obtain specific preparation information from coating manufacturer.
2. Hand or power sand visible areas of chipped, peeled, or abraded paint, and feather the edges. Follow with primer and finish coat in accordance with the specifications. Depending on extent of repair, finish sanding and additional coats may be required.
3. Evidence of runs, drips, sags, dry-spray, lap marks, blisters, or other imperfections shall be cause for rejection.
4. Repair defects in coating system per written recommendations of coating manufacturer.
5. Leave all staging up until the Engineer has inspected the surface or coating.
6. Replace staging removed prior to approval of the Engineer.

3.05 CLEANING

- A. Cleanup: At the end of each workday, remove empty cans, rags, rubbish, and other discarded paint materials from the site.
 - 1. After completing painting, clean glass and paint-spattered surfaces. Remove spattered paint by washing and scraping. Be careful not to scratch or damage adjacent finished surfaces.

3.06 PROTECTION

- A. Protect work of other trades, whether being painted or not, against damage by painting. Correct damage by cleaning, repairing or replacing, and repainting, as approved by Architect.
- B. Provide "Wet Paint" signs to protect newly painted finishes. Remove temporary protective wrappings provided by others to protect their work after completing painting operations.
 - 1. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces. Comply with procedures specified in PDCA P1.

3.07 EXTERIOR PAINT SCHEDULE

- A. Ferrous Metal: Provide the following finish systems over exterior ferrous metal. Primer is not required on shop-primed items.
 - 1. Deep-Color, Full-Gloss, Alkyd-Enamel Finish: 2 finish coats over a rust-inhibitive primer.
 - a. Surface Preparation: SP-6.
 - b. Primer: Rust-inhibitive metal primer applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.4 mils.
 - 1) Tnemec: Series 66 Epoxy Primer.
 - 2) S-W: Kem Kromik Universal Primer B50Z Series 3.0 mils DFT.
 - 3) Induron Armorlux Primer, Red @ 1.5 - 2.5 mils DFT
 - c. First and Second Coats: Deep-color, full-gloss, exterior, alkyd enamel or polyurethane applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 2.0 - 3.0 mils per coat.
 - 1) Tnemec Series 74/75 Polyurethane.
 - 2) S-W: SWP Exterior Gloss Paint A-2 Series.
 - 3) Induron Armorlux 2200 Enamel

B. Concrete and concrete masonry unit walls:

1. Surface Preparation: SSPC-SP13/NACE Surface Preparation of Concrete. Surface to be clean, dry and cured for a minimum of 28-days.
2. System: Tnemec

1 st Coat:	Tnemec Series 156 Enviro-Crete at 4.0-6.0 dry mils
2 nd Coat:	Tnemec Series 156 Enviro-Crete at 4.0-6.0 dry mils

- a. Total dry film thickness shall be 8.0 dry mills minimum per SSPC dry film thickness measuring standards.

3. System: Sherwin Williams

1 st Coat:	Sherwin Willaims Loxon XP at 7 dry mils
2 nd Coat:	Sherwin Willaims Loxon XP at 7 dry mils

- a. Total dry film thickness shall be 12.0-16.0 dry mills minimum per SSPC dry film thickness measuring standards.

3.08 INTERIOR PAINT SCHEDULE

A. Concrete and Concrete Masonry Units: Provide the following paint systems:

1. Low Luster Water or Solvent Based Catalyzed Epoxy Finish: 2 finish coats over a primer.
 - a. Primer: interior primer as recommended by manufacturer for specified finish coat applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 3.0 mil.
 - 1) Tnemec Series 163.
 - 2) S-W: Preparite Masonry Primer A28 W300 or as recommended by manufacturer for specified finish coat or approved equal.
 - b. First and Second Coats: Low-luster (eggshell or satin), Water or Solvent Based Catalyzed Epoxy applied at spreading rate recommended by the manufacturer to achieve a dry film thickness of not less than 3.0 mils per coat.
 - 1) Tnemec Series 163.
 - 2) S-W: Water Based Catalyzed Epoxy or approved equal with ASTM D4585 test for at least 3000 hours.

B. Ferrous Metal: Provide the following finish systems over ferrous metal:

1. Semigloss, Acrylic-Enamel Finish: One finish coat over an enamel undercoater and a primer.
 - a. Surface Preparation: SP-6.
 - b. Primer: Quick-drying, rust-inhibitive, alkyd-based or epoxy-metal primer, as recommended by the manufacturer for this substrate, applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 2.0 mils.
 - 1) Tnemec Series N-27 @ 4.0-6.0 mils.
 - 2) Glidden: 5207 Glid-Guard Tank & Structural Primer, White.
 - 3) Induron Armorlux Primer @ 2.0 - 2.5 mils DFT
 - 4) S-W: Kem Kromik Universal, B50Z Series.
 - c. Undercoat: Alkyd, interior enamel undercoat or semigloss, acrylic-latex, interior enamel, as recommended by the manufacturer for this substrate, applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 2.0 mils.
 - 1) Glidden: 8200 Series Spred Ultra Latex Semi-Gloss Enamel.
 - 2) Induron AC 240 Acrylic Semi-Gloss @ 2.0 - 2.5 mils DFT
 - 3) S-W: Promar 200 Latex Semi Gloss, B20 W200 series.
 - d. Finish Coat: Semigloss, acrylic-latex, interior enamel applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 4.0 mils.
 - 1) Tnemec Series 163.
 - 2) Glidden: 8200 Series Spred Ultra Latex Semi-Gloss Enamel.
 - 3) Induron AC 240 Acrylic Semi-Gloss @ 4.0 mils DFT
 - 4) S-W: Promar 200 Latex Semi-Gloss, B31 W200 Series
- C. Concrete Sealer: Provide the following finish system over concrete and masonry to be sealed:
 1. Clear or pigmented acrylic sealer.
 - a. Surface Preparation: Brushoff blast and/or acid etching.
 - b. Coverage: As recommended by manufacturer.

3.09 OTHER COATINGS

- A. Submerged Metal (including metal surfaces within one (1) foot of a water level).
 1. Surface Preparation: SP-10.
 2. Stripe Coat: Tnemec Series 140 Pota-Pox Plus, 2.0 mils DFT (at all weld seams).

PAINING

3. Primer: Tnemec Series 140 Pota-Pox Plus, 3.0-5.0 mils DFT.
4. Topcoat: Tnemec Series 140 Pota-Pox Plus, 4.0-6.0 mils DFT.

END OF SECTION

**SECTION 10400
IDENTIFYING DEVICES**

PART 1 - GENERAL

1.01 DESCRIPTION

- A. Work included: Provide identifying devices as specified herein, and as needed for a complete and proper installation including, but not necessarily limited to:
 - 1. Door signs.
 - 2. OSHA signs.
 - 3. Fire extinguisher markers.
 - 4. Chemical information signs.
 - 5. Equipment identification.

1.02 SUBMITTALS

- A. Comply with pertinent provisions of Division I specification sections.
- B. Product data:
 - 1. Materials list of items proposed to be provided under this Section.
 - 2. Manufacturer's specifications and other data needed to prove compliance with the specified requirements.
 - 3. Details of installation and anchorage sufficient to enable proper interface of the work of this Section with the work of other trades.
 - 4. Manufacturer's recommended installation procedures which, when approved by the Engineer, will become the basis for accepting or rejecting actual installation procedures used on the Work.
 - 5. Sign location and designation schedule.

PART 2 - PRODUCTS

2.01 APPROVED MANUFACTURERS

- A. Design is based on use of standard products manufactured by Seton Name Plate Company of New Haven, CT and is named to establish standards of quality.

- B. Provide all products of this Section from a single manufacturer.

2.02 DOOR SIGNS

- A. Room name signs:

1. Provide plastic laminate signs with message engraved through the first layer to expose the contrasting color of the inner core.
 - a. Outdoor "Setonflex".
 - b. Indoor - "Setonite".
2. Provide beveled edges.
3. Mounting: Use double-sided 1/32" thick vinyl tape or silastic adhesive.
4. Message: Contractor to prepare door schedule for Engineer approval.
5. Size: 2"H by length required, by 1/8".
6. Background color: To be selected by the Engineer from manufacturer's standard colors.
7. Lettering to be white.
8. Type style: "Normal Gothic", 1" high, all caps.

- B. Hazardous area signs:

1. Provide danger signs on doors and all areas containing materials or equipment indicated in the sign schedule in Paragraph 2.3 below.
2. Provide 10" x 7" sign.
3. Sign material:
 - a. Provide 60 mil. thick press polished high performance vinyl plastic.
 - b. Provide sunlight fade resistance.
 - c. Overcoat with Tedlar.
4. Provide rounded corners.
5. Mount with stainless steel screws.

- C. Exit signs:

1. Provide on the inside face of exterior doors.
2. Provide 10" x 7" sign with red letters on white background.

IDENTIFYING DEVICES

3. Comply with OSHA regulations.
4. Material - Pressure sensitive vinyl.

2.03 DANGER SIGNS

- A. Provide danger signs as specified herein.
- B. Sign material:
 1. Provide 60 mil. thick press polished high-performance vinyl plastic.
 2. Provide sunlight fade resistance.
 3. Overcoat with Tedlar.
- C. Provide 14" x 10" sign.
- D. Main heading to read: "DANGER", white letters on red background with black border. Subtitle to have black letters on white background.
- E. Comply with OSHA standards.
- F. Provide rounded corners.
- G. Mount with stainless steel screws.
- H. Danger sign schedule:

AREA	SIGN SUBTITLE	NO. SIGNS PER AREA
Electrical Room or Electrical panels	High Voltage	1
Equipment that starts Automatically	This Machine Starts Automatically	1
Chemical Rooms or Storage Areas	Caution Hazardous Chemicals	1
Confined Space	Confined Space Do Not Enter Without a Permit	1

2.04 CAUTION SIGNS

- A. Provide caution signs where specified herein.
- B. Sign material:
 1. Provide 60 mil. thick press polished high-performance vinyl plastic.

IDENTIFYING DEVICES

2. Provide sunlight fade resistance.
 3. Overcoat with Tedlar.
- C. Provide 14" x 10" sign unless otherwise designated.
- D. Main heading to read: "CAUTION", yellow letters on black background with yellow border. Subtitle to have black letters on yellow background.
- E. Comply with OSHA standards.
- F. Provide rounded corners.
- G. Mount with stainless steel screws.
- H. Caution sign schedule:

AREA	SIGN SUBTITLE	NO. SIGNS PER AREA
Non-Potable Water Sources	Do Not Drink This Water	1
Tank Sample Station	Sample Lines	1

2.05 FIRE EXTINGUISHER SIGNS

- A. Provide at each fire extinguisher one flanged, double-faced graphic marker.
- B. Size - 4" x 12".
- C. Material - Rigid vinyl, .030" thick.
- D. Mounting - Foam tape and stainless-steel screws.

2.06 EQUIPMENT IDENTIFICATION

- A. Provide for equipment listed below:
 1. Headworks.
 2. Aerators.
 3. Clarifiers.
 4. Chemical pumps and discharge.
 5. RAS pumps.
 6. All other major equipment components.

IDENTIFYING DEVICES

- B. Designate equipment name and equipment number.
- C. Sign size - 1" x length required with 1/4" lettering.
- D. Sign material - Plastic laminate, outdoor grade, black background with white lettering.
- E. Provide for both adhesive and screw mounting.
- F. Provide rounded corners.
- G. Mount with stainless steel screws.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install the work of this Section in strict accordance with the manufacturer's recommendations, using only the approved mounting materials, and locating all components firmly into position, level and plumb.
- B. Locate where directed by the Engineer.
- C. Mounting hardware to be stainless steel.
- D. Where adequate sign supports are not available, fabricate sign stand using unistrut channel and fittings.

END OF SECTION

**SECTION 10445
PIPING IDENTIFICATION SYSTEMS**

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Provide piping identification systems as specified herein, and as needed for a proper and complete installation for the following piping systems:
 - 1. Process piping.
 - 2. Potable water piping.
 - 3. Chemical piping.
 - 4. Valves.
 - 5. Gates.

1.2 QUALITY ASSURANCE

- A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

1.3 SUBMITTALS

- a. Product data: Within 60 calendar days after the Contractor has received the Owner's Notice to Proceed, submit:
 - 1. Materials list of items proposed to be provided under this Section.
 - 2. Manufacturer's specifications and other data needed to prove compliance with the specified requirements.
 - 3. Valve tag designation schedule and color schedule.
 - 4. Valve and gate marker designation schedule.

PART 2 - PRODUCTS

2.1 PIPE MARKERS

PIPING IDENTIFYING DEVICES

- A. All pipe markers shall conform to ANSI/OSHA pipe marking specifications.
- B. Each marker must show:
 - 1. Approved color coded background.
 - 2. Proper color of legend in relation to background color.
 - 3. Approved legend letter size.
 - 4. Approved marker length.
- C. Provide direction of flow arrows at each pipe marker.
- D. Provide wrap-around snap on type for piping 5" and smaller.
 - 1. Provide "Setmark" pipe markers as manufactured by Seton Name Plate Corporation, New Haven, CN or approved equal.
- E. Use pressure sensitive, adhesive backed, vinyl markers for piping 6" and larger.
 - 1. Provide "Opti-Code" pipe markers as manufactured by Seton Name Plate Corporation, New Haven, CN or approved equal.
- F. Working/Color Combinations:
 - 1. Provide markers in the required number for the following services:

LEGEND WORDING	MARKE R COLOR	LEGEND WORDING	MARKE R COLOR
Acid	Y	Primary Effluent	G
Air - Caution Hot	BL	Primary Sludge	G
Alum	Y	Propane Gas	Y
Ammonia	Y	Raw Sewage	G
Caustic	Y	Raw Water	G
Chlorine	Y	Recir. Sludge	G
Cold Water	G	Roof Drain	G
Drain	G	Sanitary Sewer	G
Electrolyte	W	Scum	G
Filtered Water	G	Storm Sewer	G
Filtrate	BR	Sulfur Dioxide (gas and solution)	O
Grit and Screenings	G	Thickened Sludge	BR

PIPING IDENTIFYING DEVICES

Hot Water	Y	Treated Water	G
Lime	B	Vacuum	Y
Non-Potable Water	G	Waste Activated Sludge	BR
Polymer	W	Wastewater	G
Potable Water	G		

2. Provide ANSI standard for other piping.

G. Pump piping:

1. Provide one each of the following markers at each pump. Locate at the piping connection to the pump.

LEGEND WORDING	MARKER COLOR
Suction	Y
Discharge	GW

2.2 VALVE IDENTIFICATION TAGS

- A. Provide an identification tag for each exposed valve, or buried valve with exposed actuator.
- B. Provide anodized aluminum tag, .032" thick, 2" diameter with 3/16" top hole.
- C. Engrave one side.
- D. Provide color to match material for valve service from schedule in 2.1 above.
- E. Include the following information on each valve:
 - 1. Valve number.
 - 2. Contents
 - 3. Normal position
 - a. "Normally Open" or "Normally Closed"
- F. Attach to valve with stainless steel "S" hook and No. 16 stainless steel jack chain.

PART 3 - EXECUTION

3.1 LOCATION FOR MARKERS

PIPING IDENTIFYING DEVICES

- A. Adjacent to each valve and fitting.
- B. At each branch and riser take-off.
- C. At each pipe passage through wall, floor or ceiling.
- D. At each pipe passage to underground.
- E. On all horizontal pipe runs, mark every thirty (30') feet.

3.2 PIPE MARKER INSTALLATION

- A. Clean pipe surface and apply markers in accordance with manufacturer's instructions.
- B. When applied to insulated or siliconed surfaces:
 - 1. Use pressure sensitive bonding type around both ends of the marker, being sure to overlap the tape onto itself.

3.3 VALVE AND GATE MARKER INSTALLATION

- A. Cast in concrete adjacent to valve or valve box cover or countersink into existing concrete.
- B. Utilize manufacturer's approved anchoring cement for all markers installed in existing concrete.
- C. Install top flush with concrete with no edges of marker exposed.

3.4 INSPECTION

- A. Correct defects and/or deficiencies to satisfaction of the Engineer.

END OF SECTION

**SECTION 10520
FIRE EXTINGUISHERS AND CABINETS**

PART 1 - GENERAL

1.01 SCOPE OF WORK

- A. Provide fire extinguishers and cabinets in the RAS Pump Station and new electrical room in the existing Control Building, as specified herein, and as needed for a complete and proper installation.

1.02 QUALITY ASSURANCE

- A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

1.03 SUBMITTALS

- A. Product data:
 - 1. Materials list of items proposed to be provided under this Section.
 - 2. Manufacturer's specifications and other data needed to prove compliance with the specified requirements.
 - 3. Dimensioned drawings as needed to depict the space required for these items, and their interface with the work of other trades.
 - 4. Manufacturer's recommended installation procedures which, when approved by the Engineer will become the basis for accepting or rejecting actual installation procedures used on the Work.

PART 2 - PRODUCTS

2.01 CABINETS

- A. Where shown on the Drawings, provide J.L. Industries, Norris Industries or W.D. Allen Manufacturing Co. factory prefinished steel cabinets, or equal products of other manufacturers.
 - 1. Tubs shall be 18-gauge epoxy coated steel.

FIRE EXTINGUISHERS & CABINETS

2. Semi-recessed units, 12"W x 27"H x 8"D, projecting 2-1/2", clear anodized aluminum trim and full glass door, double strength glazing and Futra "FIRE" handle.
3. Surface mounted cabinets, same as above except 14-1/2"W x 29-1/2"H by 8"D.
 - a. Provide surface mounted cabinets in existing structures.

2.02 FIRE EXTINGUISHERS

- A. At each fire extinguisher cabinet, provide one 10 pound, multi purpose chemical fire extinguishers with UL rating of 20A-80BC, J.L. Industries Model Cosmic 20E, or equal.
- B. Service, charge, and tag each fire extinguisher not more than five calendar days prior to the Date of Substantial Completion of the work as that date is established by the Engineer.

PART 3 - EXECUTION

3.01 SURFACE CONDITIONS

- A. Examine the areas and conditions under which work of this section will be performed. Correct conditions detrimental to timely and proper completion of the Work. Do not proceed until unsatisfactory conditions are corrected.

3.02 INSTALLATION

- A. Coordinate as required with other trades to assure proper and adequate provision in the work of those trades for interface with the work of this Section.
- B. Install the work of this Section in strict accordance with the original design, the approved Shop Drawings, pertinent requirements of governmental agencies having jurisdiction, and the manufacturer's recommended installation procedures as approved by the Engineer, anchoring all components firmly into position for long life under hard use.

END OF SECTION

**SECTION 10539
ALUMINUM MAN DOOR CANOPY**

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Provide and erect prefabricated, roll formed aluminum overhead hanger rod style canopy as indicated on the Drawings, as specified herein, and as needed for a complete and proper installation.

1.2 QUALITY ASSURANCE

- A. Referenced manufacturer is Mapes Industries, Inc. and is named to establish standards of quality. Approved equal products of other manufacturers may be provided upon approval by the Engineer.
- B. Installed unit shall conform to building code requirements of governmental agencies having jurisdiction.

1.3 SUBMITTALS

- A. Comply with pertinent provisions of Division I specification sections.
- B. Submit for review, shop drawings showing the following:
 - 1. Materials list of items proposed to be provided under this Section.
 - 2. Manufacturer's specifications and other data needed to prove compliance with the specified requirements.
 - 3. Shop drawings in sufficient detail to show fabrication, installation, anchorage, and interface of the work of this Section with the work of adjacent trades.
 - 4. Flashing connection details.
 - 5. Provide engineering prints and design calculations to show compliance with specified loading requirements.
 - 6. Manufacturer's recommended installation procedures which, when approved by the Engineer, will become the basis for accepting or rejecting actual installation procedures used on the Work.

1.4 PRODUCT HANDLING

- A. Provide additional protection as needed to assure that the work of this Section remains undamaged during fabrication, erection, and the time between completion of installation and actual acceptance of the total work.

PART 2 - PRODUCTS

2.1 ALUMINUM CANOPY

- A. Design:
 - 1. Provide canopy designed to withstand snowdrift, hurricane and seismic forces in accordance with the 2012 International Building Code.
 - 2. Concealed drainage: Drain water from covered surfaces into intermediate trough and directed to either the front for front drainage or to the rear gutter for ground level discharge via one or more designated downspouts.
- B. Roof panel:
 - 1. Decking: Interlocking roll-formed 2-1/2" "W" style pan.
 - 2. Intermediate frame members: Extruded aluminum, alloy 6063 T6 angle profile and thickness to meet design requirements.
 - 3. Rigidly fasten interlocking joints with stainless steel fastenings.
 - a. May be self-riveted by upsetting the metal or by screws or rivets.
 - b. Minimum shear strength of 350 lbs. each.
 - 4. Hanger rods and attachment hardware: Galvanized.
- C. Fascia:
 - 1. Fascia: 8" extruded "J" style, minimum .078" aluminum.
- D. Finish:
 - 1. Two coat Kynar.
 - 2. Color to be selected by the Owner.
- E. Component accessories: Roof and column brackets, flashing, etc., to be of same materials and finishes as prime components.
- F. Hardware: All bolts, nuts, washers, etc., regardless of size, shall be stainless steel.

2.2 OTHER MATERIALS

- A. Provide other materials, not specifically described but required for a complete and proper installation, as selected by the Contractor subject to the approval of the Engineer.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Perform erection by the manufacturer or his approved installer and schedule after all concrete, masonry and roofing work in the vicinity is complete and cleaned.
- B. Properly caulk with caulking as per Section 07920 of these specifications where needed and indicated on erection drawings.
- C. Install all thru-bolts at wall supported edges as required and provided by the manufacturer.

END OF SECTION

SECTION 11220
SUBMERSIBLE SEWAGE PUMPS

PART 1 GENERAL

1.01 WORK INCLUDED

A. Section Includes:

1. Scum Pump Station: Provide submersible sewage pumps for duplex sewage lift station, including, but not necessarily limited to, two (2) submersible sewage pumps. The pumps will be installed on existing pump bases and guide rails.

1.02 SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
- B. Wiring Diagrams: For power, signal, and control wiring.
- C. Operation and Maintenance Data: For pumps and controls, to include in operation and maintenance manuals.

1.03 QUALITY ASSURANCE

- A. Manufacturer: Each type of pump shall be provided by the same manufacturer for standardization of equipment to the greatest extent possible.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. UL Compliance: Comply with UL 778 for motor-operated water pumps.
- D. Provide pumps with a design point for flow and head that meets ANSI/HI 14.6 Acceptance Grade 2U.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Retain shipping flange protective covers and protective coatings during storage.
- B. Protect bearings and couplings against damage.
- C. Comply with pump manufacturer's written rigging instructions for handling.

SUBMERSIBLE SEWAGE PUMPS

1.05 COORDINATION

- A. Coordinate sizes and locations of concrete bases with actual equipment provided.

PART 2 PRODUCTS

2.01 SUBMERSIBLE SEWAGE PUMPS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include the following:

- 1. Fairbanks Morse.

- B. Capacities and Characteristics:

- 1. Unit Identification: Scum Pump Station

- a. Number of Pumps: Two (2)

- b. Service: Scum

- c. Each Pump:

- 1) Operating Point

- a) Design Capacity 145 gpm.

- b) Design Total Dynamic Head: 30 feet.

- c) Minimum Efficiency: 86%

- 2) Shutoff Head: 185 feet.

- 3) Maximum Speed: 1200 rpm.

- 4) Solids Handling Capability: 3 inches

- 5) Maximum Motor Horsepower: 5

- 6) Electrical Characteristics:

- a) Volts: 460.

- b) Phases: Three.

- c) Hertz: 60.

- d) Class I, Division 1, Groups C & D, FM Approved.

- C. Pumping equipment shall be premium quality submersible non-clog pumps for sewage service. Wet-pit pumps shall be complete with a submersible electric motor, motor electrical cable (minimum forty (40) feet in length) to connect at the demarcation box (no splicing allowed) and all other appurtenances specified or otherwise required for proper operation.

- D. Pump performance shall be stable and free from cavitations and noise throughout the specified operating head range at minimum suction submergence. Pump shall be designed so that reverse rotation at rated head will not cause damage to any component.

SUBMERSIBLE SEWAGE PUMPS

- E. Major pump components shall be of gray cast iron. All exposed nuts, bolts, washers, anchor bolts and other fastening devices coming in contact with sewage shall be 316 Stainless Steel.
- F. The impeller casing shall have well-rounded water passages and smooth interior surfaces free from cracks, porosity, blowholes, or other irregularities.
 - 1. The impeller shall be semi-open or enclosed one-piece casting with no more than two non-clog passages and must pass a minimum three (3) inch solid.
 - 2. The interior water passages shall have uniform sections and smooth surfaces and shall be free from cracks and porosity.
 - 3. The impeller shall be dynamically balanced and securely locked to the shaft.
 - 4. All interior water passages and impeller shall be coated with an approved epoxy coating to increase efficiency and resist wear.
- G. Pumps shall have mechanical seals, which shall require neither maintenance nor adjustment and shall be readily accessible for inspection and replacement. The seals shall not rely upon the pumped media for lubrication and shall not be damaged if the pump is run un-submerged for extended periods while pumping under load.
 - 1. Mechanical seals shall be solid hard faced, (not laminated type).
 - 2. The bottom seal shall be tungsten carbide or silicon carbide material.
 - 3. The top seal may be carbon-ceramic, tungsten carbide or silicon carbide material.
 - 4. Replaceable or adjustable wear rings shall be provided for all pumps.
- H. All mating surfaces (pump assembly), of major components shall be machined and fitted with o-rings where watertight sealing is required.
 - 1. Pump mating surface shall match existing to accommodate existing pump base. Field verify prior to ordering pumps.
- I. The pump shall be driven by a totally submersible electric motor.
 - 1. Pump motor shall be of sufficient horsepower as to be non-overloading over the entire length of the pump curve.
 - 2. The stator housing shall be a watertight casing.

SUBMERSIBLE SEWAGE PUMPS

3. Motor insulation shall be moisture resistant, Class F, 155 degree C. at a minimum.
 4. Where indicated for use with VFD's, the motor shall be rated for inverter-duty.
 5. Motor shall be NEMA Design B for continuous duty at 40 degree C ambient temperature and designed for at least 10 starts per hour.
 6. All motors shall be 3 phase.
 7. Cooling:
 - a. Provide an adequately designed cooling jacket.
 - b. Water jacket to encircle the stator housing.
 - c. Provide jacket with a separate circulation of pumped liquid.
 - d. Provide non-clogging cooling media channels and supports.
 - e. Provide provisions for a separate, clear, external motor cooling and lower seal flushing.
- L. Motor bearings shall be anti-friction, permanently lubricated type. Motor shall be designed to operate in a totally, partially or non-submerged condition without damage to the motor.
1. Pump cable assembly shall bear a permanently embossed code or legend indicating the cable is suitable for submerged use.
 2. Cable sizing shall conform to NEC requirements.
 3. The cable shall enter the pump(s) through a heavy-duty stainless steel assembly with grommet. The system used shall ensure a water tight submersible seal.
 4. Cable shall terminate in a junction chamber. Junction chamber shall be sealed from the motor by a compression seal.
- M. All rotating parts shall be machined and in near perfect rotational balance as possible. Excessive vibration shall be sufficient cause for rejection of the equipment. The pump impellers shall be re-balanced after being trimmed.
- N. A heavy duty chain and shackle appropriately sized (3/8" minimum) for removing and installing the pump shall be selected and provided by the pump manufacturer.
1. The lift chains shall be shackled to a heavy duty 316 Stainless Steel lifting bail attached to the pump/motor housing for removal and reinstallation.

SUBMERSIBLE SEWAGE PUMPS

2. Three feet of excess chain above the top of the wet well shall be provided to expedite removal.
 3. A chain/motor electric cable holder shall be provided and appropriately sized to accommodate the lift chains and motor electrical cables provided without deformation.
 4. Chain/electric cable holder shall include extra heavy duty three-eighths (3/8) inch rod hooks for attaching control floats, lifting chains, and other wet well accessories (6 hooks minimum) and be located on the side of the wet well hatch opening opposite to the discharge piping.
 5. The chain, shackles, lifting bail, and cable holder shall be 316 Stainless Steel.
- O. Exterior of pump shall be coated with manufacturer's standard finish.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Pump Installation Standards:
1. Comply with HI 1.4 for installation of centrifugal pumps.
- B. Wiring Method: Comply with requirements in Division 16 of the specifications.
- C. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Provide and use lacing bars and distribution spools.

3.02 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.
- B. Perform tests and inspections.
1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
- C. Tests and Inspections:
1. Perform each visual and mechanical inspection.

SUBMERSIBLE SEWAGE PUMPS

2. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
 3. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
 4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- D. Pumps and controls will be considered defective if they do not pass tests and inspections.
- E. Prepare test and inspection reports.

3.03 STARTUP SERVICE

- A. Engage a factory-authorized service representative to perform startup service.
1. Complete installation and startup checks according to manufacturer's written instructions.

3.04 ADJUSTING

- A. Adjust pumps to function smoothly, and lubricate as recommended by manufacturer.
- B. Adjust control set points.

3.05 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain controls and pumps.

END OF SECTION

**SECTION 11289
ELECTRIC ACTUATORS**

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Work included: Provide and install (in the field) one (1) electric actuator on an existing slide gate as indicated on the plans, as specified herein, and as needed to provide a complete and proper installation ready for operation.

Gate included in this Section is:

LOCATION	QTY	SIZE AND TYPE VALVE	OPEN/CLOSE OR MODULATING	UPSTREAM HEAD	DOWNSTREAM HEAD
Fine Screens	1	2'x2' Gate	Open / Close	4'	4'

- B. Related work:

1. Documents affecting work of this Section include, but are not necessarily limited to, general Conditions, Supplementary Conditions, and Sections in Division 1 of these Specifications.

1.2 QUALITY ASSURANCE

- A. Referenced manufacturers is Rotork Controls, Inc. of Rochester, NY.
- B. All technologies and devices used in the actuator must have a minimum of five years commercial operating experience at the time of startup.
- D. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.
- E. Technical services: Provide services of valve operator manufacturer's service engineer and the following:
1. Start-up and training - Two days, one trip.
2. After all actuators have completed start up, provide at least four hours solely for the instruction of personnel in operation and maintenance of the equipment.

1.3 SUBMITTALS

- A. Comply with pertinent provisions of Section 01001.

ELECTRIC ACTUATORS

- B. Product data: Within 45 calendar days after the Contractor has received the Owner's Notice to Proceed, submit:
 - 1. Materials list of items proposed to be provided under this Section.
 - 2. Manufacturer's specifications and other data needed to prove compliance with the specified requirements.
 - 3. Shop drawings showing sectional views, dimensions, end connections, and operator details.
- C. Provide maintenance manuals complying with provisions of Section 01001.
- D. Actuator factory test report. Report to include:
 - 1. No load current
 - 2. Current at maximum torque setting
 - 3. Stall Current
 - 4. Stall Torque
 - 5. Test voltage
 - 6. Motor flash test
 - 7. Actuator output speed.

1.4 SPARE PARTS

- A. Provide one set of the following items, packaged (boxed) and labeled, stored as directed by the Owner.
 - 1. One (1) set of LEDs or bulbs unless furnished as part of the main card.
 - 2. One (1) box (minimum of 10) of each size and type of fuse.
- B. Package in one container all spare parts and clearly identify on the outside what the unit is for.
 - 1. Seal tightly and properly protect for long term storage.
 - 2. Deliver to the Owner.

PART 2 - PRODUCTS

2.1 ELECTRIC ACTUATORS

- A. Comply with EN15714-2, ISA SP69.02, AWWA C540 and the following:
- B. Provide actuators to be suitable for use on nominal 480-volt, 3-phase power supply.
 - 1. Provide phase correction device to automatically correct phase sequence for desired direction of rotation.
- C. Actuators to incorporate motor, integral reversing contactor starter, local control facilities and terminals for remote control and indication connections.
- D. Actuator Sizing:
 - 1. The actuator must be sized to guarantee valve or gate closure at the specified differential pressure.
 - 2. The safety margin of motor power available for seating and unseating the valve or gate must be sufficient to ensure torque switch trip at maximum valve torque with the supply voltage 10% below nominal.
 - 3. For linear operating valves, the operating speed shall be such as to give valve closing and opening at approximately 10-12 inches per minute unless otherwise stated in the data sheet.
- E. Enclosure:
 - 1. Actuators shall be O-ring sealed, watertight to IP66/IP68 20m for 10 days, NEMA 4, 6.
 - 2. The motor and all other internal electrical elements of the actuator must be protected from ingress of moisture and dust when the terminal cover is removed for site cabling.
 - 3. The terminal compartment must maintain the same ingress protection rating with the terminal cover removed.
 - 4. The actuator enclosure must allow for temporary site storage without the need for electrical supply connection. All external fasteners shall be suitable for the actuator corrosivity category and installation environment indicated on the datasheet.
- F. Motors:
 - 1. The motor must be an integral part of the actuator, designed specifically for gate actuator applications.

ELECTRIC ACTUATORS

2. The motor shall be a low inertia, high torque design and class F insulated.
 3. Resulting in class B temperature rise with a time rating of 15 minutes at 40°C (104°F) at an average load of at least 33% of maximum valve torque.
 5. Temperature shall be limited by thermostat device embedded in the motor end windings and integrated into the actuator control.
 6. Electrical and mechanical disconnection of the motor shall be possible without draining the lubricant from the actuator gearcase.
 7. The actuator shall include a device to ensure that the motor runs with the correct rotation for the required direction of valve travel irrespective of the connection sequence of the power supply.
- G. Motor Protection: Protection must be provided for the motor as follows:
1. Stall - the motor must be de-energised within 8 seconds in the event of a stall when attempting to unseat a jammed valve.
 2. Over temperature - thermostat will cause tripping of the motor. Auto-reset on cooling.
 3. Single phasing - lost phase protection
 4. Direction – phase rotation correction.
- H. Gearing:
1. The actuator gearing must be totally enclosed in an oil-filled gearcase suitable for operation at any angle. Grease lubrication is not permissible.
 2. All drive gearing and components must be of metal construction and incorporate a lost-motion hammer blow feature.
 3. For rising spindle valves the output shaft shall be hollow to accept a rising stem, and incorporate thrust bearings of the ball or roller type at the base of the actuator.
 4. The design should be such as to permit the opening of the gearcase for inspection or disassembled without releasing the stem thrust or taking the valve out of service.
 5. Drive bushing will be machined by the actuator manufacturer based on stem details provided by the contractor.
 6. Provide one (1) blank drive bushing - not included as part of spare part requirements, but supplied to owner if not used during adaptation.

J. Hand Operation:

1. A handwheel must be provided for emergency operation, engaged when the motor is declutched by a lever or similar means, the drive being restored to electrical operation automatically by starting the motor.
2. The handwheel or selection lever must not move on restoration of motor drive.
3. Provision shall be made for the hand/auto selection lever to be locked in both hand and auto positions.
4. For linear valve types the actuator handwheel drive must be mechanically independent of the motor drive and should be such as to permit valve operation in a reasonable time with a manual force not exceeding 400N through stroke and 800N for seating/unseating of the valve.

K. Local Controls:

1. The actuator must incorporate local controls for Open, Close and Stop operation and a Local/Stop/Remote mode selector switch. Mode selection must be lockable in any one of the following three positions: local control plus local stop only, stop (no electrical operation), remote control plus local stop only. It must be possible to select maintained or non-maintained local control.
2. The local controls and display shall be rotatable through increments of 90 degrees to suit valve and actuator orientation.

L. Local Position Indication:

1. The actuator display must include a dedicated numeric/symbol digital position indicator displaying valve position from fully open to fully close in 0.1% increments. Valve closed and open positions shall be indicated by symbols showing valve position in relation to the pipework to ensure that valve status is clearly interpreted. With mains power connected, the display must be backlit to enhance contrast at all ambient light levels and must be legible from a distance of at least 5m (16ft). A power save mode shall be available to switch off the display backlight during long periods of inactivity.
2. Red, green, and yellow LEDs corresponding to open, closed, and intermediate valve positions must be included on the actuator display when power is switched on. The yellow LED should also be fully programmable for on/off, blinker and fault indication. The digital display must be maintained and updated during handwheel operation when mains power to the actuator is isolated.
3. The actuator display shall include a fully configurable dot-matrix display element with a minimum pixel resolution of 168 x 132 to display operational, alarm, configuration and graphical datalogger information. The text display shall be

selectable between English and other languages such as: Spanish, German, French, and Italian. Provision shall be made to upload a different language without removal of any covers or using specialized tools not provided as standard with the actuator.

4. Datalogger graphical displays and trend graphs must be available on the local LCD for the following functions:
 - Torque versus Position
 - Number of Starts versus Position
 - Number of starts per hour
 - Dwell Time
 - Average temperature
 5. The main display must include configurable a minimum of four different home-screens that include the following information:
 - Position and status
 - Position and torque (analogue)
 - Position and torque (digital)
 - Position and demand (positioning)
 6. An optional environmental cover to protect the display from high levels of UV radiation or abrasive materials must be available and shall be fitted without the need for any special tooling.
 7. The local controls and display must be rotatable through increments of 90 degrees to suit valve and actuator installation orientation.
- M. Integral Starter and Transformer:
1. The reversing starter, control transformer and local controls must be integral to the valve actuator and suitably housed to prevent breathing and condensation. The starter shall be suitable for 60 starts per hour during normal service or 1,200 starts per hour under reduced load conditions and of rating appropriate to motor size. The controls supply transformer shall be fed from two of the incoming three phases and incorporate overload protection. It must have the necessary voltage tapping and be adequately rated to provide power for the following functions:
 - Energizing of the contactor coils
 - 24V DC or 110V AC output for remote controls (maximum 5W/VA)
 - Supply for all the internal electrical circuits
- N. Remote Control Facilities:
1. The necessary control, wiring and terminals must be contained within the actuator enclosure. Open and close external interlocks must be made available to inhibit local and remote valve opening / closing control. It must be possible to configure the interlocks to be active in remote control only.

ELECTRIC ACTUATORS

2. Remote control signals fed from an internal 24VDC (or 110VAC) supply and/or from an external supply between 20V and 60VDC or 40V and 120VAC, must be suitable for any one or more of the following methods of control:
 - Open, Close and Stop control
 - Open and Close maintained or “push to run” (inching) control
 - Overriding Emergency Shut-Down; to close (or open) valve from a normally closed or open contact
 - Two-wire control; energise to close (or open), de-energise to open (or close)
 3. Additionally, provision shall be made for a separate ‘drive enable’ permissive input to prevent any unwanted electrical operation.
 4. It must be possible to reverse valve travel without the necessity of stopping the actuator or moving through an intermediate stop control position. The motor starter must be protected from excessive current surges during rapid travel reversal. The internal circuits associated with the remote control and monitoring functions are to be designed to withstand simulated lightning impulses up to 2kV.
- O. Gate Adaption Kit:
1. Actuator supplier shall provide and install an adaption kit designed to act as an interface between the actuator base and the gate frame.
 2. Mounting kit will be constructed of epoxy-coated steel and supplied with 304 stainless steel hardware.

PART 3 - EXECUTION

3.1 GENERAL

- A. Handle, store and install all electric actuators complying with the manufacturer's recommendations and the approved Shop Drawings.

3.2 INSTALLATION

- A. Install actuator and any adaption kit on gate as indicated on the drawings and as recommended by the actuator manufacturer.
- B. All Power and Control conduits will be sealed by the installing contractor to prevent water from entering the actuator through the conduit.

3.3 PAINTING

- A. Comply with pertinent provisions of Section 09900.

END OF SECTION

**SECTION 11291
METAL SLIDE GATES**

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. The CONTRACTOR shall furnish all labor, materials, equipment and incidentals required to install, ready for operation and field test stainless steel gates and appurtenances as shown on the Contract Drawings and as specified herein.
- B. The gates and appurtenances shall be supplied in accordance with the latest edition of AWWA C561 Standard for Fabricated Stainless Steel Slide Gates as modified herein. The allowable leakage rate for the stainless steel gates in this specification shall be 1/2 the allowable leakage listed in the latest revision of AWWA C561.

1.02 SUBMITTALS

- A. Provide the following information to confirm compliance with the specification in addition to the submittal requirements.
 - 1. Complete description of all materials including the material thickness of all structural components of the frame and slide.
 - 2. Installation drawings showing all details of construction, details required for installation, dimensions and anchor bolt locations.
 - 3. Maximum bending stress and deflection of the slide under the maximum design head.
 - 4. The location of the company headquarters and the location of the principle manufacturing facility. Provide the name of the company that manufactures the equipment if the supplier utilizes an outside source.

1.03 QUALITY ASSURANCE

- A. Qualifications
 - 1. All of the equipment specified under this Section shall be furnished by a single manufacturer with a minimum of 20 years experience designing and manufacturing water control gates. The manufacturer shall have manufactured water control gates for a minimum of 100 projects.
 - 2. The specification is based on the 900 Series Stainless Steel Gate as manufactured by Whipps, Inc. of Athol, Massachusetts.

METAL SLIDE GATES

3. Other approved manufacturers include Waterman, Rodney Hunt and Hydrogate.

PART 2 EQUIPMENT

2.01 GENERAL

- A. Gates shall be as specified herein and have the characteristics and dimensions shown on the Contract Drawings.
- B. Leakage shall not exceed 0.05 gpm/ft of wetted seal perimeter in seating head and unseating head conditions.
- C. The gate shall utilize self-adjusting seals. Due to the difficulty of accessing gates when they are in service, gates that utilize adjustable wedges, wedging devices or pressure pads are not acceptable.
- D. 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.
- E. Slide gate frames shall be shipped fully assembled with the invert member welded to the side frames and the slide installed in the frame unless the overall width of the slide gate exceeds 96 inches or the overall height of the slide gate exceed 25 feet.
- F. All welds shall be performed by welders with AWS D1.6 certification.
- G. Finish: Mill finish on stainless steel. Welds shall be sandblasted to remove weld burn and scale. All iron and steel components shall be properly prepared and shop coated with a primer.
- H. Materials:

<u>Components</u>	<u>Materials</u>
Frame Assembly and Retainers	Stainless Steel, Type 316L, ASTM A240
Slide and Stiffeners	Stainless Steel, Type 316L, ASTM A240
Stem	Stainless Steel, Type 316, ASTM A276
Anchor Studs	Stainless Steel, Type 316, ASTM A276
Fasteners and Nuts	Stainless Steel, Type 316, ASTM F593/F594
Invert Seal (Weir Gates Only)	Neoprene or EPDM ASTM D-2000
Seat/Seals and Facing	Ultra-High Molecular Weight Polyethylene ASTM D4020
Lift Nuts	Bronze ASTM B584
Pedestals and Wall Brackets	Stainless Steel, Type 316L, ASTM A240
Operator Housing	Cast aluminum or ductile iron

2.02 FRAME

- A. The frame assembly, including the guide members, invert member and yoke members, shall be constructed of formed stainless steel plate with a minimum thickness of 1/4-inch.
1. Frame design shall allow for embedded mounting, mounting directly to a wall with stainless steel anchor bolts and grout or mounting to a wall thimble with stainless steel mounting studs and a mastic gasket material. Mounting style shall be as shown on the Contract Drawings.
 2. All wall mounted or wall thimble mounted gates shall have a flange frame. Flat frame gates are not acceptable.
 3. The structural portion of the frame that incorporates the seat/seals shall be formed into a one-piece shape for rigidity. Guide members that consist of two or more bolted structural members are not acceptable. Guide member designs where water loads are transferred through the assembly bolts are specifically not acceptable.
 4. Gussets shall be provided as necessary to support the guide members in an unseating head condition. The gussets shall extend to support the outer portion of the guide assembly and shall be positioned to ensure that the load is transferred to the anchor bolts or the wall thimble studs.
 5. The frame shall extend to accommodate the entire height of the slide when the slide is in the fully opened position on upward opening gates or downward opening weir gates.
 6. On self-contained gates, a yoke shall be provided across the top of the frame. The yoke shall be formed by two structural members affixed to the top of the side frame members to provide a one-piece rigid assembly. The yoke shall be designed to allow removal of the slide. The Yoke shall be sized to withstand normal operating loads as well as the maximum hoist output. The Yoke deflection shall not exceed 1/360 of the gate width or a maximum of 1/4" whichever is less at maximum operating load.
 7. A rigid stainless steel invert member shall be provided across the bottom of the opening. The invert member shall be of the flushbottom type on upward opening gates.
 8. A rigid stainless steel top seal member shall be provided across the top of the opening on gates designed to cover submerged openings.
 9. A rigid stainless steel member shall be provided across the invert of the opening on downward opening weir gates.

METAL SLIDE GATES

2.03 SLIDE

- A. The slide and reinforcing stiffeners shall be constructed of stainless steel plate. All structural components shall have a minimum thickness of 1/4-inch.
1. The slide shall not deflect more than $1/720$ of the span or $1/16$ inch, whichever is smaller, under the maximum design head.
 2. When the width of the gate opening in feet multiplied by the maximum design head in feet is greater than 80 square feet the portion of the slide member that engages the guide shall be $1/2$ " thick. When the width of the gate opening in feet multiplied by the maximum design head in feet is greater than 120 square feet, the portion of the slide that engages the guide members shall be of a "thick edge" design. The thick edge portion of the slide shall have a minimum thickness of 2.5 inches.
 3. Reinforcing stiffeners shall be welded to the slide and mounted horizontally. Vertical stiffeners shall be welded on the outside of the horizontal stiffeners for additional reinforcement. When required to maintain proper plate stress and deflection intermediate vertical gussets shall be provided. Appropriate safety factors shall be applied to the ultimate tensile and yield strength of the material.
 4. The stem connector shall be constructed of two angles or plates. The stem connector shall be welded to the slide. A minimum of two bolts shall connect the stem to the stem connector.

2.04 SEALS

- A. All gates shall be provided with a self-adjusting seal system to restrict leakage in accordance with the requirements listed in this specification.
1. All gates shall be equipped with UHMW polyethylene seat/seals to restrict leakage and to prevent metal to metal contact between the frame and slide. Seat contact pressure shall not exceed 600 psi at the design head.
 2. 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.
 3. All upward opening gates shall be provided with a resilient seal to seal the bottom portion of the gate. The seal shall be attached to the invert member or the bottom of the slide and it shall be held in place with stainless steel attachment hardware.

METAL SLIDE GATES

4. All downward opening weir gates shall be provided with UHMW polyethylene seat/seals across the invert member.
5. The seal system shall be durable and shall be designed to accommodate high velocities and frequent cycling without loosening or suffering damage.
6. All seals must be bolted or otherwise mechanically fastened to the frame or slide. Arrangement with seals that are force fit or held in place with adhesives are unacceptable.
7. The seals shall be mounted so as not to obstruct the water way opening.
8. Gates that utilize rubber "J" seals or "P" seals are not acceptable.
9. The seal system shall have been factory tested to confirm negligible wear (less than 0.01") and proper sealing. The factory testing shall consist of an accelerated wear test comprised of a minimum of 25,000 open-close cycles using a well-agitated sand/water mixture to simulate fluidized grit.

2.05 STEM

- A. A threaded operating stem shall be utilized to connect the operating mechanism to the slide. On rising stem gates, the threaded portion shall engage the operating nut in the manual operator or motor actuator. On non-rising stem gates, the threaded portion shall engage the nut on the slide.
 1. The threaded portion of the stem shall have a minimum outside diameter of 1-1/2 inches. Stem extension pipes are not acceptable.
 2. The stem shall be constructed of solid stainless steel bar for the entire length, the metal having a tensile strength of not less than 75,000 psi.
 3. The stem shall be threaded to allow full travel of the slide unless the travel distance is otherwise shown on the Contract Drawings.
 4. Maximum L/R ratio for the unsupported part of the stem shall not exceed 200.
 5. The operating stem shall be designed to transmit in compression at least 2 times the rated hoist output with an effort of 40 lb on the crank or handwheel. The Euler column formula shall be utilized. Where a hydraulic or electric actuator is used, the stem design load shall not be less than 1.25 times the output thrust of the hydraulic cylinder with a pressure equal to the maximum working pressure of the fluid supply or 1.25 times the output thrust of the electric actuator at the stalled condition..

METAL SLIDE GATES

6. The stem shall be designed to withstand the tension load caused by the application of a 40 lb effort on the crank or handwheel without exceeding 1/5 of the ultimate tensile strength of the stem material.
7. The threaded portion of the stem shall have machine rolled threads of the full Acme type with a 16 microinch finish or better. Stub threads are not acceptable.
8. Stems of more than one section shall be joined by stainless steel or bronze couplings. The coupling shall be bolted to the stems.
9. Stems, on manually operated gates, shall be provided with adjustable stop collars to prevent over closing of the slide.

2.06 STEM GUIDES

- A. Stem guide shall be provided when necessary to ensure that the maximum L/R ratio for the unsupported part of the stem is 200 or less.
 1. Stem guide brackets shall be fabricated of stainless steel and shall be outfitted with UHMW or bronze bushings.
 2. Adjustable in two directions.

2.07 WALL THIMBLES

- A. Wall thimbles shall be provided when shown on the Contract Drawings.
 1. The wall thimble depth shall be equal to the thickness of the concrete wall in which the thimble is to be mounted.
 2. Wall thimbles shall be fabricated stainless steel construction of adequate section to withstand all operational and reasonable installation stresses.
 3. Wall thimbles shall be constructed of 1/4-inch minimum thickness stainless steel and the front face shall have a minimum thickness of 1/4-inch.
 4. The fabrication process shall ensure that the wall thimble is square and plumb and the front face is sufficiently flat to provide a proper mounting surface for the gate frame.
 5. The face of the wall thimble shall only be machined if recommended by the gate manufacturer. If the wall thimble is to be machined, the front face shall have a minimum thickness of 1/4-inch after machining.

METAL SLIDE GATES

6. A water stop shall be welded around the periphery of the thimble. Wall thimbles shall be designed to allow thorough and uniform concrete placement during installation.
7. Studs and nuts shall be stainless steel. Water stop may be stitch welded.
8. A suitable gasket or mastic shall be provided to seal between the gate frame and the wall thimble.

2.08 MANUAL OPERATORS

- A. Unless otherwise shown on the Drawings, gates shall be operated by a manual handwheel or a manual crank-operated gearbox. The operator shall be mounted on the yoke of self-contained gates or on the pedestal of non-self contained gates.
 1. 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.
 2. An arrow with the word "OPEN" shall be permanently attached or cast onto the operator to indicate the direction or rotation to open the gate.
 3. Handwheel operators shall be fully enclosed and shall have a cast aluminum housing.
 - a. Handwheel operators shall be provided with a threaded cast bronze lift nut to engage the operating stem.
 - b. Handwheel operators shall be equipped with roller bearings above and below the operating nut.
 - c. Positive mechanical seals shall be provided above and below the operating nut to exclude moisture and dirt and prevent leakage of lubricant out of the hoist.
 - d. The handwheel shall be removable and shall have a minimum diameter of 15 inches.
 4. Crank-operated gearboxes shall be fully enclosed and shall have a cast aluminum or ductile iron housing.
 - a. Gearboxes shall have either single or double gear reduction depending upon the lifting capacity required.
 - b. Gearboxes shall be provided with a threaded cast bronze lift nut to engage the operating stem.
 - c. Bearings shall be provided above and below the flange on the operating nut to support both opening and closing thrusts.
 - d. Gears shall be steel with machined cut teeth designed for smooth operation.
 - e. The pinion shaft shall be stainless steel and shall be supported on ball or tapered roller bearings.

METAL SLIDE GATES

- f. Positive mechanical seals shall be provided on the operating nut and the pinion shafts to exclude moisture and dirt and prevent leakage of lubricant out of the hoist.
 - g. The crank shall be cast aluminum or cast iron with a revolving nylon grip.
 - h. The crank shall be removable.
5. All gates having widths in excess of 72 inches and widths greater than twice their height shall be provided with two gearboxes connected by an interconnecting shaft for simultaneous operation.
- a. Interconnecting shafting shall be constructed of aluminum or stainless steel.
 - b. Flexible couplings shall be provided at each end of the interconnecting shaft. Couplings shall be stainless steel or non-metallic.
 - c. One crank shall be provided to mount on the pinion shaft of one of the gearboxes.
 - d. If the operating assembly is motorized, a stainless steel enclosure shall be provided over the interconnecting shaft to comply with OSHA regulations.
6. An extended operator system utilizing chain and sprockets shall be furnished by the manufacturer when the centerline of the crank or handwheel, on a non-geared operator, is located over 48-in above the operating floor. Chain wheels are not acceptable.
- a. A removable stainless steel or aluminum cover shall be provided to enclose chain and sprockets.
 - b. The extended operator system shall lower the centerline of the pinion shaft to 36-in above the operating floor.
 - c. A handwheel may be utilized in conjunction with a gearbox in lieu of the extended operator system if the centerline of the pinion shaft is 60-in or less above the operating floor.
7. Pedestals shall be constructed of stainless steel. Aluminum pedestals are not acceptable.
- a. The pedestal height shall be such that the handwheel or pinion shaft on the crank-operated gearbox is located approximately 36-in above the operating floor.
 - b. Wall brackets shall be used to support floor stands where shown on the Drawings and shall be constructed of stainless steel.
 - c. Wall brackets shall be reinforced to withstand in compression at least two times the rated output of the operator with a 40 lb effort on the crank or handwheel.
 - d. The design and detail of the brackets and anchor bolts shall be provided by the gate manufacturer and shall be approved by the ENGINEER. The gate manufacturer shall supply the bracket, anchor bolts and accessories as part of the gate assembly.

METAL SLIDE GATES

8. Operators shall be equipped with fracture-resistant clear butyrate or lexan plastic stem covers.
 - a. The top of the stem cover shall be closed.
 - b. The bottom end of the stem cover shall be mounted in a housing or adapter for easy field mounting.
 - c. Stem covers shall be complete with indicator markings to indicate gate position.

9. When shown on the Contract Drawings, provide 2 inch square nut, mounted in a floor box, with a non-rising stem.
 - a. The square nut shall be constructed of bronze.
 - b. The floor box shall be constructed of stainless steel or cast iron and shall be set in the concrete floor above the gate as shown.
 - c. Provide one aluminum or stainless steel T-handle wrench for operation.

2.10 ANCHOR BOLTS

- A. Anchor bolts shall be provided by the gate manufacturer for mounting the gates and appurtenances.
 1. Quantity and location shall be determined by the gate manufacturer.
 2. If epoxy type anchor bolts are provided, the gate manufacturer shall provide the studs and nuts.
 3. Anchor bolts shall have a minimum diameter of 1/2-inch.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Installation of the gates and appurtenances shall be done in a workmanlike manner. It shall be the responsibility of the CONTRACTOR to handle, store and install the equipment specified in this Section in strict accordance with the manufacturer's recommendations.
- B. The CONTRACTOR shall review the installation drawings and installation instruction prior to installing the gates.
- C. The gate assemblies shall be installed in a true vertical plane, square and plumb.
- D. The CONTRACTOR shall fill the void in between the gate frame and the wall with non-shrink grout as shown on the installation drawing and in accordance with the manufacturer's recommendations.

METAL SLIDE GATES

- E. The CONTRACTOR shall add a mastic gasket between the gate frame and wall thimble (when applicable) in accordance with the manufacturer's recommendations.

3.02 FIELD TESTING

- A. After installation, all gates shall be field tested in the presence of the ENGINEER and OWNER to ensure that all items of equipment are in full compliance with this Section. Each gate shall be cycled to confirm that they operate without binding, scraping, or distorting. The effort to open and close manual operators shall be measured, and shall not exceed the maximum operating effort specified above. Electric motor actuators shall function smoothly and without interruption. Each gate shall be water tested by the CONTRACTOR, at the discretion of the ENGINEER and OWNER, to confirm that leakage does not exceed the specified allowable leakage.

3.03 MANUFACTURERS FIELD SERVICE

- A. Provide the service of gate manufacturer's service engineer complying with the following:
 - 1. Installation - One day, one trip
 - 2. Start-up and training - One day, one trip

END OF SECTION

**SECTION 11312
SELF-PRIMING WASTEWATER PUMPS**

PART 1 GENERAL

1.1 SCOPE OF WORK

- A. Work included: Provide three (3) self-priming pumping units each including, but not necessarily limited to, V-belt electric motor drives, controls, etc. all as necessary or needed to provide a complete installation ready for operation.
- B. Furnish control panel for RAS pumps 3 and 4 as specified herein. The controls for the septage receiving pump shall be furnished in accordance with Section 16400.

1.2 QUALITY ASSURANCE

- A. Referenced manufacturer is the Gorman-Rupp Company of Mansfield, Ohio and is named to establish standards of quality. Equal products of other manufacturers complying with these Specifications and conforming to the Bid Form may be provided upon approval by the Engineer.

1.3 SUBMITTALS

- A. Product data: Within 30 calendar days after the Contractor has received the Owner's Notice to Proceed, submit:
 - 1. Materials list of items proposed to be provided under this Section.
 - 2. Manufacturer's specifications and other data needed to prove compliance with the specified requirements.
 - 3. Shop drawings showing plan, elevation and sectional views, materials of construction, base plate and anchor bolt details.

PART 2 PRODUCTS

2.1 PUMPS

- A. Pumps shall be horizontal, self-priming sewage pumps, specifically designed for pumping return activated sludge meeting the following requirements:

SELF-PRIMING WASTEWATER PUMPS

Pump	Septage Receiving	RAS Pump No. 3	RAS Pump No. 4
Service	Septage Waste	RAS	RAS
VFD	No	Yes	Yes
Duty Point Flow (gpm)	150	1,200	1,200
Duty Point TDH (ft)	16	27	27
Total Dynamic Suction Lift (ft)	11.4	4.5	4.5
Maximum Re-priming lift (ft)	4	15	15
Max. Motor Power (hp)	5	25	25
Max. Motor Speed (rpm)	1,800	1,800	1,800
Operational Current	460 volt, 3-phase	460 volt, 3-phase	460 volt, 3-phase
Suction Diameter (in)	4	8	8
Discharge Diameter (in)	4	8	8

- C. All areas of the pump casing and volute, which are exposed to sewage shall, be constructed of cast iron of no lesser grade than class 30.
- D. All openings, internal passages, and internal re-circulation ports shall be large enough to permit the passage of a sphere 3" in diameter, and any trash or stringy material, which may pass through the average house collection system. Screens or any internal devices that create a maintenance nuisance or interfere with priming and performance of the pump shall not be permitted. Upon request from the engineer, Professional Engineer certified dimensional drawings indicating size and locations of the priming re-circulation port or ports shall be submitted to the engineer prior to shipment.
- F. Consideration shall be given to the sanitary sewage service anticipated, in which occasionally debris will lodge between the pump suction check valve and seat, resulting not only in the loss of liquid in the suction leg, but also in the siphoning of liquid from the pump casing to the approximate center line of the impeller. Such occurrence shall be considered normal with proper installation of air release line free to atmosphere.

SELF-PRIMING WASTEWATER PUMPS

- G. In consideration of such occurrence and of the unattended operation intended, each pump shall be so designed as to retain adequate liquid in the pump casing to insure unattended automatic re-priming while operating at its rated speed in a completely open system without suction check valves and with a dry suction leg.
- H. Each pump must be capable of a re-prime lift of 15 feet at the selected speed and impeller diameter. Re-prime lift is defined as the static height of pump suction centerline above liquid that the pump will prime; and delivery within five minutes on liquid remaining in the pump casing after a delivering pump is shut down with the suction check valve removed. Additional standards under which re-prime tests shall be run are:
1. Piping shall incorporate a discharge check valve downstream from the pump. Check valve size shall be equal (or greater than) the pump discharge diameter.
 2. A ten-foot length of one-inch pipe shall be installed between pump and discharge check valve. This line shall be open to atmosphere at all times to duplicate the air displacement rate of a typical pump station fitted with an air release valve.
 3. No restrictions shall be present in pump or suction piping, which could serve to restrict the rate of siphon drop of the suction leg. Suction pipe configuration for re-prime test shall incorporate a minimum horizontal run of 4.5 Feet and one 90-degree elbow.
 4. Impeller shall be set at the clearances recommended by the manufacturer in the pump service manual.
 5. Re-prime lift repeatability shall be demonstrated by five sequential re-prime cycles.
 6. Liquid to be used for the re-prime test shall be water.
- I. Upon request from the engineer, certified re-prime performance test data, prepared by the pump manufacturer and certified by a registered professional engineer, shall be submitted to the engineer prior to shipment.
- J. The pump manufacturer shall demonstrate to the engineer's satisfaction that due consideration has been given to reducing maintenance costs by incorporating the following features.
- K. No special tools shall be required for replacement of any components within the pump.

SELF-PRIMING WASTEWATER PUMPS

- L. The pump must be equipped with a removable clean-out cover plate, allowing access for service and repairs without removing suction or discharge piping. The clean-out cover shall permit the removal and replacement of the suction flap valve. The coverplate should also incorporate pusher bolt capability to assist in its removal. Pusher bolt threaded holes shall be sized to accept same retaining capscrews as used in rotating assembly.
- M. The pump shall be fitted with replaceable front and rear wear plates. Replacement of the front wear plate, impeller, seal, and suction check valve shall be accomplished through the removable suction head. The entire rotating assembly, which includes bearings, shaft, seal, and impeller, shall be removable as a unit, through the front or rear of the pump, without removing the pump volute or piping.
- O. Each pump shall incorporate a suction valve that can be removed or installed through the removable clean-out cover plate opening, without disturbing the suction piping. Sole function of check valve shall be to eliminate re-priming with each cycle. Pumps requiring suction check valves to prime or re-prime will not be acceptable.
- P. Clearances shall be maintained by external shimless coverplate adjustment, utilizing collar and adjusting screw design for incremental adjustment of clearances by hand. Requirement of realignment of belts, couplings, etc., shall not be acceptable. Coverplate shall be capable of being removed without disturbing clearance settings. There shall be provisions for additional clearance adjustment in the event that adjustment tolerances have been depleted from the coverplate side of the pump. The removal of stainless steel shims from the rotating assembly side of the pump shall allow for further adjustment as described above. Clearance adjustment by means of positioning the shaft only toward the wear plate, thereby reducing pressure on the seal, shall not be acceptable.
- Q. The impeller shall be two-vaned, semi-open, non-clog, cast in austempered ductile iron with integral pump out vanes on the back shroud. Impeller shall be dynamically balanced and thread onto the pump shaft and be secured with a lock screw.
- R. The pump shaft shall be sealed against leakage by a mechanical seal. Both the stationary sealing member and mated rotating member shall be of tungsten titanium carbide alloy. Each of the mated surfaces shall be lapped to a flatness of three light bands, as measured by an optical flat under monochromatic light. The stationary seal seat shall be double floating so that faces will not lose alignment during periods of shock loads that will cause deflection, vibration, and axial movement of the pump shaft. The seal shall be lubricated with oil from a separate, oil-filled reservoir. The same oil shall not be used to lubricate both the shaft seal and the shaft bearings.

SELF-PRIMING WASTEWATER PUMPS

- S. The pump shaft bearings shall be anti-friction ball or tapered roller bearings, of ample size and proper design to withstand all radial and thrust loads, which can reasonably be expected during normal operation. Bearings shall be lubricated from a separate reservoir. Pump designs in which the same oil lubricates both the shaft bearings and the shaft seal shall not be acceptable.
- T. Pumps to be supplied with a drain kit for ease of maintenance. The kit to contain 10' length of reinforced plastic hose with a female quick connect fitting at one end, and factory installed drain fittings in each pump. Fittings include a pipe nipple, bushing, bronze ball valve and male quick connect fitting.

2.8 AIR RELEASE VALVE

- A. An automatic air release valve shall be furnished for each pump, which is designed to permit the escape of air to the atmosphere during initial priming or unattended re-priming cycles. Upon completion of the priming cycle or re-priming cycle, the valve shall close to prevent re-circulation.
- B. Valves shall provide visual indication of valve closure and shall operate solely on discharge pressure. Valves which require connection to the suction line shall not be acceptable.
- C. All valve parts exposed to sewage shall be constructed of cast iron, stainless steel, or similar corrosion resistant materials.
- D. Diaphragms, if used, shall be of fabric-reinforced neoprene or similar inert material.
- E. A cleanout port, three inches in diameter, shall be provided for ease of inspection, cleanout, and service.
- F. Provide stainless steel ball valves on the inlet piping.
- G. Valves shall be field adjustable for varying discharge heads.

2.9 GAUGE KIT

- A. A gauge kit shall be supplied for each pump.
- B. Suction pressure shall be monitored by a glycerin-filled compound gauge, and discharge pressure by a glycerin-filled pressure gauge.
- C. Gauges to be at least 4 inches in diameter, graduated in feet water column. Rated accuracy shall be 1% of full-scale reading. Compound gauge shall be graduated -34 to +34 feet water column minimum. Pressure gauge to be graduated 0 to 140 feet water column minimum.

SELF-PRIMING WASTEWATER PUMPS

- D. Gauges to be factory mounted on a resilient panel with frame assembly secured to pumps or piping.
- E. Gauge installations shall be complete with all hoses and fittings, including a shutoff valve for each gauge line at the point of connection to suction and discharge pipes.

2.10 DRIVE MOTORS - ELECTRIC

A. Description:

1. Pump motors shall be 3 phase, 60 hertz, TEFC, horizontal, 1,800 RPM, NEMA design B with cast iron frame with copper windings, induction type, with Class F insulation and 1.15 service factor for normal starting torque and low starting current characteristics, suitable for continuous service on a VFD.
2. The motors shall not overload at the design condition or at any head in the operating range as specified. Motors shall be tested in accordance with provisions of ANSI/IEEE Standard 112.
3. Motors intended for outdoor operation shall be outfitted with 120 volt space heaters.

B. Drive Transmission:

1. Power to pumps shall be transmitted by V-belt drive assemblies.
2. The sheave/belt combination shall provide the speed ratio needed to achieve the specified pump operating conditions.
3. Each drive assembly shall utilize at least two V-belts providing minimum a combined safety factor of 1.5. Single belt drives or systems with a safety factor of less than 1.5 are not acceptable.
4. Computation of safety factors shall be based on performance data published by the drive manufacturer.

C. Belt Guards

1. Pump drives to be enclosed on all sides by a guard constructed of a corrosion resistant HDPE. No opening to a rotating member shall exceed 1/2 inch. Guards must be completely removal without interference from any unit component and shall be securely fastened and braced to the unit base. The guard shall be finished in accordance with Section 3, Color Definitions of ANSI 253.1; Safety Color Code for Marking Physical Hazards.

SELF-PRIMING WASTEWATER PUMPS

2.5 PUMP BASE

- A. The pump unit(s) shall be mounted on an individual v-belt base.
- B. The base shall comprise a base plate, perimeter flange, and reinforcements.
- C. Base plate shall be fabricated of steel not less than 1/4" thick.
- D. Flange and reinforcements shall be designed to prevent flexing or warping under operating conditions.
- E. Base plate and/or flange shall be drilled for hardware used to secure unit base to concrete pad as shown on the contract drawings. The base shall contain provisions for lifting the complete pump unit during shipping and installation.

2.5 THERMOSTAT

- A. The pump shall be provided with a N.O. thermostat, which shall cause the pump to be disconnected in the event of a high pump temperature condition.
- B. A high pump temperature protection circuit shall override the level control and shut down the pump motor(s) when required to protect the pump from excessive temperature.
- C. A thermostat shall be mounted on each pump casing. If casing temperature rises to a level sufficient to cause pump damage, the high pump temperature protection circuit shall interrupt power to the pump motor.
- D. The pump motor shall remain locked out until the pump has cooled and circuit has been manually reset.
- E. Automatic reset of this circuit is not acceptable.

2.7 SPARE PARTS

- A. The following minimum spare parts shall be furnished with the pumps:
 - 1. One cover plate O-Ring.
 - 2. One rotating assembly O-Ring.
 - 3. One set of impeller clearance adjustment shims.

SELF-PRIMING WASTEWATER PUMPS

2.8 FLOAT SWITCHES

- A. Provide three (3) float switches. Two will be used for control of the septage receiving pump from the MCC and one will be used at the fine screens for control of the diversion gate actuator.
- B. The floats shall be 50' weighted direct acting chemical resistant float switches. Roto Float, Conery, or equal.

2.11 PUMP CONTROL PANEL (RAS PUMP NO. 3 AND NO. 4)

- A. Enclosure:
 - 1. Provide 14 gauge Type 304 stainless steel enclosure complying with NEMA 4X, gasketed, with rain shield.
 - a. Provide free standing with leg stand kit and stainless steel anchor bolts.
 - 2. Provide a single 3-point locking latch.
 - a. Attach with stainless steel screws.
 - 3. Include removable inner swing panel fabricated of aluminum having a minimum thickness of 0.125" mounted on a continuous stainless steel piano type hinge.
 - a. Panel shall be of adequate size to completely cover all wiring and components mounted on the back panel and shall make provisions for the mounting of all basic and optional controls and instruments.
 - b. Panel shall have a minimum horizontal swing of 90° and shall be held in the closed position with straight slot screws.
 - 4. Provide removable back panel of 0.125" minimum thickness, aluminum, attached to enclosure on collar studs, and of adequate size to accommodate all basic and optional components.
 - a. Mount components to back panel securely utilizing screws and lockwashers.
 - b. Tap panel to accept mounting screws.
 - c. Do not use any self-tapping screws.
 - 5. Back panel to be painted with two coats of white epoxy enamel.
 - 6. Provide engraved nameplates on door-mounted hardware.
 - a. Attach with stainless steel screws.
 - 7. Provide control panel cooling as specified in 16910.

SELF-PRIMING WASTEWATER PUMPS

- B. Provide VFD for each motor in accordance with 16160. VFD user interfaces shall be mounted on the front of the inner swing panel.
- C. Components:
 - 1. Provide power disconnect on each circuit breaker with operator handle located on exterior of inner swing panel.
 - a. Include interlock permitting swing panel to be opened only when circuit breakers are in the "OFF" position.
 - 2. Provide "H-O-A" switches for each motor.
 - a. Provide UL rated, heavy duty, 600 VAC, NEMA 4X, oil-tight switches, Allen Bradley Series 800H or Square D Class 9001 SK.
 - b. "Hand" position not to override motor overload shutdown.
 - 3. Provide the following components with the panel:
 - a. Pilot run light for each motor.
 - b. Lockable enclosure.
 - c. Condensation heater.
 - d. Undervoltage, phase failure and phase reversal protection unit, TimeMark Model 265, or Engineer-approved equal.
 - e. Reset-motor over temperature.
 - f. GFI 20A duplex receptacle with stainless steel cover.
 - g. Control relays.
 - h. Remote alarm terminals.
 - i. "High temperature" indicator lamps.
 - j. "Power on" indicating lamp.
 - k. Setpoint controller to set flow while as measure by the flow transmitter.
 - k. The control panel shall accept a 4-20mA signal from the external flow transmitter.
- D. Monitoring contacts
 - 1. Provide the following dry contacts in the control panel for external use.
 - a. Pump #1 Running
 - b. Pump #2 Running
 - c. Pump #1 overtemp/VFD alarm
 - d. Pump #2 overtemp/VFD alarm
- E. Pump alternator relay:
 - 1. Provide relay of electrical/mechanical industrial design, Series ARB, as manufactured by Diversified Electronics or equal.

SELF-PRIMING WASTEWATER PUMPS

2. Include three position selector switch to override automatic alternator and provide manual selection of either Pump No. 1 or No. 2.
 3. Only one pump shall run at a time.
- F. High temperature shutdown:
1. Provide high temperature shutdown for each motor utilizing the temperature switches embedded in the motor windings.
 - a. Under high temperature conditions switch shall open, de-energizing the motor starter and stopping the pump motor.
 - b. High motor temperature shutdown device shall be automatic reset type.
- H. Provide overload reset device operable without opening the inner swing panel.
- I. Provide the following components and mount on the back plate:
1. Provide a 115V control circuit transformer (open core and coil type) with primary circuit breaker and secondary circuit breakers for:
 - a. Control
 - b. Duplex receptacle
 - c. Condensation heater
 - d. Exterior GFI receptacle
 - e. Existing flow transmitter
 2. Provide lightning arrestor, Delta Type "LA" or equal.
 3. Provide power terminals and control terminals.
- J. Design control sequence so that panel is functioning automatically again after a power failure and manual reset is not necessary.
- K. Provide a terminal board for connection of line, pump leads and temperature.
- L. Provide elapsed time meter wired to each motor starter, six digit, non-resettable, to indicate total running time in hours and tenths.
- N. Electrical schematic:
1. Provide a number indexed laminated electrical schematic diagram of the pump controls including terminal board connections.
 2. Permanently mount on the inside of the enclosure door.
- P. All attachment screws are to be stainless steel.

SELF-PRIMING WASTEWATER PUMPS

- Q. Provide components as specified on Section 16910. A PLC is not required.

PART 3 - EXECUTION

3.1 INSTALLATION OF PUMPING UNIT

- A. Locate within the structure as indicated on Drawings.
- B. Block and shim as necessary to place at proper elevation plumb and level.
- C. Snug down anchor bolt nuts and place concrete base completely under pump base.
 - 1. Use 4000 psi concrete, complying with Section 03300.

3.2 PIPING

- A. Install suction, discharge and air piping, as indicated on the Drawings.
- B. Locate interior piping parallel with, or at right angles to, walls, ceilings, equipment, etc. unless otherwise indicated.
- C. Clean flange faces, fit joint with 1/16" red rubber full face gasket and make bolts up finger tight.
 - 1. Use torque wrench, alternately tightening bolts 180° apart until full gasket flow and seal are secured.
 - 2. Bias cut or unusual refacing of any flange will not be acceptable.

3.3 FIELD WIRING

- A. Comply with pertinent provisions of Section 16.
- B. Extend grounding wire from control panel main ground to external ground as indicated and complying with NEC and local electrical codes.

3.4 PAINTING

- A. Provide finish painting complying with Section 09900.

3.5 TESTING AND INITIAL OPERATION

- A. Factory test pumps measuring flow, head, speed, and power consumption.

SELF-PRIMING WASTEWATER PUMPS

1. Test for a minimum and maximum design flows and pressures and shutoff head.
 2. Submit test report to the Engineer prior to shipping.
- B. Place units in service utilizing services of equipment manufacturer's service personnel.
1. Conduct in the presence of the Engineer.
 2. Confirm that each pump conforms to the performance requirements specified herein.
 3. Operate pumps utilizing manual and automatic modes, demonstrating proper operational sequences including alarm conditions.

END OF SECTION

**SECTION 11335
CLARIFIER EQUIPMENT REFURBISHMENT**

PART 1 GENERAL

1.01 SCOPE

- A. Description of Work
1. Refurbishment of clarifier equipment for three (3) secondary clarifiers as specified herein.
 2. Clarifier type for each is a 70-foot rim flow Tow-Bro by Envirex® Products of Evoqua Water Technologies in Waukesha, WI.
- B. Work and Components Included (but not limited to):
1. The Equipment Manufacturer shall furnish and install the items listed below:
 - a. Drive mechanism complete with a gearmotor reduction unit, micro-switch torque overload devices and shear pin (for Clarifier Nos. 1 and 2 only).
 - b. Manifold seals and 316 stainless steel clamp kits (for Clarifier Nos. 1, 2 and 3).
 - c. All associated hardware and anchor bolts
 2. The Contractor shall be responsible for all activities associated with Cleaning, blasting and painting.

1.02 QUALIFICATIONS

- A. References
1. American Gear Manufacturers Association (AGMA):
 - a. 201.02 - Tooth Proportions for Coarse-Pitch Involute Spur Gears.
 - b. 390.03a - Handbook - Gear Classification, Materials and Measuring Methods for Bevel, Hypoid, Fine Pitch Wormgearing and Racks Only as Unassembled Gears.
 - c. 908 - Information Sheet - Geometry Factors for Determining the Pitting Resistance and Bending Strength of Spur, Helical and Herringbone Gear Teeth.
 - d. 2000 - Gear Classification and Inspection Handbook - Tolerances and Measuring Methods for Unassembled Spur and Helical Gears (Including Metric Equivalents).
 - e. 2001 - Fundamental Rating Factors and Calculation Methods for Involute Spur and Helical Gear Teeth.
 - f. 2004 - Gear Materials and Heat Treatment Manual.
 - g. 6019 - Standard for Gearmotors Using Spur, Helical, Herringbone, Straight Bevel or Spiral Bevel Gears.
 - h. 6022 - Design Manual for Cylindrical Wormgearing.

CLARIFIER EQUIPMENT REFURBISHMENT

- i. 6034 - Practice for Enclosed Cylindrical Wormgear Speed Reducers and Gearmotors.
 - j. 9005 - Industrial Gear Lubrication.
2. American Institute of Steel Construction (AISC):
 - a. Specification for Structural Steel Buildings - Allowable Stress Design and Plastic Design.
 - b. Code of Standard Practice for Steel Bridges and Buildings.
3. American Society of Mechanical Engineers (ASME)
 - a. B29.1M - Precision Power Transmission Roller Chains, Attachments and Sprockets.
4. American Society for Testing and Materials (ASTM):
 - a. A 36/ A 36M - Standard Specifications for Structural Steel.
 - b. A 48 - Standard Specification for Gray Iron Castings.
 - c. A 148/ A 148M - Standard Specification for Steel Castings, High Strength, for Structural Purposes.
 - d. A 276 - Standard Specification for Stainless Steel Bars and Shapes.
 - e. A 325 - Standard Specification for High-Strength Bolts for Structural Steel Joints.
 - f. A 536 - Standard Specification for Ductile Iron Castings.
5. American Welding Society (AWS):
 - a. D 1.1 - Structural Welding Code for Steel.
6. American Bearing Manufacturers Association (ABMA):
 - a. 9 - Load Ratings and Fatigue Life for Ball Bearings.
7. International Conference of Building Officials (ICBO):
 - a. Uniform Building Code (UBC).
8. National Electrical Manufacturers Association (NEMA):
 - a. 250 - Enclosures for Electrical Equipment (1,000 volts maximum).

1.03 GUARANTEE AND WARRANTY

- A. Seller shall furnish its standard warranty against defects in material and workmanship for all Equipment provided by Seller under this Section. The Seller shall warrant the Equipment, or any components thereof, through the earlier of:
 1. Eighteen (18) months from delivery of the Equipment or
 2. Twelve (12) months from initial operation of the Equipment.

PART 2 PRODUCTS

2.01 EQUIPMENT

- A. Drive Mechanism
 1. General

CLARIFIER EQUIPMENT REFURBISHMENT

- a. Drive mechanism consisting of primary helical gear reduction, intermediate worm gear reduction unit and enclosed final reduction unit consisting of internal spur gear and pinion in a turntable base is to be completely assembled and finish painted in the Manufacturer's shop.
 - b. All gearing shall be enclosed in gray cast iron ASTM A-48 Class 40B housings. Fabricated steel housings, exposed gearing and submerged bearings will not be acceptable.
 - c. The drive shall be designed to allow removal and replacement of internal gear, balls and strip liners without raising the walkway.
 - d. All components of the drive mechanism shall be designed in accordance with AGMA Standard 6034-B92 "Practice for Enclosed Cylindrical Worm Gear Speed Reducers and Gearmotors", and Standard 2001-D04 "Fundamental Rating Factors and Calculation Methods for Involute Spur and Helical Gear Teeth"; for 24-hour continuous, uniform load duty and 20-year design gear life at the specified output speed. The AGMA rated torque of the drive shall be the lowest value computed for worm gear set, spur gear and pinion for strength and durability.
 - e. Select conservative values for bending strength and pitting resistance life factors KI and CI based on a minimum of 420,000 cycles of the main gear. The drive AGMA torque rating shall be as specified above with a minimum 1.25 service factor.
 - f. All bearings shall be designed for a minimum B-10 life of 200,000 hours.
2. Primary Reduction Unit
- a. Provide commercially available helical gear reducer or gearmotor in a cast housing.
 - b. All bearings shall be anti-friction type running in oil.
 - c. Motor shall be totally enclosed, ball bearing type, of ample power for starting and continuously operating the drive mechanism without overloading.
 - d. Motor to conform to NEMA standards and be suitable for operation on 230/460 volt, 3 phase, 60 Hertz current.
 - e. Primary reduction unit shall drive the intermediate reduction through a chain and sprocket arrangement with #80L self-lubricating chain and non-corrosive OSHA approved removable chain guard.
 - f. Provide proper chain tension by an adjustable steel base mounted on the intermediate reduction unit.
3. Intermediate Reduction Unit
- a. Provide worm gear speed reduction with grease and oil lubricated anti-friction type bearings in cast iron housing securely bolted on the machined top face of the final reduction unit. Worm and shaft

CLARIFIER EQUIPMENT REFURBISHMENT

- shall be a two-piece assembly for ease of maintenance. Cycloidal and planetary gearing will not be acceptable.
- b. Align and maintain accurate centers with the final reduction gearing. Swivel base mounting of the intermediate unit will not be acceptable.
 - c. Mount an electro-mechanical overload device on the thrust end of the worm shaft consisting of plate spring assembly, plunger, indicator dial two (2) micro-switches (one N.O. and one N.C.) and a terminal block, all enclosed in a weather tight, gray cast iron housing. Amperage metering devices will not be considered equal to the overload device specified.
 - d. Micro-switches shall be factory set to: (1) sound an alarm when the load on the mechanism reaches 100% of the AGMA torque; and (2) stop the motor when the load reaches 120% of the AGMA torque.
 - e. Provide a shear pin device mounted on the drive end of the worm shaft.
4. Final Reduction
- a. Provide internal, full depth involute tooth design, ductile iron spur gear driven by a heat-treated steel pinion from the slow speed shaft of the intermediate reduction unit. Stub tooth design will not be acceptable.
 - b. Provide bearings at top and bottom of pinion to ensure complete tooth contact between mating surfaces. Pinion and pinion shaft shall be furnished as a two-piece assembly for ease of maintenance.
 - c. Provide cast iron turntable base with annular raceway to contain balls upon which the internal gear rotates. The ball race shall ensure low unit ball load, long life and stability without the use of submerged guide shoes, bumpers or steady bearings.
 - d. Provide four (4) 3/8" thick x 3/4" wide renewable special hardened (38-42 Rockwell C) steel liner strips force fitted (pins and cap screws not permitted) into the turntable base and internal gear for balls to bear on vertically and horizontally.
 - e. Provide an internal gear of split design with precision mating surfaces for ease of removal of gear, balls and liner strips without raising bridge. Drives without this feature are not acceptable.
 - f. Internal gear, pinion and balls to run in an oil bath and be protected by a felt seal and vertical neoprene dust shield.
 - g. Provide oil filling and level pipe along with a drain plug and sight gauge.
 - h. Turntable base shall be bolted to the center column and be designed to support the bridge, internal gear and rotating mechanism.

CLARIFIER EQUIPMENT REFURBISHMENT

5. Drive unit to be H40AHT Drive 603-81657-80 as manufactured by Evoqua Water Technologies.
- B. Manifold Seals
 1. Provide three (3) replacement seals for bolted connection to the sludge collection header and bottom of cage. 316 stainless steel clamp kits shall be provided to attach the manifold seals.

2.07 PAINTING AND SURFACE PREPARATION

- A. All non-submerged carbon steel shall be sandblasted to SSPC-SP-6 specifications. All submerged steel shall be sandblasted to SSPC-SP-10 specifications. After blast cleaning, the clarifier equipment shall be painted with two coats of Sherwin Williams 235 Industrial Marine Coating with the color Grey, 5-7 mills dry film thickness per coat.
- B. Clarifier Units 1 & 2: The clarifier equipment shall be blasted and painted with the first coat prior to the removal and replacement of the new drive to prevent grit from getting into the new drive. After the drive is replaced, the second coat of paint shall be applied.
- C. Clarifier Unit 3: Prior to blasting and painting, the clarifier drive and motor shall be carefully covered/wrapped or otherwise protected from blast material and paint. The remaining clarifier equipment shall be blasted and painted. Drive shall be hand prepared for application of paint.
- D. Gear motors shall be furnished with the manufacturer's standard enamel.
- E. The following items are hot dipped galvanized and no coating repair is required:
 1. Suction header.
 2. Scum blade.
 3. Turnbuckles for the steel tie bars.

PART 3 EXECUTION

3.01 CLARIFIER START-UP

- A. A start-up inspection and test shall be performed on each clarifier to verify proper installation, alignment and operation.
- B. Testing shall include the following:
 1. Drive

CLARIFIER EQUIPMENT REFURBISHMENT

- a. Alignment and Installation
 - 1) Check alignment of the drive and driven sprockets
 - 2) Check chain for proper tension
 - 3) Ensure proper fit of chain guard
 - 4) Measure the stop block clearance and lower drive housing
 - 5) Review and confirm the correct motor, gear reducer, and drive chain have been installed on the clarifier drive per the defined mechanism design
 - 6) Confirm installation of the proper shear pin
 - 7) Bump motor to confirm correct rotation
 - b. Lubrication
 - 1) Check the drive mechanism for the correct lubrication levels
 - 2) Service all lubrication points and grease fittings
 - 3) Check the air vents in the gear reducers.
 - c. Micro-switches
 - 1) The torque protection micro-switches must be connected per the diagram on the drive drawing.
 - 2) The shut-down switch must be connected: a manual reset must be wired in the circuit when the motor shut-off switch is activated.
 - 3) Set alarm and motor shut-off torque overload gap per the drive drawing
2. Clarifier Mechanism
- a. Installation
 - 1) Confirm that the upper and lower manifold seals are installed properly.

END OF SECTION

Attachment: Evoqua Inspection Report



evoqua
WATER TECHNOLOGIES

INSPECTION REPORT

LAKE CITY SOUTH CAROLINA



01/27/2020

Doug Pimlott

Tel: 262-521-8468

Fax: 262-521-8272

douglas.pimlott@evoqua.com

www.evoqua.com

Equipment: General Clarifier Evaluation.

Purpose – Lake City, South Carolina owns and operates two (2) Circular Clarifiers under project number 14079-02. The clarifier type for each is a 70-foot rim flow Tow Bro, with 12' 2" side water depth. It was reported the units were not working and needed evaluation.

Initial Findings – We were met by the plant staff and entered the premises for introductions. I was accompanied by Tommy Lawson from Heyward. We met with plant staff who were very accommodating for our visit.

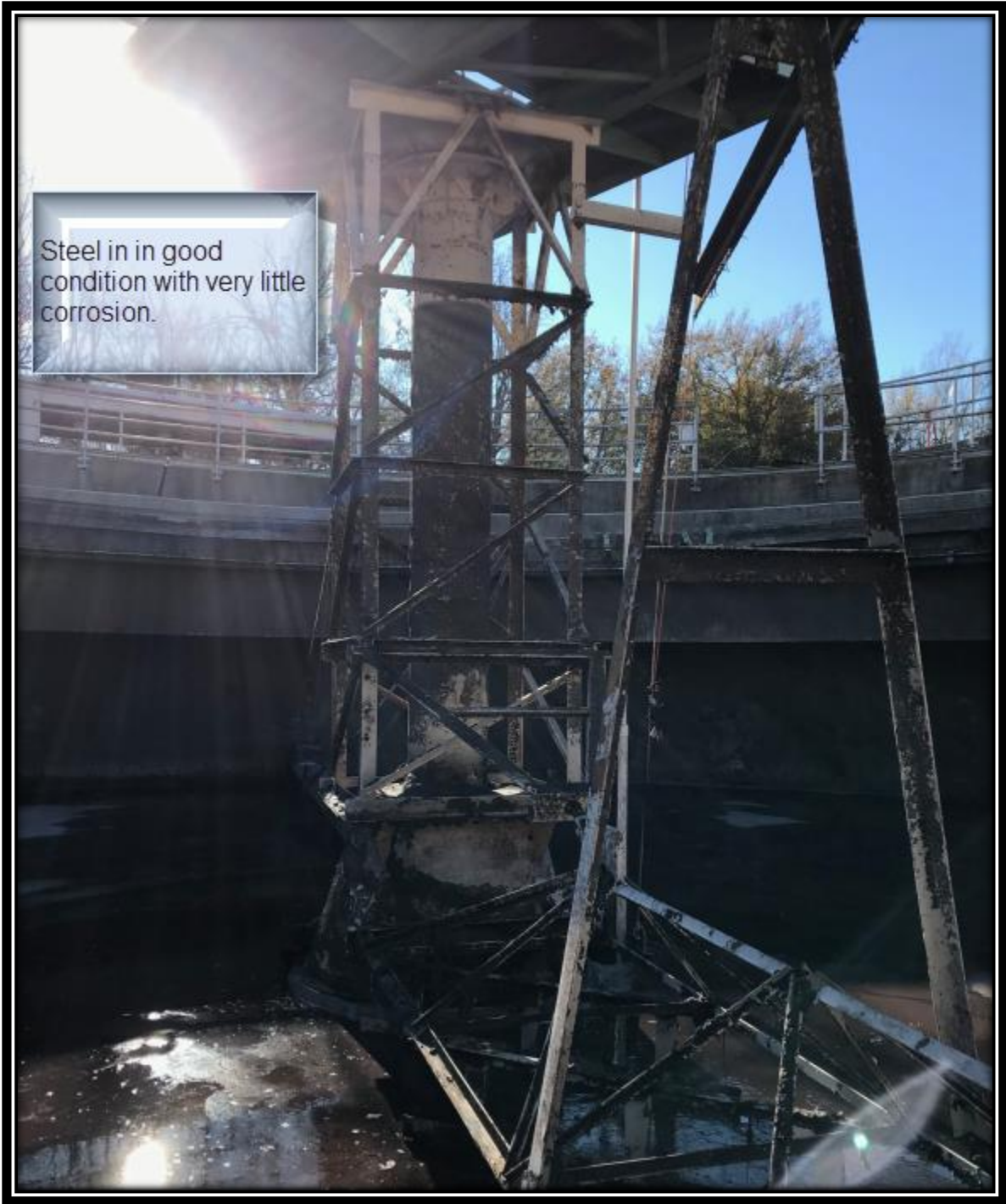
The tank for one of the units was drained with proper ladder access upon arrival. This evaluation is based on this unit.

Overall Structural:

The overall structural steel appears to be in relatively good shape as the clarifier is approximately 25 years old. There were some places where the topcoat of paint was starting to peel, however the original factory coat appeared to be in good condition.

The welds were evaluated at typical break points and all appeared in good shape, with no obvious signs of damage. Often, when the skimmer gets caught on the scum trough it can tear the welds at the A-frames. This area was cleaned and evaluated with no obvious signs of failure or damage, indicating the unit had likely never experienced a skimmer / scum beach collision.

There was very little evidence of corrosion or steel fatigue. Overall, the client can expect to enjoy many more years of service out of this unit.

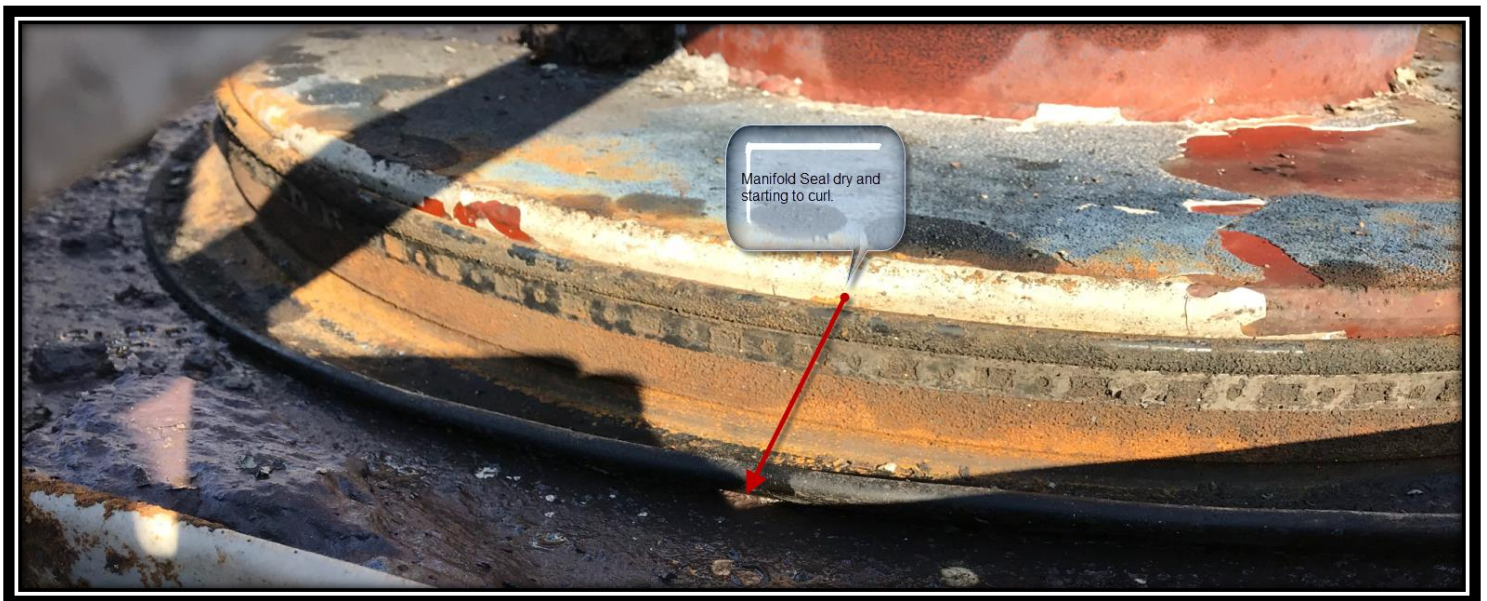




Manifold Seal –

Both the upper and lower manifold seal need replacement.

They are both present however, are dry and starting to curl up. It is a relatively low cost to replace and prior to starting back up the unit, it is recommended to replace the seals.



Unitube Header.

The Header appears to be in good condition with regards to corrosion. The hot dip galvanized (HDG) coating is starting to deteriorate, however HDG is by design self-sacrificing and there is little to no degradation of the base steel. The unit is, however, filled with solids which have clogged the orifices. This will inhibit solids removal from the floor, as well as add unwanted weight to the header side of the clarifier thus throwing the unit out of balance. This can be remedied in-house by using plant water to hose out the header. The unit can be flushed by using a spray hose and flushing the orifice holes from the periphery hole to the center. It may take several passes, and when water comes out with little solids, the flush is complete.



Weirs and Baffles –

The Weirs and baffles also appear to be in an overall good condition. UV tends to make fiberglass reinforced plastic brittle over the years, however, the integrity of the fiberglass has lasted well, and the FRP appears to be in fair condition for its age. There is a ~ 14 ft section missing - it appears the skimmer got hung up on it and damaged some sections. This should be replaced prior to starting up the unit. The rest of the weirs and baffles can be saved and used as is.



Drive -

The drive is in a state of disrepair. The unit has a design life of 20 years which can be extended with good maintenance. The unit is ~ 25 years old. The drive showed oil around the base of the drive much of which appeared to have been emulsified and had been there for some time. We checked the oil in the lower turntable and a small amount of water was present with little to no oil. It is likely the bearings have not seen lubrication for many years while the unit was in operation. The unit should be replaced prior to start up.



Inspectors closing comments –

Structurally the units appeared to be in good shape for their age (approximately 25 years). There was very little loss of material regarding steel surfaces. The client can enjoy many years of operation from this unit with regards to the structural steel members. The drive should be replaced immediately, and the weirs and baffles should be replaced in the section that is damaged. Both should occur prior to putting the unit back into service. Cleaning and flushing the header should occur prior to these repairs, however, this requires no material purchase, and can be done by plant labor.

With regards to the second, similar unit installed under this project number. While time did not permit for an evaluation of this unit, it seems reasonable to assume that similar conditions exist. Based on our observations and the life of the equipment, we would recommend planning for (if not performing) a replacement of unit's drive mechanism, at a minimum.

Should you have any questions regarding this report or unit please do not hesitate to call me.

Doug Pimlott,

Doug Pimlott

Evoqua Water Technologies LLC
N19W23993 Ridgeview Pkwy, Suite 200
Waukesha, WI 53188
Tel: 262-521-8468
Fax: 262-521-8249
douglas.pimlott@evoqua.com
www.evoqua.com

**SECTION 11350
BELT FILTER PRESS REFURBISHMENT**

PART 1 GENERAL

1.1 SCOPE OF WORK

- A. Furnish all labor, equipment, tools, materials, and other facilities to rebuild an Andritz belt filter press used in wastewater treatment. The belt filter press is an Andritz Model CPF 2.0 Meter SMX-S8.
- B. The Owner will furnish the new top belt and bottom belts for replacement.
- C. The new control panel shall not be installed until the City has repaired the roof of the dewatering facility.

1.2 QUALITY ASSURANCE

- A. Technical Services: Provide services of the original equipment manufacturer's service engineer complying with the following:
 - 1. Installation - One day, one trip.
 - 2. Start-up - One day, one trip.

1.3 SUBMITTALS

- A. Product data: Within 30 calendar days after the Contractor has received the Owner's Notice to Proceed, submit:
 - 1. Materials list of items proposed to be provided under this Section.
 - 2. Literature and drawings describing the equipment in sufficient detail, including parts list and materials of construction to indicate full conformance with the specifications.

PART 2 PRODUCTS

2.1 ITEMS TO BE REPLACED

- A. The following items shall be removed and replaced by the original equipment manufacturer:
 - 1. 4-Air bellows
 - 2. 4-Air bellows (replaces item 131410460)

BELT FILTER PRESS REFURBISHMENT

3. 8-Shower seal 3" wide x 1/16" thick x 90" long
4. 2-Seal 4" wide x 1/8" thick x 163" long
5. 1-Seal headbox end eliminator
6. 2-Emergency stop
7. 2-Limit switch lever
8. 2-Limit switch
9. 1-Top belt (provided by the Owner)
10. 1-Bottom belt (provided by the Owner)
11. 1-Control Panel including the following:
 - a. NEMA 4X, 316 SST enclosure
 - b. Main circuit breaker disconnect
 - c. AB Powerflex VFD
 - d. Bussman power fuses
 - e. Control voltage transformer, surge suppressor
 - f. Rockwell CompactLogix PLC, I/O and Ethernet communication
 - g. Rockwell PanelView with OIT 10" color touchscreen
 - h. Ethernet switch
 - i. Misc relays, power supplies, circuit breakers, switches, terminals and hardware
 - j. Enclosure AC unit

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Contractor shall not take the existing belt filter press out of service until all required parts and materials are on site and available. Once all parts and materials are on site, the Contractor shall coordinate with the OEM complete the work of installation and testing within seven (7) days.
- B. Contractor shall coordinate with the OEM to install all parts in accordance with manufacturer's instructions and approved shop drawings. Prior to start-up of the press, the manufacturer shall inspect the installation, make necessary final adjustments and certify the units ready for operation.

BELT FILTER PRESS REFURBISHMENT

3.5 FIELD TESTING

- A. The belt filter press shall be field tested by the manufacturer to determine that the assembly and installation is correct.

END OF SECTION

SECTION 11372
POSITIVE DISPLACEMENT BLOWERS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Work included: Provide seven (7) horizontal, electric motor driven positive displacement blowers with all appurtenances as indicated and specified, and as needed to provide a complete and proper installation ready for operation.
 - 1. Provide blowers in the following locations:
 - a. New Blower Building.
 - b. Existing Blower Building.

1.2 QUALITY ASSURANCE

- A. Referenced manufacturer is the Gardner Denver (Sutorbilt) of Quincy, IL and is named to establish standards of quality. Equal products of other manufacturers and system suppliers conforming to these specifications may be provided as outlined in the Bid Form.
- B. Technical services: Provide a service engineer for the following periods of time:
 - 1. For start-up and performance testing - One 2-day trip.
 - 2. Six months after acceptance of equipment - One 1-day trip.
- C. Perform factory testing as specified hereinafter:
 - 1. Do not ship units until approval of factory test results.

1.3 SUBMITTALS

- A. Comply with pertinent provisions of Division 1.
- B. Product data: Within | calendar days after the Contractor has received the Owner's Notice to Proceed, submit:
 - 1. Materials list of items proposed to be provided under this Section.
 - 2. Manufacturer's specifications and other data needed to prove compliance with the specified requirements.

POSITIVE DISPLACEMENT BLOWERS

- 3. Shop drawings showing plan, elevation and sectional views, materials of construction, location and size of anchoring eyes, and complete data on power section.
 - 4. Names and addresses of the nearest service and maintenance organization that readily stocks repair parts.
- C. Provide for approval at appropriate time (3) copies of factory test reports.
- D. Provide Operation and Maintenance manuals complying with Division 1.

1.5 **WARRANTY**

- A. Comply with pertinent provisions of Division 1.

1.6 **SPARE PARTS**

- A. Provide the following spare parts:
 - 1. One pressure gauge for each blower package size.
 - 2. One replacement filter media for each blower package size.

PART 2 - PRODUCTS

2.1 **BLOWER PERFORMANCE**

- A. Provide blowers with the following operating conditions:

Blower	No. 1	No. 2	No. 3	No. 4	No. 5	No. 6	No. 7
Location	Ex. Blower Bldg.	Ex. Blower Bldg.	Ex. Blower Bldg.	Ex. Blower Bldg.	New Blower Bldg.	New Blower Bldg.	New Blower Bldg.
Capacity (scfm)	1,600	1,600	1,600	1,600	2,500	2,500	2,500
Discharge Pressure (psig)	8	8	5	5	8	8	8
Operating Speed (rpm max)	3,327	3,327	3,244	3,244	1,943	1,943	1,943
Motor Horsepower	100	100	60	60	125	125	125
Power (Ph, Volts, Hz)	3, 480, 60	3, 480, 60	3, 480, 60	3, 480, 60	3, 480, 60	3, 480, 60	3, 480, 60

2.2 BLOWER

- A. Positive displacement rotary blower for oil free atmospheric air
 - 1. Three-lobed rotors with ground profile, statically and dynamically balanced, made in nodular cast iron GS 400-15 EN 1563.
- B. Casing with integrated LOW PULSE device for damping pressure impulses, reinforced with ribbing to eliminate distortions caused by loads and made in high strength grey cast iron G250 EN 1561.
- C. Side-covers reinforced with ribbing to resist induced loads from shafts, made in high strength grey cast iron G 250 EN 1561.
- D. Shafts integrated with rotors made in nodular cast iron GS 400-15 EN 1563 or coupled to rotors by means of forced coupling and key, made in steel C40 EN 10083/1.
- E. Cylindrical Roller bearings for a calculated operating life of 100,000 hours at the maximum design speed and pressure conditions
- F. Maximum peripheral speed of the lobe head below 40 m/s (131.2 feet per second).
- G. Timing gears with helical toothed wheels and involute profile, hardened and grounded, made in steel.
- H. 16 Mn Cr 5, coupled to the shafts by means of forced coupling with cone 1:50 and with pressurized oil mounting and demounting.
- I. Utilizes piston ring seals on each shaft.
- J. Oil seal on each shaft, without sliding parts and wear free coupled with labyrinth seal to prevent the leaking of oil vapor into the air chamber of the blower.
- K. Oil seal on the drive shaft by means of lip seal ring in high strength rubber (VITON) and hardened and ground shaft protection sleeve to ensure extended working life.
- L. Lubrication of all bearings (drive side and gear side) and of the timing gears by oil bath with oil.
- M. Splash disks locked onto the drive shaft

2.3 BASE FRAME

- A. Provide base frame supporting both the blower and motor integrated with anti-vibration mounts.

2.4 MOTORS

- A. Drive each blower by a premium efficiency electric motor with the characteristics in the table above.
- B. Service factor of 1.15.
- C. Chemical and mill duty with Class F insulation.
- D. Cooling system TEFC casing cooled with external fan on the shaft.
- E. Over-temperature Class B.

2.5 V-BELT TRANSMISSION

- A. Provide V-belts with V cross sections.
- B. Service factor greater than or equal to 1.4
- C. Belt tensioning device based on the motor weight with automatic compensation for the belt stretching and maintenance free.

2.6 SOUND ENCLOSURE

- A. Provide sound enclosure made up of modular self-supporting panel in steel with a white powder coating.
 - 1. Panels to include sound-absorbing material consisting of open cell polyurethane foam thickness, 2" with profiled finish, fire resistant according to ISO 3795.
 - 2. Seal between the panels by means of special rubber joints to ensure airtight closure.
- B. Hood ventilation with auxiliary electric motor driven fan. 1-phase, 120-volt, 60 Hz.
- C. Hood air inlet and outlet ducts silenced with a lined single-chamber plenum and lined bends.

2.7 ACCESSORIES

POSITIVE DISPLACEMENT BLOWERS

- A. Provide inlet silencer for reduction of the sound energy emitted in the base frequency of the compressor and a second absorption section for the reduction of the sound energy.
- B. Provide discharge silencer consisting of diffusion and resonance sections.
- C. Provide an inlet filter in the inlet silencer with a filter efficiency of 93% on 10 micron particles using paper media.
- D. Provide direct acting spring loaded safety valve fitted on the outlet of the discharge silencer in order to limit the differential pressure on the blower.
- E. Provide each blower unit with all required interconnecting piping from the inlet filter to the discharge silencer.
- F. Provide a factory installed rubber (EPDM) coated flapper plate type check valve.
- G. Provide a discharge pressure gauge, 2.5" diameter in glycerine bath.
- H. Provide a vacuum gauge for measuring filter clogging, 2.5" diameter.
- I. Normally closed temperature switch. Contacts open on temperature rise at 140-degrees F.
- J. Fan Control Panel:
 - 1. Digital temperature switch.
 - 2. Timing relay.
- L. Temperature gauge.

PART 3 - EXECUTION

3.1 FACTORY TESTING

- A. Test each blower prior to shipment to indicate conformance with the previously indicated performance criteria.
- B. Submit certified copies of test data complying with Paragraph 1.3 of this Section.

3.2 INSTALLATION OF BLOWER UNITS

- A. Locate blowers(s) as indicated on the Drawings.

POSITIVE DISPLACEMENT BLOWERS

- B. Block and shim as necessary to place at proper elevation plumb and level.
- C. Install concrete equipment pad with stainless steel anchor bolts.
 - 1. Use 4000 psi concrete complying with Section 03300.
- D. Snug down anchor bolt nuts on concrete equipment pad completely under prefabricated bases.

3.3 PIPING

- A. Install suction and discharge piping, as indicated on the Drawings.
- B. Locate interior piping parallel with, or at right angles to, walls, ceilings, equipment, etc. unless otherwise indicated.
 - 1. Use torque wrench, alternately tightening bolts 180° apart until full gasket flow and seal are secured.
 - 2. Bias cut or unusual refacing of any flange will not be acceptable.

3.4 FIELD WIRING

- A. Comply with pertinent provisions of Division 16.

3.5 PAINTING

- A. Comply with Section 09900.

3.6 TESTING

- A. Operate blower demonstrating proper operational and control sequence.

END OF SECTION

**SECTION 11375
FINE BUBBLE MEMBRANE DIFFUSERS**

PART 1 GENERAL

1.1 SCOPE OF WORK

- A. Work included: Provide all labor, material and equipment to furnish and install the new fine bubble aeration system as shown on the contract drawings and as specified herein. The Equipment Manufacturer shall furnish fine bubble membrane diffused aeration equipment for installation in two (2) new tanks, each 125' long x 30' wide x 14' SWD. Also included will be a field inspection of the existing aeration tanks to help identify deficiencies that are in need of correction.

1.2 QUALITY ASSURANCE

- A. The referenced manufacturer is Evoqua Water Technologies of Waukesha, WI and is named to establish standards of quality. Equal products of other manufacturers complying with these Specifications and conforming to the Bid Form may be provided upon pre-approval by the Engineer.
- B. With the general arrangement drawing submittal, the manufacturer shall provide certified data documenting the integrity of the membrane.
1. All membrane endurance test data shall be certified by an independent Registered Professional Engineer or testing laboratory.
 2. This certified data shall consist of an accelerated endurance test over a minimum 1,000,000 expansion and contraction cycles. Minimum cycle time shall be 3 secs. air on and 3 secs. air off.
 3. Testing shall be done with a full size membrane and holder frame assembly and shall be submerged completely under a minimum of 36 inches of water column.
 4. The tested air rate across the diffuser shall be at a flux rate of 8.5 scfm/sq. ft. of perforated membrane area.
 5. Test data shall demonstrate the membrane to exhibit no deterioration in elasticity or elongation in membrane aperture size by more than 1% during such testing.
 6. Full size membranes, which have been endurance tested, shall be provided for examination by the Engineer. In lieu of the certified test data, the manufacturer shall supply 100% spare diffuser sites and 50% spare membranes.

FINE BUBBLE MEMBRANE DIFFUSERS

- C. The manufacturer shall furnish the services of a competent Representative experienced in the operation of the equipment to inspect the installation of the new equipment and instruct the plant operating personnel in the proper operation and maintenance of the diffused air equipment.
- D. After the new installation is complete and placed into operation, an additional site inspection will be provided whereby the Representative shall inspect the facility's existing installation to help identify deficiencies that are in need of repair/correction. Contractor is responsible for draining and cleaning the existing basin prior to this inspection and making corrections identified.

1.3 EXISTING BASIN REPAIR

- A. General - In addition to the construction of the new aeration facilities included on the project, a site evaluation will be performed to help identify deficiencies with the existing diffused aeration system. To help expedite the repair/correction of any deficiencies identified, an allotment of typical parts needed for repairs will be provided as part of this project. If additional parts are required, they will be documented and provided as directed at an additional cost. Parts not used will be retained by the owner for future use as plant spares. If additional plant spares are desired by the owner, they can be provided at an additional cost. Contractor will include in their bid all labor, time and equipment required to install all materials included in Section B - Components.
- B. Components:
 - 1. Membrane diffuser assembly to include membrane holder, membrane, 316 clamp, hardware and all gaskets required to install on existing (or new) boss. Provide (twenty) 20 assemblies.
 - 2. Diffuser membrane and new 316 clamp and hardware to attach to existing holder. Provide twenty (20) units.
 - 3. 1-1/2-inch PVC Boss. Provide twenty (20) units.
 - 4. Boss Caps with band clamps. Provide twenty (20) units.
 - 5. Fixed Support assemblies to include 316 threaded rod, anchor adhesive, pipe clamp halves and all hardware required for new support installation. Provide ten (10) 4-inch assemblies and ten (10) 8-inch assemblies.
 - 6. Expansion Support assemblies to include 316 threaded rod, anchor adhesive, pipe clamp halves and all hardware required for new support installation. Provide ten (10) 4-inch assemblies and ten (10) 8-inch assemblies.

FINE BUBBLE MEMBRANE DIFFUSERS

1.4 SUBMITTALS

A. Shop Drawings

1. Shop drawings shall be submitted to the Engineer for approval. Shop drawings shall include dimensional layouts, materials, details of appurtenances, anchoring, installation, and operation instructions. Fabrication and installation shall be in accordance with approved drawings.
2. Certified diffuser performance test data shall be submitted. It shall include air flow versus headloss data, and Standard Oxygen Transfer Tests conducted in clean water in accordance with the latest Standard published by the ASCE Subcommittee on Oxygen Transfer Standards.
3. SOTE calculations to verify the clean water oxygen transfer efficiency of the diffuser at both design and maximum airflow.
4. Headloss Calculations for the complete aeration system shall start from the top of the drop leg and continue to the furthest diffuser. Calculations shall include the total headloss across the membrane, balancing orifice, piping system and static head at both design and maximum airflow.
5. Six (6) copies of the manufacturer's operation, installation and maintenance manual shall be submitted for approval prior to shipment of the equipment.

PART 2 PRODUCTS

2.1 GENERAL

- A. Provide fine bubble, flexible membrane aeration system complete up to and including the stainless steel flange at the top of the tank.

1. The Equipment Manufacturer shall furnish the items listed below:
 - a. Drop Pipe(s)
 - b. Manifold(s)
 - c. Distribution Header(s)
 - d. Fine Bubble Diffusers
 - e. Supports
 - f. Airlift Purge System(s)

2.2 DESIGN CRITERIA

- A. The diffuser system shall have an oxygen transfer efficiency, under standard conditions, using the non-steady state procedure outlined herein, as follows:

FINE BUBBLE MEMBRANE DIFFUSERS

DESIGN CONDITION	STANDARD OXYGEN REQUIREMENT (LBS O ₂ /DAY)	AIR FLOW (SCFM)	MINIMUM O.T.E. %
AVERAGE (PER BASIN)	14,752	2,500	24.26

*Design parameters are for each aeration basin.

- B. Maximum flux rate 2.59 (scfm/sq. ft. perforated membrane area).
- C. Area of tank/ Area of diffuser* (perforated area) 4.09.
- D. Diffuser area is defined as the horizontally projected surface of the diffuser.

2.3 DROP AND MANIFOLD PIPING

- A. Pipe and fittings shall be fabricated from sheets and plates of (Schedule 5) (Schedule 10) 304L stainless steel having a maximum carbon content of 0.3% and a 2D finish. The connecting flange shall be loose, follower type.
- B. Manifold piping shall include outlets for distribution headers. Outlets shall be provided along the (bottom) (side) centerline of the manifold.
 - 1. Manifold piping shall be PVC fabricated per ASTM D 1785, Schedule 40.
- C. Any connections between pipe sections shall be expansion type allowing independent rotation of sections.
- D. All manifold ends shall be furnished with a 4" minimum diameter threaded clean-out.
- E. Manifold supports shall be ANSI 304 stainless steel. Spacing shall not exceed 8'.

2.4 AIR DISTRIBUTION HEADER PIPING AND SUPPORTS

- A. The distribution piping shall be 4" diameter, SCH 40 PVC, conforming to ASTM D 1784 and 1785, with a hydrostatic design stress rating of 2000 psi. Piping shall be ultraviolet stabilized with T10₂. Header section lengths shall not exceed 20'.
 - 1. All connections between pipe sections, pipe and fittings, or fittings, shall be expansion type couplings allowing for thermal expansion over a range of 120°F.
- B. Distribution pipe shall be provided with factory installed, high strength, glass

FINE BUBBLE MEMBRANE DIFFUSERS

reinforced PVC mounting saddles, threaded for mounting diffuser holders.

1. Laboratory test data shall be provided to show that the disc diffuser assembly, which includes manufacturer's holder, diffuser mount and PVC header pipe can achieve a minimum of 5.0 million cycles with a constant 185 in. -lb. peripheral bending load when rotated at a minimum of 100 rpm.
 2. Air shall be constantly discharged through the assembly at a design air flow rate at a minimum temperature of 120° F throughout the test. Field installation of mounting saddles shall not be acceptable.
 3. Distribution piping furnished with factory installed holders shall be shipped crated to prevent damage during shipment and storage.
- C. Threaded end plugs, which can be removed for cleaning, shall be used at the end of each air header. Solvent weld end caps are not acceptable.

2.5 PIPE SUPPORTS

- A. Distribution pipe support spacing shall not exceed 8' and shall allow a minimum vertical adjustment of " 2" and lateral adjustment of " 7/8".
1. Support anchors shall be ANSI 316 stainless steel.
 2. Pipe supports shall be designed to provide a pipe flexural stress less than 750 psi at the maximum operating diffuser air rate.
 3. Certified calculations, stamped by a registered professional engineer, shall be submitted with shop drawings to verify this design.
 4. Supports shall be secured by two (2) type 304 stainless steel threaded rods with a minimum diameter of 1/2" and anchored to the concrete by vinylester resin adhesive designed for long term wet base conditions.

2.6 DIFFUSERS

- A. Diffuser membrane shall be an EPDM based elastomeric material with an ultraviolet inhibitor and compounds designed for resistance to chemical attack, weathering and aging.
1. Data shall be provided to show the types of chemicals the membrane is resistant to.
 2. The membrane shall be secured onto the 20" diameter mounting holder with a tongue and groove lip designed to increase the tension on the point of engagement as the diffuser air rate increases.
 - a. The membrane shall be further fastened to the holder with a type 316

FINE BUBBLE MEMBRANE DIFFUSERS

stainless steel clamp band with stainless steel hardware. The band shall be reusable and furnished with an integral adjustment screw for fastening.

- b. Diffuser holders which do not have a stainless steel retaining ring/band to securely hold the membrane in place and allow easy replacement, will not be allowed. All metallic diffuser components shall be type 316 stainless steel; type 304 stainless steel shall not be acceptable. Tube shaped diffusers are not acceptable.
- B. The diffuser membrane shall have a minimum flexure of 1-1/4" at the operating air rate required to meet the minimum SOR as specified herein. Certified test data, calculations, and photographs shall be provided to document this capability.
 - C. The membrane mounting holder shall consist of polypropylene, glass filled for structural rigidity.
 1. The membrane holder shall have an integral back flow prevention mechanism.
 2. The back flow valve shall be designed without mechanical moving parts.
 3. If the backflow mechanism is designed with moving parts, the Manufacturer shall provide certified data at the time of shop drawing submittal and as prepared by an independent consultant documenting the operation of the backflow mechanism over a minimum of 15,000 cycles in wastewater, without mechanical failure or jamming.
 - D. Diffusers shall be shipped completely assembled to the job site.
 - E. Diffuser headloss shall be a minimum of 5" water column to assure adequate distribution under all conditions and shall not exceed 25" water column at the air flow rate corresponding to the maximum design range of the diffuser.
 - F. A glass filled PVC mounting saddle shall be factory solvent welded to the PVC distribution piping to allow ease in attaching the diffuser element.

PART 3 EXECUTION

3.1 GENERAL

- A. Diffusers shall be installed as shown in conformance with the recommendations of the manufacturer. Particular care shall be taken to ensure that all diffuser air connections on a single header are installed in a single horizontal plane within a tolerance of plus or minus 3/8 inch.

3.2 FIELD TESTING

FINE BUBBLE MEMBRANE DIFFUSERS

- A. After the piping, headers, and diffusers for any tank have been installed, clear water shall be introduced into the tank until the diffusers have been covered about 2 inches. Compressed air shall then be released through the piping and any leaks through joints, piping, and the like shall be repaired. This test shall be repeated until the entire system is tight, to the satisfaction of the Engineer. Testing will be done by the Contractor under the direction of the Engineer.
- B. By visual inspection, air release shall be shown to be uniform for each diffuser and header section.
- C. The Contractor shall make all modifications and repairs until the system passes all tests at no cost to the Owner.

END OF SECTION

**SECTION 11379
SEPTAGE RECEIVING STATION**

PART 1 - GENERAL

1.1 SCOPE OF WORK

- A. Furnish all labor, materials, equipment and incidentals required, and install, test completely and make ready for operation, one septage receiving station as shown on the Drawings and specified herein. The septage receiving station will consist of a spiral assembly, screen basket assembly, transport tube assembly, press zone assembly, discharge assembly, drive system, tank assembly, flow meter, plug valve and controls.
- B. The septage receiving station will be designed to receive septage through an influent pipe on the tank assembly. The influent will be directed to the internal surface of the screen basket where the larger solids will be retained. The spiral will transport the solids up the screen basket through the transport tube and into the press zone where they will be dewatered. The dewatered solids will then be discharged to a receptacle (provided by others).

1.2 SUBMITTALS

- A. Submit materials required to establish compliance with this Section. The submittal shall include the following:
 - 1. The name and address of the receiving station manufacturer.
 - 2. Certification of experience in manufacturing and providing septage receiving stations with associated equipment including components described herein.
 - 3. Description of a minimum of five installations by the proposed equipment manufacturer using similarly sized components. Include the names and contact information for references at each installation.
 - 4. Certification of one-year full warranty for all equipment per specification.
 - 5. Certified dimensional drawings of each item of equipment and auxiliary apparatus to be furnished, and the weight of each item.
 - 6. Certified foundation and anchor bolt plans and details.
 - 7. Certified shop and erection drawings showing all important details of construction. Shop drawing submittals shall include all materials of construction, descriptive data, performance characteristics, drawings, piping diagrams, wiring schematics, and shall indicate complete

SEPTAGE RECEIVING STATION

compliance with these Specifications. Cut sheets from promotional or sales literature shall not be acceptable.

8. A statement certifying bearing life.
 9. Manufacturer's certified station performance curve or statistics, to satisfy the specified design conditions, Catalog sheets showing a family of curves will not be acceptable.
 10. Certification that the manufacturer of the pre-fabricated control panel has a minimum of five years of experience in the design, manufacture, and start-up of septage receiving stations, and has a minimum of 5 installations in service.
 11. Descriptive literature, bulletins and catalogs of the equipment.
 12. The total weight of the equipment including the weight of the single largest component,
 13. A complete total bill of materials.
 14. Complete description of surface preparation and shop prime painting for all equipment.
 15. Detailed electrical drawings of all equipment including the control panel. Electrical and control submittals shall include a written description of the sequence of operation, metering equipment, alarm points, alarm sequences, and all other elements included.
 16. Upon completion of installation, submit statement certified by equipment manufacturer that the installed system meets or exceeds the requirements of the manufacturer and the specified requirements. Include certified reports of all tests conducted during start-up as specified.
- B. Test Reports
1. Submit certified copies of results of tests performed by the manufacturer on the septage receiving station equipment, as specified herein.
- C. Operation and Maintenance
1. Submit operating and maintenance instructions. The instructions shall be prepared specifically for this installation and shall include all required cuts, drawings, equipment lists, descriptions, etc, that are required to instruct operating personnel unfamiliar with such equipment. Operations and maintenance instructions shall be provided for mechanical, electrical,

SEPTAGE RECEIVING STATION

instrumentation, and all other elements included in this Section but not specifically referenced.

- D. In the event that it is impossible to conform with certain details of the Specifications, describe completely all non-conforming aspects.

1.3 QUALITY ASSURANCE

- A. Reference manufacturer is JWC Environmental, Series SRS3235 Honey Monster Receiving Station and Model PC2450 Controller, Huber or approved equal.
- B. All Septage Receiving Station equipment shall be furnished by a single manufacturer who is fully experienced, reputable and qualified in the manufacture of the equipment to be furnished. The equipment shall be designed, constructed and installed in accordance with the best practices and methods. This Section calls attention to certain features, but does not purport to cover all details entering into the design and construction of the equipment.
- C. As described in Paragraph 1.03, submit certification in manufacturing and satisfactory evidence of relevant experience in each component as listed below.
 - 1. Septage Receiving Station equipment: 5 years Five (5) Operating Installations.
 - 2. Pre-fabricated control panel: 5 years
- D. Septage Receiving Station manufacturers unable to meet all of the specified experience requirements will not be acceptable.
- E. All components of the equipment to be furnished shall be fully compatible with each other and be designed for extended service.

1.4 WARRANTY

- A. The CONTRACTOR shall guarantee all materials and equipment furnished and WORK performed for a period of one (1) year from the date of SUBSTANTIAL COMPLETION.
- B. Manufacturer submits a document clearly identifying the scope, term and exclusions of coverage for a standard 12-month limited warranty plus 5-year warranty on the wet end of the grinder including coverage for failure from excessive wear of the cutters, spacers, seals, bearings and shafts.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Packaging

SEPTAGE RECEIVING STATION

1. Containers or skids shall be constructed for normal shipping, handling, and storage.
2. Containers shall provide adequate protection for the equipment in a dry indoor environment.

PART 2 - PRODUCTS

2.1 SEPTAGE RECEIVING SYSTEM

A. General

1. The septage receiving station(s) shall effectively reduce, separate, wash and de-water septic waste that has been delivered to the system. The septage receiving station shall record transaction data and provide the information for use.

B. Performance

1. Septage receiving station(s) shall be rated for 1000 GPM clean water flow.
2. Septage receiving station(s) shall be rated for 15 PSI maximum inlet pressure.

2.2 METAL TRAP

A. Description

1. The metal trap shall reduce inlet velocities to allow large metal and other large objects entrained in the process flow to be captured and removed at a convenient location. A manual knife gate shall allow the captured objects to be discharged into a debris receptacle for draining of excess liquid and disposal of the large objects.

B. Components

1. Metal Trap shall be constructed of AISI 304 stainless steel and PVC/stainless steel knife gate.
2. A 4-inch cast aluminum male cam & groove fitting with removable cap shall provide connection to inlet feed hoses.
3. A velocity reduction zone shall reduce velocities to 3 ft/s (.91 m/s) at 375 GPM (23.6 l/s)
4. A manual knife gate shall be used to open the trap to release captured objects into the debris receptacle.

SEPTAGE RECEIVING STATION

5. Debris receptacle shall have a 4-inch NPT drain and a removable basket with ½-inch (13 mm) perforations.

2.3 INLET PIPING

A. Description

1. Inlet piping shall provide connection between the metal trap, grinder, plug valve, flow meter, and tank.

B. Components

1. Inlet Piping shall be constructed of passivated AISI 304 stainless steel.
2. Pipe segments shall have 4-inch class 150 lb weld neck flanges.
3. Gaskets shall be constructed of 1/8 neoprene rubber.
4. Fasteners shall be constructed of 18-8 stainless steel.

2.4 GRINDER

A. Description

1. Grinder shall reduce inlet solids for protection of other components and enhance the separation, washing, and de-watering process. Grinder shall be two shafted design consisting of individual cutters and spacers. Grinder shall have a single piece main body housing consisting of pipe flanges and inspection ports. Cutter cartridge shall be removable with the main body housing remaining in situ. Grinder shall have motor and speed reducer for cutter drive.

B. Components

1. Cutters and Spacers
 - a. Cutting stack height shall be a nominal height of 12-inches (305 mm).
 - b. 7-tooth cam cutters, 0.438 in. thick 55-60 HRc Chromium-molybdenum steel.
 - c. Spacers smooth O.D. 0.446 in. thick 34-42 HRc Chromium molybdenum steel.
2. Shafts
 - a. Shafts shall be constructed from ASTM 4140 alloy steel with a minimum tensile strength of 149,000 PSI (1,027 kPA).
 - b. Shafts shall be measure a nominal 2-inches (51 mm) across flats of hex.

SEPTAGE RECEIVING STATION

- c. Shafts shall be hardened to 32-38 Rockwell C.
3. Seal Cartridges
- a. Seals and bearing incorporated into a cartridge style design requiring no external seal flush or lubricants to operate wet or dry.
 - b. Rated for maximum operating depth: 346 feet (150 psi).
 - c. Secondary lip seal with grease barrier.
 - d. Dynamic and Static seal faces to be Tungsten carbide with 6% nickel binder.
 - e. Cartridge bushing and housing are AISI 304 stainless steel.
 - f. O-rings to be Viton (Fluorocarbon).
4. Housings and Covers
- a. Main body, gear, base, and end housings shall be ASTM A536-84 ductile iron.
 - b. Top cover and inspection port covers shall be ASTM A536-84 ductile iron.
 - c. Main body housing shall have inlet and outlet flanges with bolt pattern machined to class 150 4-inch pipe flange size.
 - d. Main body housing shall have integral side wall deflectors to direct solids into cutters.
 - e. Inspection port covers shall be on both inlet and outlet sides of main body housing.
 - f. End housing shall have integral bushing deflector to guide solids away from seal cartridges.
5. Speed Reducer
- a. Reducer shall be manufactured by Sumitomo Machinery Corporation of America.
 - b. Reducer shall be internal planetary mechanism with trochoidal curved tooth profile.
 - c. Reducer shall be a vertically mounted single 29:1 reduction.
 - d. Reducer shall be grease lubricated.
6. Motor
- a. Motor shall be manufactured by Baldor Electric Company.
 - b. Motor shall be 5 hp (4 kW), XPFC, 1725 rpm, 230/460 volt, 3 phase, 60 Hz.
 - c. Motor shall have a minimum service factor of 1.00, 87.5% minimum efficiency factor at full load, minimum 80% power factor at full load.
- C. Performance
- 1. Grinder shall have a maximum headloss of 11 inches (280 mm) of water column at 400 GPM of clean water (25 L/S).

SEPTAGE RECEIVING STATION

2. Grinder shall provide a peak shaft torque of 4,246 lb-in/hp (643 Nm/kW).
3. Grinder shall provide a peak force at cutter tip of 1,831 lbf/hp (10,921 N/kW).

2.5 PLUG VALVE

A. Description

1. The actuated plug valve shall provide security and regulate the process flow as controlled by the ultrasonic level sensor.

B. Components

1. Valve Body
 - a. Valve body shall be manufactured by Milliken and cast of ASTM A-126 iron class B.
 - b. Valve shall have 4-inch (100 mm) class 125 inlet and outlet flanges.
 - c. Valve body shall have 316 SST sleeve type metal shaft bearings, sintered, oil impregnated permanently lubricated.
 - d. The valve plug shall a cylindrical seating surface that is offset from the center of the plug shaft.
 - e. The valve plug shall be 100% encapsulated with Buna-N, 70 shore and shall withstand 75 lbs pull under test procedure ASTM D-429-73 Method B.
2. Actuator
 - a. The actuator shall be manufactured by Rotork and be model IQT125
 - b. The actuator enclosure shall be rated NEMA 4/4x/6 (IP68).
 - c. The actuator shall have a drive hand wheel for emergency manual operation.
 - d. A hand held infra-red IQ Setting Tool shall be included to make setting changes without removal of any covers.

2.6 FLOW METER

A. Description

1. The flow meter shall provide a discrete pulse output to the controller providing flow measurement of the processed fluid in gallons or liters.

B. Components

1. Flow meter shall be manufactured by Endress+Hauser.

SEPTAGE RECEIVING STATION

2. Flow meter body shall have class 150 4-inch inlet and outlet flanges.
3. Throat of flow meter body shall be coated with polyurethane.
4. Electrodes shall be AISI 316L stainless steel bullet nose type.
5. Control transceiver housing shall be rated NEMA 4X (IP67).

2.7 TANK ASSEMBLY

A. Description

1. The tank shall house auger assembly and spray wash assemblies for the purpose of separating undesirable solids from the processed fluid. The tank shall include covers for access and removal of the inclined screw conveyor for maintenance. The tank shall include mounting tubes for the ultrasonic level sensor. Two spray wash assemblies shall direct water onto to the captured solids and perforations of the incline screw screen trough for purposes of cleaning the captured solids. A third spray wash assembly shall direct water onto the tank walls for cleansing. The spray wash assemblies shall all be controlled from a single control loop with 1-inch NPT inlet connection.

B. Components

1. Tank
 - a. Tank shall have a class 150 4-inch inlet flange.
 - b. Tank shall have a 12-inch straight pipe discharge port.
 - c. Tank shall be constructed of passivated 10 gauge AISI 304 stainless steel.
 - d. Tank shall include lifting points for slings and separate lifting points for forklift.
 - e. Tank shall include mounting points for spray wash assemblies.
 - f. Tank shall have fully removable covers
2. Spray Wash Assemblies
 - a. Basket strainer shall be 304 stainless steel with 80 mesh screen.
 - b. Y-strainer shall be 304 stainless steel construction with a 20 mesh AISI 304 stainless steel screen.
 - c. Solenoid valves shall be bronze body construction with a 120-volt AC Coil, explosion proof.
 - d. Ball valves shall be manual and constructed of 304 stainless steel.
 - e. Pipe and fitting shall be constructed of 316 stainless steel.
 - f. Spray nozzles shall be constructed of 303 stainless steel, V-spray.
 - g. Nozzles shall be AISI 303 stainless steel and rated 1.5 GPM @ 40 PSI.

SEPTAGE RECEIVING STATION

- h. Tank spray rotating nozzle shall be AISI 304 stainless steel/polypropylene and rated 10 GPM @ 40 PSI.

2.8 PIVOT SUPPORT

A. Description

1. Pivot Support shall provide a structure for positioning and lifting of the inclined screw in or out of the tank. Pivot Support shall allow 3600 rotation of the inclined screw once removed from the tank. Pivot Support shall include a maintenance support stand for supporting of the inclined screw above the tank.

B. Components

1. Support and stand shall be constructed of AISI 304 stainless steel.
2. Support shall include braces for positioning of the Pivot Support relative to the tank.
3. Support stand shall allow inclined screw to disengage from stand without disassembly.
4. Pivot Support shall support inclined screw at a 35° inclination.

2.9 INCLINED SCREW CONVEYOR

A. Description

1. Inclined screw conveyor shall separate, transport, de-water, and discharge captured solids. Inclined screw shall include a perforated screen trough, transport segment, de-watering segment, packing gland, drive, and rotor. The baffles of the screen trough shall create an overflow weir for protection of excess flow.

B. Components

1. Perforated Screen Trough
 - a. Screen trough shall be constructed of AISI 304 stainless steel and electropolished to remove burrs.
 - b. Perforations shall be 1/4-inch (6 mm) diameter.
 - c. Screen trough shall have baffles mounted on either side of the trough with replaceable 1/4-inch neoprene seals attached to the baffles.
2. Transport Segment

SEPTAGE RECEIVING STATION

- a. Transport segment shall be constructed of passivated AISI 304 stainless steel.
 - b. Transport segment shall have 17-4PH wear bars.
 - c. Transport segment shall be 19-11/16 inch (500 mm) flange to flange.
3. De-watering Segment
- a. De-watering segment shall be constructed of passivated AISI 304 stainless steel.
 - b. De-watering segment shall have dual compartment design for shaft to enter in one compartment and captured solids into another compartment.
4. Packing Gland and Housing
- a. Packing shall be constructed of four (4) PTFE impregnated cords.
 - b. Packing Gland housing shall be constructed of AISI 304 stainless steel.
5. Rotor
- a. Rotor shall be constructed of alloy steel.
 - b. Lower section of rotor shall be 480mm diameter with 1/2-inch (12.7mm) groove for mounting of brush.
 - c. Brush shall mount into groove and be secured with set screws.
 - d. Rotor shall have a transition section from 480 mm to 285mm.
 - e. Rotor shall have a double helix 285 mm section prior to compaction zone.
 - f. Brush shall be single piece design with stainless steel backing and nylon bristles.
6. Speed Reducer
- a. Reducer shall be manufactured by Nord Gear Corporation
 - b. Reducer shall be helical parallel shaft mounted with a 160:1 reduction.
7. Motor
- a. Motor shall be manufactured by Baldor Electric Company.
 - b. Motor shall be 2 hp (1.5 kW), XPFC, 1725 rpm, 230/460 volt, 3 phase, 60 Hz.
 - c. Motor shall have a minimum service factor of 1.00, 84% minimum efficiency factor full load, minimum 79% power factor at full load.
8. Neoprene Tremie Tube

2.10 CONTROLLER

- A. Provide Control Panel in accordance with 16910.

SEPTAGE RECEIVING STATION

- B. Control panel shall accept 30A, 480v feed from the Main Switchboard MSB.
- C. Description
 - 1. A dual enclosure controller shall provide control of the septage receiving station components. The operator enclosure shall have a magnetic card reader, Operator Interface Terminal, printer and control devices for operating the system and providing data collection. The main enclosure shall have indicator lights, switches and other control devices. Provide local readout for flow from flow meter.
- D. Components
 - 1. Enclosures
 - a. Main enclosure shall be AISI 304 stainless steel NEMA 4X and house the control devices, motor starters, Emergency Stop and PLC.
 - b. Operator Enclosure shall be AISI 304 stainless steel NEMA 4X and house the printer, magnetic card reader, OIT with compact flash memory card recorder, and Start & Stop pushbuttons.
 - 2. Magnetic Card Reader (Operator Enclosure)
 - a. Card reader shall be rated for outdoor use.
 - b. Card reader shall provide identification and authorization for use of the system.
 - 3. Printer (Operator Enclosure)
 - a. Printer shall use 80 mm wide single roll thermal paper.
 - b. Printer shall print a transaction receipt that lists site address, date, time, user ID, and total flow processed.
 - 4. Operator Interface Terminal (Operator Enclosure)
 - a. OIT shall be rated for outdoor use.
 - b. OIT shall display fail, service reminder and operational messages.
 - c. OIT shall display Volume, Tank Level and Valve Position when processing a transaction.
 - d. OIT shall allow for a programmable system cleaning cycle.
 - e. Recorder shall store transaction data and provide transfer of the data via a memory card reader as a CSV file to a Personal Computer.
 - f. A custom template that formats the data shall be provided on CD.
 - 5. Start & Stop Pushbuttons (Operator Enclosure)
 - a. Pushbuttons shall be rated NEMA 4X.
 - b. Start pushbutton shall initiate operation of the system after successful identification and authorization of the user's PIN has been entered via the card reader or OIT.

SEPTAGE RECEIVING STATION

- c. Stop pushbutton shall initiate a stop of the system and immediately stop the grinder motor, and close the plug valve. Transaction data shall be written to the PLC data register and a transaction receipt printed. Tank spray wash solenoid shall energize and operate along with the auger motor and auger spray wash for the duration of the cleaning cycle.
6. Grinder ON/OFF/AUTO three-position keyed selector switch. (Main Enclosure)
 - a. In the ON position, the grinder shall run continuously.
 - b. In the AUTO position, the grinder shall operate as controlled by the START and STOP pushbuttons.
7. Auger ON/OFF/AUTO three-position keyed selector switch. (Main Enclosure)
 - a. In the ON position, the auger shall run continuously.
 - b. In the AUTO position, the auger shall operate as controlled by the START and STOP pushbuttons.
8. Plug Valve OPEN/CLOSE/AUTO three-position keyed selector switch. (Main Enclosure)
 - a. In the OPEN position, the plug valve will open.
 - b. In the CLOSE position, the plug valve will close.
 - c. In the AUTO position, the plug valve will open and close as controlled by the ultrasonic level sensor mounted on the tank.
9. RESET momentary two-position keyed selector switch. (Main Enclosure)
 - a. Switch shall be rated NEMA 4X
 - b. Reset switch shall clear any fault condition and rest system for operation.
10. Pilot Lights (Main Enclosure)
 - a. Lights shall be LED type rated NEMA 4X.
 - b. Lights shall indicate GRINDER RUN, AUGER RUN, PLUG VALVE OPEN and FAIL.
11. Emergency Stop Pushbutton (Main Enclosure)
 - a. Emergency Stop Pushbutton shall be rated NEMA 4X.
 - b. When activated Emergency Stop shall close plug valve, stop all motors and de-energize solenoid valves.
12. Motor Starter and Control Transformer (Main Enclosure)
 - a. Starter shall be a full-voltage reversing type with 120 volt operating coils.
 - b. Overload relays shall be adjustable and sized to full load amperes (FLA) of the motor

SEPTAGE RECEIVING STATION

13. I/O
 - a. All vendor supplied control panels shall be supplied with an Allen Bradley Micrologix Series PLCs along with all necessary Allen Bradley 1762 series I/O modules. The Micrologix PLC shall be capable of communicating via Ethernet/IP to facilitate integration into the plant's future SCADA system. Any other Ethernet/IP based devices located in the vendor supplied control panel should be configured to prevent local Ethernet/IP traffic from exiting the control panel. If additional hardware is necessary (such as a managed switch) it shall be provided to eliminate unnecessary traffic from entering out onto the future SCADA network.
14. The Control panel shall include space for a fiber/copper media converter for future use.
15. The control panel shall include a 20 amp, 1P, 120V ground fault breaker for external heat trace circuit.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Septage Receiving Station(s) and controller(s) shall be installed in accordance with the supplier's installation instructions, and in accordance with all OSHA, local, state, and federal codes and regulations.

3.2 OPERATION AND MAINTENANCE

- A. Submit operating and maintenance instructions. The instructions shall be prepared specifically for this installation and shall include all required cuts, drawings, equipment lists, descriptions, etc, that are required to instruct operating personnel unfamiliar with such equipment. Operations and maintenance instructions shall be provided for mechanical, electrical, instrumentation, and all other elements included in this Section but not specifically referenced.
- B. The manual shall emphasize:
 1. Detailed equipment drawings, including exploded views, sub-component enlarged views and similar graphics with parts numerically keyed to tabular descriptions with re-order number and material references, etc. Include all electrical wiring diagrams, with color and numeric codings identified. Show and label all terminal strips.
 2. Provide a complete and detailed system schematic to present the inter-relationship of the system components and to overview the operational

SEPTAGE RECEIVING STATION

concepts; include the normal range of all operational parameters, including all variables for sensors provided with the equipment.

3. Maintenance Schedule. Provide a 12-month schedule of all normal and periodic maintenance requirements of the equipment, including a typical daily list of observations, measurements and the like. Include any tolerance checks, adjustments, seasonal settings, lubrication requirements, filter replacements, instrument recalibration, etc, show each month on a separate page of the manual. Provide a list of three lubricants and three suppliers locally available.
4. Troubleshooting Section. Present entirely in tabular form, concise self-diagnostic information for out-of-spec equipment performance.
 - a. Provide three copies of each table laminated and suitable for wall or bulletin board mounting.
5. Narrative of Operation and Control. Provide a concise presentation of the basis of the equipment design, the fundamentals of equipment operation and the operation and control concept and detail of the specific installation, including full discussion of operation over the entire design range of conditions. Where appropriate, reference valve or gate positionings by tag numbers identified in the manual drawings referenced above.

3.3 SPARE PARTS

- A. A complete set of bearings, seals, macerator cutters, and gaskets, in addition to those parts reasonably expected to need replacement during the first year of operation.
- B. All spare parts including gaskets, seals and belts, with rubber or rubber-like components which age with exposure shall be given to the CMAR in sealed, airtight transparent containers, with the contents clearly labeled, including the date of packaging.
- C. All spare parts are to be wrapped in waterproof packages suitable for export service. Each individual package is to be labeled with the description and part number.
- D. Furnish a one-year supply of all grease and lubricants.

3.4 TESTING

- A. Test the Septage Receiving Station to demonstrate correct alignment, smooth operation and freedom of excessive vibration and noise. Test period shall include one cycle of processed fluid that demonstrates accurate measurement of the flow and all run cycles are properly set.

3.5 TRAINING

- A. A field training course shall be provided for operating and supervisory staff members. Field instruction shall cover all items contained in the operation & maintenance manuals.

END OF SECTION

**SECTION 11380
SUBMERSIBLE MIXERS**

PART 1 - GENERAL

1.1 SCOPE OF WORK

- A. Furnish all labor, materials, equipment and incidentals required and install submersible mixers, and appurtenances in the septage pump station as shown on the Drawings and as specified herein.

1.2 SUBMITTALS

- A. Submittals shall include at least the following:
 - 1. Certified shop and erection drawings and other data.
 - 2. Mixing and Power Calculations.
 - 3. Layout Drawings
 - 4. Literature and drawings describing the equipment and showing all important details of construction and dimensions.
 - 5. A list of the manufacturer's recommended spare parts, with the manufacturer's current prices for each item.
- B. In the event that it is impossible to conform with certain details of the Specifications due to different manufacturing techniques, describe completely all nonconforming aspects.

1.3 QUALITY ASSURANCE

- A. Copies of all materials required to establish compliance with the Specifications shall be submitted in accordance with the provisions of Section 01300.
- B. Acceptable manufacturers are Flygt, and ABS. Referenced equipment is ABS XRW 2121.

1.4 WARRANTY

- A. The contractor shall guarantee all materials and equipment furnished and work performed for a period of one (1) year from the date of substantial completion.

PART 2 - PRODUCTS

2.1 MIXER DESIGN

- A. The mixer shall be capable of handling raw, screened septage.
- B. The mixer(s) shall be able to be easily raised, lowered and removed for inspection or service on a guide rail system.
- C. The entire weight of the mixer unit shall be supported by a single bracket that must be able to handle all thrust created by the mixer.
- D. The mixer and power cable shall be capable of continuous submergence under water without loss of watertight integrity to a depth of 65'.

2.2 CONSTRUCTION

- A. General: Each mixer shall be of the close-coupled, submersible type design.
 - 1. All components of the mixer, including the motor shall be capable of continuous underwater operation while the mixer propeller is completely submerged.
 - 2. In addition, all components of the mixer shall be capable of operation in air, completely unsubmerged for two (2) hours.
 - 3. All exposed hardware shall be 316 stainless steel. All surfaces coming into contact with the mixing liquid other than stainless steel shall be protected with a two- part epoxy paint.
- B. Propeller: The propeller shall be self cleaning backward curved design preventing material buildup on the blades that decreases mixer performance and increases vibration.
 - 1. Each propeller shall be dynamically balanced so its imbalance is less than ISO 1940 G6.3 tolerances preventing excessive vibration or other unsatisfactory characteristics when the mixer is operating.
 - 2. The propeller shall be capable of handling solids, fibrous materials, sludge and other matter normally found in sewage, water, wastewater, etc. applications.
- C. Cable Entry: The cable entry shall be an integral part of the motor housing.
 - 1. The cable entry shall be comprised of a single cylindrical elastomer grommet flanked by stainless steel sealing washers designed with a close tolerance fit against the cable outside diameter and the entry inside

SUBMERSIBLE MIXERS

diameter. This will provide a leak proof, watertight seal at the cable entrance without the need for specific torque requirements.

2. The assembly shall be supported by a shoulder in the upper lid and be evenly compressed by four (4) socket head screws threaded into the motor housing.
 3. The connection chamber and motor compartment shall be isolated from each other. Isolation and sealing shall be accomplished through the use of O-rings and compression grommets, providing a watertight seal.
- D. Shaft: The propeller and motor shaft shall be an integral unit.
1. The shaft shall be 420 stainless steel and designed to resist the maximum forces generated by the mixer and minimize shaft deflection.
 2. The mixer shaft shall have machined shoulders to permit exact bearing, seal and propeller placement.
- E. Shaft Seals: The mixer shall be provided with a triple seal system consisting of a mechanical seal on the outer side and a radial shaft seal on the inner side, all working independently of the other.
1. The mechanical seal shall contain both stationary and rotary silicon carbide faced rings. Each mixer shall be equipped with a solids deflection ring to prevent seal failure due to interference from solids contained in the mixed liquid.
 2. Only the seal faces of the outer mechanical seal assembly and its retaining clips shall be exposed to the mixed liquid.
 3. The seals shall require neither routine maintenance nor adjustment and shall not be damaged when the mixer is run dry. The seals shall not rely on the mixing liquid as a lubricant.
- F. Oil Chamber: The oil chamber located between the outer and inner seals shall hold a sufficient quantity of oil to provide lubrication and cooling for the shaft seals.
1. The oil shall also act as a sensing medium for the seal monitoring system to detect the presence of moisture.
- G. Bearings: The mixer shall rotate on two (2) permanently lubricated bearings.
1. Bearings shall be of single row, (double row on single phase) deep grooved design and sized to transfer all radial and axial loads to the

SUBMERSIBLE MIXERS

mixer housing and minimize shaft deflection for increased bearing and seal life.

2. Bearings shall not require a pre-load and shall be maintenance free with a minimum L-10 bearing life of 100,000 hours at design conditions.
- H. Elastomers: All mating part surfaces of the mixer shall be machined and fitted with static O-rings providing watertight sealing.
1. Mating surfaces shall be designed to provide watertight seals when metal to metal contact is made resulting in controlled compression of the O-rings without special torque requirements.
 2. No secondary sealing compounds, rectangular gaskets, elliptical O-rings, grease or other devices shall be used.

2.3 MOTOR

- A. General: The motor shall be of the squirrel-cage, induction, shell type NEMA B design, housed in an air filled, watertight chamber.
1. Stator windings and leads shall be insulated with moisture resistant Class F insulation which will resist a temperature of 155° C (311°F).
 2. The stator shall be dipped and baked three (3) times in Class F varnish.
 3. The motor shall be designed for continuous duty, capable of sustaining (10) evenly spaced starts per hour.
 4. The rotor bars and short circuit rings shall be constructed of aluminum.
 5. Explosion proof design shall be FM approved for use in NEC Class I, Division I, Groups C & D hazardous locations.
 6. Motor to be 480 volt, 3 Phase, 60 Hz, 1780 RPM, 2.1 HP and connected directly to the propeller.
- B. Thermal Protection: Each phase of the motor shall contain a set of three bi-metallic temperature monitors in the stator windings; one in each phase.
1. The monitors shall be connected in series and coupled to the contactor in the control panel to provide over temperature shutdown of the motor.
 2. The temperature setting shall be 140°C ± 5°C (284°F± 9°F). The temperature monitors shall automatically reset once the stator temperature returns to normal.

SUBMERSIBLE MIXERS

- C. Seal Failure Warning System: An electrical probe shall be provided in the oil chamber for detecting the presence of water in the oil chamber. This probe shall be provided for both standard and explosion proof versions.
 - 1. A solid-state device mounted in the mixer control panel or in a separate enclosure shall send a low voltage, low amperage signal to the probe. If water enters the oil chamber, the probe shall signal the solid state relay in the control panel. The relay shall then energize a warning light on the control panel, or cause the mixer to be shut down.
 - 2. The equipment supplier shall provide the solid state device for installation in the motor control center. The contractor shall coordinate.

2.4 MIXER MOUNT ASSEMBLY

- A. Provide Type 316 stainless steel mixer mount assembly consisting of upper, lower, and intermediate support brackets.

PART 3 - EXECUTION

3.1 HANDLING

- A. Handle mixers and accessories so as to ensure delivery to the point of installation in sound, undamaged condition.
- B. Store equipment in approved location and protect mixers and accessories from dirt and soil during storage.

3.2 INSTALLATION

- A. Install equipment in this section in accordance with details as shown on the Drawings and/or as directed by the Engineer.

3.3 FIELD WIRING

- A. Comply with provisions of Division 16.
- B. Extend grounding wire from control panel main ground, screw to electrical ground as indicated and comply with NEC and local electrical codes.
- C. Seal all conduit between junction box and control panel in accordance with NEC requirements.
- D. Use only licensed electricians.

END OF SECTION

**SECTION 13329
TEMPORARY SLUDGE DEWATERING AND DISPOSAL**

PART 1 GENERAL

1.01 DESCRIPTION

- A. Provide mobilization, removal, dewatering and offsite disposal of sludge from the following structures:
1. Rotating biological contactors (RBC)
 2. Aeration Basin Nos. 1 and 2
 3. Aeration Basin No. 3
 4. Aerobic Digester No. 4
- B. The City will remove all solid waste that can be removed from the basins via pumping. It is assumed the following quantities will be remaining and require removal by the Contractor:

LOCATION	ESTIMATED SLUDGE VOLUME	ESTIMATED SLUDGE QUANTITY**
RBC	1,310 cy	1,767 dry tons
Aeration Basin Nos. 1 & 2	40 cy	54 dry tons
Aeration Basin No. 3	32 cy	43 dry tons
Aerobic Digester No. 4	105 cy	142 dry tons

**The performance criteria for residuals dewatering shall be a minimum cake solids percentage of 15% with no visible water and meet minimum dry solids as required by landfill. The estimated sludge quantity is based on this minimum percentage.

1.02 QUALITY ASSURANCE

- A. Sludge disposal contractor shall own all major sludge removal and dewatering equipment.
1. Miscellaneous support services may be subcontracted such as local trucking or landfill disposal site.
- B. Demonstrate ten (10) years of experience in the removal and dewatering of sludge.

1.03 DEFINITIONS

- A. Mobilization: The setting up of sludge removal process operation onto the staging areas of the site. Mobilization includes temporary facilities, sludge assessment, sludge characterization, name and location of approved licensed disposal site.

**TEMPORARY SLUDGE
DEWATERING AND DISPOSAL**

- B. Sludge removal from the basins, sludge dewatering, centrate/filtrate recycle and disposal of dewatered sludge cake to an approved site constitutes the sludge removal process operation.
- C. Dewatered sludge: High concentration sludge produced by sludge dewatering process.

1.04 SUBMITTALS

- A. Staging area diagram showing:
 - 1. Sludge withdrawal unit including pumps and piping.
 - 2. Dewatering units showing type of unit, footprint required for operation, and staging area layout at each location.
 - 3. The pipe routing of centrate/filtrate discharge location.
 - 4. Utilities connections including electrical and potable water.
- B. Submit the transportation plan indicating routes, form of transportation and approved disposal site for Engineer approval.
- C. Submit chemicals that will be used for sludge conditioning in sludge removal operation.

1.05 STAGING AREA

- A. Make arrangements for staging area for transport trucks and/or containers.

1.06 REGULATORY REQUIREMENTS

- A. Comply with all applicable regulations governing the following:
 - 1. OSHA Standards in relation to onsite sludge dredging and sludge processing operation.
 - 2. DOT Regulations on transportation of dewatered sludge.
 - 3. Obtain all necessary permits from the South Carolina Department of Health and Environmental Control (SCDHEC) and comply with SCDHEC and Department of Labor, Licensing and Regulation (LLR) regulations regarding qualifications of personnel.
- B. Permits:
 - 1. Provide all appropriate operational and disposal permits.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 SLUDGE REMOVAL OPERATION

- A. Provide sludge removal operation at the facilities indicated in 1.01.A.

TEMPORARY SLUDGE DEWATERING AND DISPOSAL

1. Verify and document sludge depth after draining basin.
 2. Basin sludge depth will be determined by the average of five (5) depth locations determined by the Engineer.
- B. Do not interfere with normal plant operations.
- C. Keep the sludge removal process staging area clean and tidy at the end of daily operations.
1. Removal any sludge spill on site and clean the area immediately.

3.02 DEWATERING OPERATIONS

- A. Location and staging area preparation is the responsibility of the Contractor and Subcontractor.
1. Sludge may be stored on site for dewatering adjacent to the equalization basin as an alternative to mechanical dewatering. See Drawing C00.10.
- B. Sludge dewatering processes shall be self contained with no leakage or spillage from the process:
1. Provide spill containment.
 2. Leaking hoses are not allowed.
 3. Protect surface water drainage structures.
- C. Provide all necessary equipment and appurtenances to acquire power and utilities for operation of the removal and dewatering equipment.
1. Three phase power is available to the site.
 - a. Provide all electrical wiring, conduit, and power connections to connect to existing electrical utilities.
 2. Provide generator if necessary.
 3. Potable water is available at the site. Provide all piping, fittings, backflow prevention, and valves to connect to existing potable water utilities.
 4. Temporary utility connections are not to interfere with plant operations. Provide means to protect utilities near plant traffic areas. Where temporary utilities must cross vehicular traffic areas, provide traffic rated pipe and cable protectors.
 5. Filtrate can be returned to the nearest sanitary sewer manhole from where removal operations are occurring.
 6. Working hours should be 7 am to 5 pm, five (5) days per week. No operations should be allowed in the evenings, weekends, or holidays without approval from the Engineer.
 7. Procure a disposal site and payment of fees associated with disposal.

**TEMPORARY SLUDGE
DEWATERING AND DISPOSAL**

3.03 SLUDGE TRANSPORTATION

- A. Provide all labor, equipment, material and insurance necessary to accomplish sludge disposal by transportation.
- B. The Contractor will be responsible for any spill from an accident, transportation, and disposal of sludge and sludge loading to the trucks/containers. Dewatered sludge storage will not be allowed on site.
- C. Noise and number of trucks, disruption of the community during transportation and sludge removal operation must be kept to a minimum.

3.04 SURFACE RESTORATION

- A. The staging areas and all damaged surfaces including the areas where the withdrawal and discharge lines were placed will be restored to pre-existing condition. Surface restoration will include repair of damaged roads and curbs.
- B. Remove sludge from the surface due to spill and sludge discharges during the sludge removal process operation.

3.05 RECORD KEEPING

- A. Keep and maintain records in order to monitor for the compliance of the project requirements. Records will clearly show the following:
 - 1. Weight, percent solids concentration and unit weight of dewatered sludge.
 - 2. Number of truck loads, capacities and number of trips to the disposal sites.
 - 3. Copies of sludge shipping manifest.
 - 4. Copies of disposal records from a licensed landfill facility.
 - 5. All weigh station records.
 - 6. All laboratory records.

END OF SECTION

**SECTION 13300
CONTROLS**

PART 1 - GENERAL

1.1 DESCRIPTION

A. Work Included:

1. Provide and install at the Dewatering Facility's Equipment Room, one (1) control panel as specified herein and as needed to provide a complete and proper control system for the effluent pump station and the return sludge pump station.
2. Provide and replace the PLC processor in the existing grit collector control panel.

1.2 QUALITY ASSURANCE

A. The controls as specified herein shall be supplied by one equipment supplier who shall be responsible for the complete system.

1. These specifications cover the intended functions of the control system but do not necessarily cover all details necessary for a complete, operable and functional system. The supplier shall provide all devices and appurtenances necessary to provide a complete, operable and satisfactory system as indicated or specified.

B. Manufacturer:

1. The referenced manufacturer of the Programmable Logic Controllers, (PLC's) is Allen Bradley. The referenced manufacturer of the control panels is Heyward Services. Equal products of other manufacturers may be provided as outlined in Division 1 and as approved by the engineer.
2. It is the intent of these specifications and drawings that the Contractor shall engage an approved and qualified manufacturer to provide the control system as specified and indicated.
3. Manufacturer shall design and furnish a complete, integrated and functionally operating system, warranted to perform the intended functions as herein specified.
4. Provide or supply all instruments specified herein or required and provide all required and specified collateral services in connection with the system such as testing, calibration, start-up, operations and maintenance manuals.

C. Contractor:

1. Shall be fully and solely responsible for the work of the instrument manufacturer and solely responsible to the Owner for having supplied to the Owner the complete instrumentation and control system.
2. To provide personal direction to the work, maintaining and supplying complete supervision over and coordination between all subcontractors employed by him.
3. To be responsible for defining the limits of his subcontractor's work.
 - a. Setting of instruments (including alarms, etc. as provided under other sections) and final connections to all instruments shall be made by the Contractor and/or electrical subcontractor.

D. Technical Services:

1. Provide services of a factory trained service engineer, specifically trained on the type of control system specified herein:
 - a. Installation and Erection - One Day, One Trip.
 - b. Start-Up and Training - Two days, Two Trips.
 - c. Six Months After Start-Up - Done Day, One Trip
 - d. One Year After Start-Up - One Day, One Trip
2. The minimum days specified above do not relieve the system manufacturer of providing sufficient service to place the system in satisfactory operation.

1.3 SUBMITTALS

- A. Comply with pertinent provisions of Division 1.
- B. Product data: Within 90 calendar days after the contractor has received the Owner's Notice to Proceed, submit:
 1. Component manufacturing data sheet indicating pertinent data and identifying each component by item number and nomenclature as indicated on the drawings and in the specifications.
 2. Component drawing showing dimensions, mounting and external connection details.
 3. System wiring schematics, each on a single drawing with full description of operation. Component identification on the schematic shall be as indicated above.

4. A system schematic of the hardware with the component manufacturing data sheets for each item, including all system peripherals.
- C. Provide Operation and Maintenance manuals complying with provisions of Division 1.
1. Operating instructions shall incorporate a functional description of the entire system, including the system schematics which reflect “as-built” modifications.
 2. Special maintenance requirements particular to the system shall be clearly defined along with special calibration and test procedures.
 3. As part of the operation and maintenance manuals, provide three hard copies of the program used to program the programmable logic controller.

1.3 COORDINATION OF WORK

- A. Coordinate work of this section with work of Sections listed in 1.1.B above.

1.5 PRODUCT DELIVERY, HANDLING AND STORAGE

- A. Schedule the delivery of the control panel, VFD panels and equipment to coordinate with the project completion schedule.
1. Each item of equipment to be tagged with identifying number shown on the Shop Drawings.
- B. Contractor’s attention is directed to the fact that instruments and control system are delicate components which have been shop calibrated. Extreme care shall be taken in handling this control system to avoid internal and/or external damages.
- C. Damaged instruments and control system will not be accepted.
- D. Instruments and equipment not for immediate use shall be stored inside a building, with enclosures under protective coverings, and shall be fully protected from moisture, dust, extreme heat and vibration.

1.6 WARRANTY

- A. Comply with pertinent provisions of Division 1.
- B. Manufacturer shall, during the warranty period of on year, furnish all service necessary to repair deflection equipment or work, and no charges will be made for any service due to these reasons.

1. For any service visit during this period, provide Owner and Engineer with written report stating the reason for control system failure and recommendations to prevent recurrence.

PART 2 - PRODUCTS

2.1 GENERAL

- A. All equipment and material shall be new, unused and proven by previous use of similar products to be completely suitable for the service intended.
- B. Equipment and materials shall be as specified or approved equal.
- C. All of the equipment shall be the manufacturer's latest and proven design. Specifications and drawings call attention to certain features but do not purport to cover all details entering into the design of the instrumentation system. The completed system shall be compatible with the functions required and other equipment furnished by the Contractor.
- D. All electrical components of the system shall be powered by 120 volt, single phase, 60 cycle current, except as otherwise indicated or specified.
- E. Provide complete control systems for remote electrically operated or motor driven control system, including all necessary auxiliary relays so as to require only wiring and connections to the control system control circuit.
 1. All contacts for control, remote motor operated, or electrically operated equipment shall be rated not less than 10 amperes on 120 volts unless otherwise specified herein.
- F. All remote motor operated or electronically operated equipment will have a separate 120 volt control circuit.
- G. Information transmission shall be by means of 4-20 mA dc signals unless otherwise indicated.
- H. Provide all necessary fuses or switches required by the instrumentation manufacturer for his equipment.
 1. Provide internal on/off switch at all instruments requiring an internal power supply.
- I. Include all necessary energy sources.
- J. The control panel and appurtenant equipment shall contain the fuses or switches required by the hardware manufacturer.

- K. All instrument systems and their individual components, whether panel or field mounted units, shall be protected from voltage and/or current surges which may originate as a result of lightning or other external causes.
 - 1. Protective equipment to be provided by the instrumentation supplier and installed in accordance with his recommendations.
 - 2. Schematics of the instrument submitted for approval to the Engineer shall indicate how this protection will be provided and identify the items of equipment which shall be used for this purpose.
- L. System manufacturer to supply "as-built" drawings containing all necessary information for proper maintenance and operation of the system.
 - 1. Interconnection information between system components and equipment found in other sections of these specifications shall be complete with all necessary interconnection information.
 - 2. Notes refer to equipment manufacturer's drawings for proper interconnection will not be acceptable.

2.2 CONTROL PANEL

- A. General:
 - 1. Provide a freestanding floor mounted style control and instrumentation panel for the Effluent and RAS pump stations.
 - 2. Provide panel constructed of 11 gauge stainless steel complying with NEMA 1 standards with stainless steel support members where required to prevent deflections of the panel.
 - 3. Panel to be completely flat, ground smooth, free from all welded splatter and fabrication blemishes.
 - 4. Reinforce panels around cutouts to maintain rigidity of panel.
 - 5. Mount all monitors, instruments, display lamps, switches, etc. on panel front and wire to terminal blocks with identifying numbers as shown on the panel fabrication drawings.
 - 6. Neatly bundle all wiring with wire ties and/or in wire wrap with all wiring identified by color coding or numbering.
 - 7. Connect all external electrical connections to pressure type terminals located at the bottom of panel section

CONTROLS

8. Provide a power distribution panel with equisized breakers and branch circuit protection for isolated power requirements.
9. Wiring to be type MTW, 600 volt rating, sized per National Electric Code for load requirements.
10. Identify sections of the control panel with engraved micarta signs, white lettering on block background.
 - a. Cement labels to panel with epoxy cement.
 - b. Hand lettering or type on letters are not allowed.
11. Provide all necessary fuses or switches required by the instrumentation manufacturer.
12. Provide an internal on/off switch for each instrument requiring internal power.
13. Provide all necessary relays, etc. for remote controls.
 - a. Provide so only wiring and connections to the equipment control circuit will be required.
 - b. Provide contact rated not less than 10 amperes on 120 volt unless otherwise specified.
14. Factory install all wiring inside the control panel.
15. Protect all instrument systems and their individual components from power surges, including panel mounted and field mounted units.
16. Provide H-O-A switches for all motor-driven units.
17. Control panel to be UL labeled.
18. Provide dual outlet 120V receptable for printer and programmer use.

B. PROGRAMMABLE LOGIC CONTROLLER:

1. General:
 - a. Provide one (1) Programmable Logic Controller (PLC) for monitoring, fault detection, control functions and other operations as required for two (2) complete and operable systems.
 - b. The PLC and power supply shall be installed in local I/O racks with both EEPROM and battery backup in case of power failure. The battery life time shall not be less than 2 years.
 - c. I/O modules shall be 8 or 16 point, 120VAC input or output modules, analog input or output modules and RIO scanner module.

- d. Cabling between RIO scanner module and remote I/O racks and cabling to the analog modules shall be with twin axial cable.
2. Performance Criteria:
- a. The PLC shall be a microprocessor based modular designed unit encased in a sheet metal enclosure and shall perform the logic control functions based on the program stored in memory and the status of connected inputs and outputs.
 - b. The PLC shall be rated to withstand and function in humidity of 5 to 95% (non-condensing) at an ambient temperature of 0 to 50°C. The unit shall not require any method of cooling other than heat sinks cooled by free air flow convention.
 - c. The system power supply shall be protected against short circuits and shall be capable of providing a minimum of 20 ms ride through on loss of power. The power supply shall contain its own overcurrent and overvoltage protection.
 - d. In the event of power loss, the PLC shall retain the register and ladder information and shall use lithium battery to power the memory. If the battery voltage has fallen below a threshold level, a visual indication shall be provided to indicate this.
 - e. The PLC shall be capable to transfer program from the EEPROM to the processor automatically in the event that a processor memory error is detected at power up.
3. The minimum standard control functions of the PLC shall include:
- a. Relay ladder logic.
 - b. Latch/unlatch relays
 - c. Timers
 - d. Counters
 - e. Data comparisons (equal, not equal, greater than, less than)
 - f. Data transfers.
 - g. Synchronous shift registers forward and reverse.
 - h. Transitional output.
 - i. Master control relay
 - j. Bit read and control
 - k. I/O forcing
 - l. BCD to binary conversion or vice versa
 - m. Process Control (PID) computations
 - n. Logic functions: AND< OR< Exclusive OR.
 - o. Scan control functions for JUMP and 4 level subroutines.
 - p. Timed interrupt
 - q. Software security functions which limit and/or prevent access to all portions of the control program.
- C. Operator Interface:

CONTROLS

1. General: Provide an operator interface for the two pump stations in the control panel.
 - a. Mount on inner seeing panel(s).
 - b. Network with PLC
 - c. UL Listed
 - d. NEMA 4x rated
 - e. 40K memory to be provided
 - f. Provide real time clock
 - g. Data scaling to be in standard engineering units
 - h. Provide printer port using RS 232
 - i. Operating temperature range to be 32°F to 140°F.
 - j. Humidity rating to be 5% to 90% non-condensing.
 2. Display:
 - a. Provide 4 lines x 20 characters.
 - b. Characters to be a minimum of .19" x .12" and visible from 25'.
 - c. Provide vacuum fluorescent display.
 3. Keypad:
 - a. Provide stainless steel dome membrane.
 - b. Membrane to be rated for 1 million cycles.
 4. Referenced Manufacturer:
 - a. Provide Allen Bradley DTAM Plus.
- D. Manual Controls and Indicators:
1. Provide and mount on inner swing panel.
 2. H-O-A switches for each pump.
 3. Speed adjusting potentiometers for each pump for use in the hand mode.
 4. Alarm, run status and high temperature lights for each pump.
 5. Low and high level alarm lights.
 6. Elapsed time meter for each pump to indicate total run time in hours and tenths.
 7. Wet well level.
 8. Alarm silence pushbutton.
 9. Alarm light test pushbutton.
 10. High temperature reset.

11. Flow totalizer for each sludge return pump (by flowmeter supplier).

E. Level Sensing System:

1. Provide at the effluent pump station a dual level sensing system of capacitance type with a Teflon probe and a proportional level transmitter.
2. The level sensing system shall contain all the sensing equipment required for proper start-up sequence and speed signal reference as required in the specifications and plans and include high and low level float switches wired into the system in case of probe outage.
3. Controllers shall be Magnetrol Series 82 or equal, suitable for outdoor installation.

2.3 FLOW TRANSMITTER

A. General:

1. Provide a Foxboro IMT25 flow transmitter.
2. Flow transmitter shall be compatible with the Owner's existing electromagnetic flow tube. (9308A-SIBA-TSJ-NM-E, SN: 99432156). Transmitter shall be started up and calibrated in accordance with the existing calibration.
3. Provide sunshield and surge protection in accordance with 16910.

2.4 CELLULAR RTU

- A. Provide a cellular monitor capable of transmitting alarms and data over a cellular network. The monitor shall be enclosed in a NEMA 4X polycarbonate enclosure and include a surge suppressor. The monitor shall be powered by 120 volts AC and have a built in battery backup capable of keeping the RTU powered for 24 hours in case of primary AC failure. The monitor shall be capable of monitoring up to six (6) digital inputs.
- B. The cellular monitor shall be an HTT900, Mission or Generating Solutions and shall monitor inputs shown on the electrical drawings.
- C. Include omnidirectional antenna with 6' cable.
- D. Include one year of prepaid cellular service.

PART 3 - EXECUTION**3.1 CONTROLS FOR EFFLUENT PUMP STATION**

- A. Configure the operator interface and PLC to provide the following controls for operation of the effluent pump station.
1. General:
 - a. HAND-OFF-AUTO selection for each pump/VFD.
 - b. Run and alarm status for each pump/VFD.
 - c. Wet well level indication.
 - d. Manual or automatic LEAD_LAG selection of pumps.
 - e. Automatic alternation of lead and lag pumps upon each low level cutoff or twenty-four hour time period based on cumulative elapsed run time.
 - f. High Water level remote alarm terminal.
 - g. Total elapsed run time for each pump/VFD.
 - h. Indication of pump speed based on VFD output.
 2. Start Sequence:
 - a. Start pumps at minimum speed.
 - b. Initiate adjustable time delay before adjusting pump speed to match wet well level.
 3. Rising Wet well Level Sequence:
 - a. At wet well level 54.00', initiate start sequence for the lead pump.
 - b. After completion of start sequence, for lead pump, vary lead pump speed linearly between wet well levels 53.00' (600 rpm) and 58.00' (1180 rpm).
 - c. At wet well level 59.00', initiate start sequence for the lag pump.
 - d. After completion of start sequence, for lag pump, vary both pump speeds linearly between wet well level 58.00' (900 rpm) and 61.00' (1180 rpm).
 - e. At wet well level 61.50', energize high level alarm
 - f. Provide high level float switch at wet well level 62.00' to energize high level alarm.
 3. Falling Wet Well Level Sequence:
 - a. At wet well level 57.00' shutdown lag pump and vary lead pump speed linearly between wet well level 52.5' (600rpm) an 57.00' (1180 rpm).
 - b. At wet well level 52.0', energize low level alarm and shut down pumps.
 - c. Provide low level float switch at wet well level 51.5' to energize low level alarm and shutdown pumps.
 5. Field Adjustable Parameters:
 - a. To be password protected.

- b. Wet well level setpoints.
- c. Start sequence time delays.

3.2 CONTROLS FOR RAS PUMP STATION

- A. Configure the operator interface and PLC to provide the following controls for operation of the RAS pump station:
 - 1. General:
 - a. HAND-OFF-Auto selection for each pump/VFD.
 - b. Run and alarm status for each pump/VFD.
 - c. Total elapsed run time for pump/VFD/
 - d. Indication of pump speed based on VFD output.
 - 2. Sludge Recirculation Flow:
 - a. Instantaneous Flow Indicator.
 - b. Totalized Flow Indicator.
 - c. Pump Speed Adjustment.
 - d. Adjustable On/Off Timers.

3.3 CONTROLS FOR THE GRIT COLLECTOR CONTROL PANEL

- A. Replace the existing SLC PLC process with a new Compactlogix processor.
- B. The existing I/O will not be replaced.
- C. Make other modifications to the control panel to accept the new processor.

3.4 LOCATION

- A. Locate all instrumentation, piping, wiring, etc. as indicated.
- B. Securely anchor all equipment to floors or walls.

3.5 FIELD WIRING

- A. All signal and control wiring and conduit required for the instrumentation and control system to be furnished and installed by the General Contractor.
- B. This wiring is defined as:
 - 1. All single phase 120 VAC or less;
 - 2. Direct current;
 - 3. Audio cable;

4. Special shielded signal cable;
 5. Any wiring for control, report back or signal purposes between panels, terminal units and all field mounted devices.
- C. Wiring materials, methods of installation, etc. shall conform to Section 16400.

3.5 FIELD CALIBRATION

- A. Calibrate all instrumentation in the presence of the Engineer with the range and accuracy specified herein.
- B. Provide monthly written report detailing progress of system start-up.
 1. Include specific tabulations of devices on which start-up has been completed.

3.6 SUBSTANTIAL COMPLETION

- A. Acceptance of instrumentation and control systems as substantially complete will be made only when:
 1. All pertinent requirements of Sections in Division 1 are met; and
 2. All mechanical systems being served by the instruments become fully operational to the extent that the said instruments can be fully utilized and are capable of demonstrating performance during conditions which stimulate the Engineer's design parameters for the respective systems.

END OF SECTION

**SECTION 15110
PIPING AND ACCESSORIES**

PART 1 GENERAL

1.1 WORK INCLUDED

- A. This Section covers the Work necessary to furnish, install, and complete, the plant piping specified herein.

1.2 SUBMITTALS

- A. The following information shall be provided:
1. Shop Drawings:
 - a. For piping systems greater than three (3) inches in diameter, provide double-line Drawings of each piping system to the scale stated on the Contract Drawings, locating each support, identifying the type by catalog number or shop Drawing detail number, and showing anchor locations and identifying them by shop Drawing detail number.
 - b. Detailed information for piping thrust protection systems used at all specified locations, which enable the Engineer to determine the adequacy and acceptability of the system being submitted for review.
 2. Manufacturer's written certification that the factory-applied coating system(s) is identical to the requirements specified herein. Where, in the manufacturer's opinion, the coating system(s) exceeds the requirements specified herein, submit complete technical literature of the proposed system(s) to the Engineer for review.

PART 2 PRODUCTS

2.1 DUCTILE IRON PIPE

- A. General:
1. Comply with ANSI/AWWA C150/A21.50 or AWWA C151/A21.51, latest revision.
 2. The class or nominal thickness, net weight without lining, and casting period shall be clearly marked on each length of pipe. Additionally, the manufacturer's mark, country where cast, year in which the pipe was produced, and the letters "DI" or "Ductile" shall be cast or stamped on the pipe.

PIPING AND ACCESSORIES

3. Wall thickness in accordance with Table 50.5 of ANSI/AWWA C150/A21.50, depth of cover indicated and Type 3 bedding conditions (unless indicated otherwise on the Drawings), minimum Pressure Class as follows:
 - 4" - 12" Pressure Class 350
 - 14" - 20" Pressure Class 250
 - 24" Pressure Class 200
 - 30" -36" Pressure Class 150
4. Use cement mortar lining complying with ANSI/AWWA C104/A21.4, standard thickness for piping services as indicated in the Piping Schedule.
5. Provide Protecto 401 or equivalent lining for piping services as indicated in the Piping Schedule.

B. Joints:

1. Use mechanical or push-on joints complying with ANSI/AWWA C111/A21.11 as modified by ANSI/AWWA C151/A21.51.
2. Use gaskets and lubricant complying with ANSI/AWWA C111/A21.11.
3. Lubricants shall be compatible with pipe and gasket materials, shall not support bacteria growth and shall not adversely affect potable quality of line contents.
 - a. NSF 61 approved.
4. Exposed pipe:
 - a. Class 53 minimum.
 - b. Use flanged joints complying with ANSI/AWWA C115/A21.11, latest revision; and
 - 1) Provide solid type flanges with country where cast stamped or cast into the flange."
 - 2) Use full face, red rubber, factory cut, 1/16" thick for pipe up to 10" diameter and 1/8" thick for larger sizes.
 - 3) Bolts and nuts shall be 316 stainless steel bolts, hex head complying with ANSI A21.11/AWWA C111.

C. Fittings:

1. Provide 250 psi rated ductile iron fittings or specials unless otherwise indicated, complying with ANSI/AWWA C110/A21.10 and in accordance with ANSI/AWWA C111/A21.11.
2. Compact fittings may be provided in accordance with ANSI/AWWA C153/A21.53.88.b.

PIPING AND ACCESSORIES

3. Fittings for use with push-on joint pipe, comply with ANSI/AWWA C111/A21.11.
 4. Use lining per 2.1 of this Section.
- D. Restrained joint pipe and fittings:
1. Provide restrained joint pipe and fittings where indicated on the plans.
 2. Restrained joints shall be equal to TR-Flex or Field Lok by U.S. Pipe or Flex-Ring or Fast Grip Gasket by American Cast Iron Pipe Company.
 3. Provide wedge type retainer glands for use with mechanical joint fittings.
 - a. Provide "MEGALug" series 1100 or series 1200 as manufactured by EGGA Iron, Inc. or qual.

2.2 PVC PIPE

- A. General:
1. Marked with National Sanitation Foundation approval at 18" intervals.
 2. Gaskets to comply with ASTM F 477.
 - a. Natural rubber gaskets are not acceptable.
- B. Pipe 3" and smaller: Comply with ASTM D2241 for PVC 1120, SDR 21.
- C. 4" - 12": Comply with ANSI/AWWA C900, Table 2, Pressure Class 150 (DR18).
- D. 14" and above: Comply with ANSI/AWWA C905, Table 2, Pressure Class 165 (DR 25).
- E. Color of pipe to be blue for potable water and green for sewer.
- F. Joints:
1. Use integral bell or coupling type with elastomeric gaskets.
 2. Integral bells to comply with ASTM D2672.
 3. Couplings to comply with ANSI/AWWA C900.
 4. Gaskets to comply with ASTM F477.
 - a. Natural rubber gaskets are not acceptable.
 5. Lubricants shall be compatible with pipe and gasket materials, shall not support bacteria growth and shall not adversely affect potable quality of line contents. Vegetable shortening shall not be used to lubricate joints.

PIPING AND ACCESSORIES

- a. NSF 61 approved.
- G. Fittings:
- 1. Buried pipe:
 - a. 4" and larger: Provide ductile iron fittings as specified above.
 - b. 3" and smaller: Provide PVC fittings, 160 psi at 73°F pressure rating, joint design to conform to pipe joints.
 - 2. Exposed pipe:
 - a. Use schedule 80 PVC fittings with solvent weld joints.
 - b. Where threaded fittings are indicated, use Schedule 80 conforming to ASTM D2464.
 - c. Where flanged joints are indicated, provide Type 316 stainless steel bolts, nuts and washers.
- H. Restrained joint pipe and fittings:
- 1. Provide restrained joint pipe where indicated on the plans.
 - 2. Provide restraint for all ductile iron fittings as specified above.
 - 3. Provide restraint for C900 PVC and C905 PVC by mechanical means separate from the mechanical joint sealing gland.
 - a. Provide series 1600 for C900 PVC and series 2800 for C905 PVC as manufactured by EBBA Iron, Inc. or equal.
- 2.3 STAINLESS STEEL PIPE AND FITTINGS, 3" DIAMETER AND LARGER:
- A. Provide schedule 10 pipe and fittings unless otherwise indicated on the drawings.
 - B. Pipe, fittings, flanges and couplings of Type 304L stainless steel as indicated on the drawings.
 - C. Provide pipe manufactured from ASTM A-240 annealed and pickled sheets and plates in accordance with ASTM A-778.
 - D. Provide butt weld type fittings manufactured in accordance with ASTM A-774 and of the same material and thickness as the pipe.
 - 1. Provide long radius elbows up to 24" diameter with constant radius of 1.5 times the nominal pipe diameter.
 - 2. Provide short radius, special radius, and reducing elbows and long radius elbows greater than 24" diameter of mitered construction with at least five (5) mitered sections for 90° bends, three (3) mitered sections for 45° and 60° bends, and two (2) mitered sections for 30° and smaller bends.

PIPING AND ACCESSORIES

- 3. Provide eccentric and concentric reducers.
- 4. Provide tees, crosses, laterals and wyes shop fabricated from pipe.
- E. Provide No. 2D finish on pipe and fittings as specified in ASTM A-778 and A-774, respectively.
- F. Provide flanged pipe ends made up of stainless-steel slip-on type rolled angle face rings with stainless steel back-up flanges drilled to ANSI B 16.1 Class 125 Standard.
 - 1. Stainless steel type to be same as pipe.
 - 2. Provide angle face rings continuously welded on both sides of the pipe or fitting and of thickness equal to or greater than the pipe or fitting to which it is welded.
 - 3. Provide back-up flanges manufactured of stainless- steel ASTM A-240 with the following nominal thicknesses:

Nominal Pipe Size (inches)	Flange Thickness (inches)
3 - 8	1/2
10 - 14	5/8
16 - 20	3/4
24 - 30	1

- G. Provide shop welded wall stops on wall pipes.
- H. Provide couplings where shown on drawings or as required for a complete and satisfactory installation.
 - 1. Provide Type 316L stainless steel arched band type couplings of equal or superior alloy and wall thickness as the pipe.
 - 2. Provide Depend-O-Lok type as manufactured by Brico or approved equal.
- I. Provide stainless steel bellows type expansion couplings where shown on the drawings and as necessary for a complete and satisfactory installation.
 - 1. Provide expansion couplings constructed of Type 316L with 125 lb. ANSI flanges.
 - 2. Couplings to be designed to operate at 20 psi pressure and 20" Hg vacuum and temperature of 220°F.

PIPING AND ACCESSORIES

3. Provide "OMNI-FLEX" expansion couplings as manufactured by Depend-O-Lok, Inc. of Atlanta, GA, or approved equal.
- J. Provide threaded connections for gauge and instrument connections and other devices using stainless steel #150 threaded half couplings conforming to ASTM A-182 or ASTM A-276, shop welded to the pipe at location shown on the drawings.
- K. Provide joints as follows:
1. Provide flanged at all valves, meters, flanged couplings and other equipment as shown on the drawings.
 2. Pipe and fitting spools shall be shop fabricated to the greatest extent possible in 40'0" maximum lengths. Provide smaller pipe with joints as shown on the drawings for special handling, installation, and/or disassembly requirements.
 - a. Flanged coupling adapters to be Type 316L stainless steel, Depend-O-Lok or approved equal.
- L. Provide full face gaskets at all flanged joints and gaskets at coupled joints.
1. Air lines - Gore-Tex style R rated for 400 degrees or greater.
 2. All other lines - Full face, red rubber with cloth insertions, factory cut, 1/16" thick gasket for pipe up to 10" diameter and 1/8" thick gasket for larger sizes.
- M. Provide Type 316 stainless steel bolts and nuts and washers for attaching all flanges, couplings, equipment, etc. Provide molybdenum disulfide based anti-seize compound, Molycoat-6 or approved equal.
- N. Fabricate stainless steel pipe and fittings in accordance with the following:
1. Pickle by immersion in 25% solution of nitric hydrofluoric acid for 20 minutes supplemented by manual scrubbing or brushing with non-metallic pads or stainless-steel wire brushes followed by water immersion and spray rinse and air drying.
 2. Employ welders and procedures qualified in accordance with ASME Section IX.
 3. Weld with TIG (GTAW) for pipe thicknesses up to and including 11 Ga. Weld heavier walls after beveling with TIG (GTAW) root pass weld and subsequent weld passes performed using TIG (GTAW) process, MIG (GMAW), or Metallic Arc (SMAW) process.

PIPING AND ACCESSORIES

- a. Use filler metal of equal or superior ELC grades to provide cross section at weld equal to or greater than the parent metal.
- b. Provide smooth evenly distributed weld deposits with weld reinforcement as follows:

Wall Thickness	Weld Reinforcement (max)	
	I.D.	O.D.
Up to 12 Ga. (0.109")	1/16"	3/32"
11 Ga. (0.125") to 3/16" Pl	3/32"	1/8"
1/4" Plate & Larger	1/8"	3/16"

- c. Provide full penetration to interior surface and argon gas shielding to the interior and exterior of the joint at all butt welds.
 - d. Exterior welds may be welded by MIG (GMAW) or Metallic Arc (SMAW).
 - e. Remove excessive weld deposits, slag, splatter, etc., by grinding.
- O. Fabricate spools to the "Pipe Fabrication Institute" fabrication tolerances ES-3 (1981).
 - P. Swab exterior welds on long spools after fabrication with acid pickling solution, scrub manually, rinse with clean water and air dry.
 - Q. Mark all fabricated piping pieces with identification numbers corresponding to Contractor's layout and installation drawings.

2.4 STAINLESS STEEL PIPE AND FITTINGS, 2-1/2" DIAMETER AND SMALLER

- A. Provide Schedule 40 pipe for threaded fitting and/or Schedule 10 pipe for pressfit connections.
- B. Provide Type 304L.
- C. Provide Victaulic Pressfit connections and fittings for Schedule 10 piping.
- D. Provide NPT threaded connections and fittings for Schedule 40 piping.
- E. Provide stainless steel unions at all connections to fixtures, pumps, equipment, etc.
- F. Provide joint compound for thread sealant on threaded connections.
 - 1. Provide Lok-Tite PST or approved equal.
 - 2. Submit shop drawings for approval.

PIPING AND ACCESSORIES

- G. Provide two (2) Pressfit PFT 505 fitting tools with two (2) sets of pressing jaws for all pipe size diameters between ½" to 2".

2.5 PLASTIC FLEXIBLE TUBING (TYGON TUBING)

- A. Provide flexible tubing where indicated on the contract drawings.
- B. Comply with Federal Specification L-T-7908.
- C. Tubing shall be clear in color.
- D. Provide NSF approved nylon reinforced tubing, for suction applications, and for pressure applications greater than the un-reinforced tubing working pressure.
- E. Provide nylon fittings with stainless steel hose clamps.

2.6 LINK SEAL SLEEVE SEAL

- A. Provide sleeve seals where indicated on the plans to seal between pipe sleeves and piping.
- B. Provide glass reinforced nylon plastic pressure plates.
- C. Provide Type 316 stainless steel bolts and nuts.
- D. Provide EPDM sealing element.
- E. Provide Silicone sealing element for air piping.
- F. Provide square two (2) piece escutcheon plate on exposed side(s) of sleeve(s).
 - 1. Fabricate from .063" clear anodized aluminum sheet.
 - 2. Mount with stainless steel sleeve and stainless-steel stove bolts.
- G. Acceptable manufacturer is Link Seal, Type S or equal.

2.7 ADAPTER FLANGES

- A. Provide adapter flanges where indicated on the plans.
- B. Provide high strength ductile iron flange, ASTM A536, Grade 65-45-12.
- C. Provide set screws with a Rockwell hardness of C40-45 converted from Brinnell.
- D. Gasket material:

PIPING AND ACCESSORIES

1. Air lines - Gore-Tex style R rated for 400 degrees for greater.
 2. All other lines - BUNA S.
- E. Minimum pressure rating - 150 psi.
- F. Provide adapter flanges with a minimum of a 2 to 1 safety factor.
- G. Provide adapter flanges with MEGA-BOND Restraint Coating System.
1. Wash all adapter flanges and appurtenances in a phosphate wash prior to coating.
 2. Coat with a minimum of two coats of liquid Xylan fluoropolymer coating with heat cure to follow each coat.
- H. Provide Series 2100 Megaflange Restrained Flange Adapter by EBAA Iron.

2.8 SERVICE SADDLE

- A. Provide of the following materials:

Body	Type 304 Stainless Steel
Bales and Strips	Type 304 Stainless Steel
Studs	Type 304 Stainless Steel
Hardware	Type 304 Stainless Steel

- B. Provide double-strap for sizes 5" and larger.
- C. Provide Romac 305 and 306 or approved equal.
- D. Connect to pipeline using a 6" long stainless-steel nipple.
1. Do not use a threaded PVC connection.

2.9 YARD HYDRANT

- A. Lever type:
1. Provide Woodford Model Y1, Zurn or approved equal.
 2. Inlet opening, 1".
 3. Casing - 1-1/4" galvanized steel pipe.
 4. Provide 1" brass nozzle with 1" x 3/4" nozzle adapter.
 5. Provide vacuum breaker.

2.10 DETECTION TAPE

- A. Provide 2" wide metallic detection tape on all buried PVC piping.
 - 1. Provide 5.0 mil overall thickness with no less than a 50 gauge solid aluminum foil core.
 - 2. Foil to be visible from both sides.
 - 3. No inks or printing extended to the edges of the tape.
 - 4. Encase printing to avoid ink rub-off.
 - 5. Tensile strength - 28 lbs/inch.
 - 6. Use heat set mylar inks.
- B. Locate 12" below ground surface in pipe trench.
- C. Color to be safety brown.
- D. Wording on tape to indicate pipe contents and repeated a minimum of every 24".

2.11 PIPE EXPANSION JOINT

- A. Provide triple arched flanged expansion joints consisting of a filled style arches, inner tube, body, and outer cover where indicated on the construction drawings or as needed for a complete and proper installation.
- B. Provide steel reinforced Neoprene rubber construction.
- C. Install expansion joints between two fixed anchor points in a piping system.
 - 1. The piping system must be rigidly anchored on each side of the expansion joint.
- D. When proper anchoring cannot be provided, provide 316 stainless steel control rods.
 - 1. Minimum 150 psi service with a minimum factor of safety of 1.5.
- E. Provide ANSI B 16.5, Class 150#, full-faced integral flanges, with 316 stainless steel flange bolts, so that no gaskets are necessary.
- F. Provide two-piece, 3/8" thick, 316 stainless steel flange retaining rings.
- H. Provide Series 1100 rubber expansion joints as manufactured by General Rubber Corporation or equal.

2.12 PIPING SUPPORT SYSTEMS

PIPING AND ACCESSORIES

A. General:

1. Piping shall be supported, in general, as described hereinafter and as shown by the pipe support details on the Drawings. Manufacturers' catalog figure numbers are typical of the types and quality of standard pipe supports to be employed.
2. No attempt has been made to show all required pipe supports in all locations, either on the Drawings or in the details. The absence of pipe supports and details on any Drawings shall not relieve the Contractor of the responsibility for providing them throughout the facility.
3. All submerged piping supports, guides, and fasteners or those installed below wet wall tops shall be type 316 stainless steel. All other pipe supports to be type 304 stainless steel.
4. All support anchoring devices, including anchor bolts, inserts and other devices used to anchor the support onto a concrete base, roof, wall or structural steel works, shall be of the proper size, strength and spacing to withstand the shear and pullout loads imposed by loading and spacing on each particular support.
5. Where piping connects to equipment it shall be supported by a pipe support and not by the equipment. All piping shall be supported in a manner which will prevent undue strain on any valve, fitting, or piece of equipment. In addition, pipe supports shall be provided at changes in direction or elevation, adjacent to flexible couplings, and where otherwise shown.
6. Pipe support system components shall withstand the dead loads imposed by the weight of the pipes filled with water, plus any insulation. Commercial pipe supports and hangers shall have a minimum safety factor of five (5).
7. The maximum distance between supports or hangers shall not exceed:

	Stainless Steel Tubing, PVC	Copper, Stainless Steel, Steel or Ductile Iron
3/8" diameter and smaller	2-	4'
1/2" diameter	2-1/2'	6'
3/4" and 1" diameter	3'	8'
1-1/4" to 2" diameter	3-1/2'	10'
2-1/2" diameter to 5" diameter	4'	12'
6" diameter and larger	5'	12'

2.13 PIPE INSULATION

PIPING AND ACCESSORIES

- A. Insulation on all exterior, exposed piping shall be foamed glass with a maximum K-factor of 0.4 Btu-in/hr.-sq. ft. -F at thirty (30) degrees F, a permeability rating of 0.00 perm-inch, and a maximum absorption of 0.2 percent by volume. Insulation shall be Foamglas, as manufactured by Pittsburg Corning or equal. Insulation thickness shall be two (2)-inches for pipes three (3)-inches and smaller and 1½-inches for pipes four (4)-inches to eight (8)-inches.
- B. Insulation on aboveground piping shall be covered with minimum 0.016-inch thick aluminum jacket. The jacket shall be held in place by a continuous friction type joint, providing a positive weatherproof seal over entire length of jacket. The circumferential joints shall be secured with preformed snap straps containing weatherproof sealant. Cover outdoor fittings with matching preformed aluminum jackets, two (2) piece elbows and flange covers, secured with stainless steel bands. Fitting covers shall be as manufactured by Childers, Papco, or equal.

PART 3 EXECUTION

3.1 INSTALLATION OF BURIED PIPING - GENERAL

- A. Trench excavation and backfill requirements are specified in Section 02200.
- B. All buried pipe shall be prepared as hereinbefore specified and shall be laid on the prepared sub-grade and bedded to ensure uniform bearing. No pipe shall be laid in water or when, in the opinion of the Engineer, trench conditions are unsuitable. Take all precautions necessary to prevent uplift and floating of the pipe prior to backfilling.
- C. When the pipe laying is not in progress, including the noon hours, the open ends of pipe shall be closed, and no trench water, animals, or foreign material shall be permitted to enter the pipe.

3.2 INSTALLATION OF EXPOSED PIPING - GENERAL

- A. Unless shown otherwise, piping shall be parallel to building lines. Hangers on adjacent piping shall be aligned where possible on common size ranges.
- B. All pipe flanges shall be set level, plumb, and aligned. All flanged fittings shall be true and perpendicular to the axis of the pipe. All bolt holes in flanges shall straddle vertical centerline of pipes.
- C. Unions shall be installed where required for piping or equipment installation, even though they are not shown on the Drawings.
- D. Piping shall be installed without springing or forcing the pipe in a manner which would set up stresses in the pipe, valves, or connected equipment.
- E. Valve handwheels shall be oriented to permit easy access to the handwheels, and

to avoid interference.

- F. Tubing shall be installed straight with smooth bends. Tubing lengths shall be minimized by using hard piping up to the equipment items before transitioning to tubing.

3.3 INSTALLATION OF FLEXIBLE COUPLINGS AND FLANGED ADAPTERS

- A. Prior to installation, thoroughly clean oil, scale, rust, and dirt from the pipe to provide a clean seat for the gasket. Care shall be taken that the gaskets are wiped clean before they are installed. If necessary, gaskets may be lubricated with soapy water or manufacturer's standard lubricant before installation on the pipe ends. Install in accordance with the manufacturer's recommendations. Bolts shall be tightened progressively, drawing up bolts on opposite sides a little at a time until all bolts have a uniform tightness. Workmen tightening bolts shall use torque limiting wrenches.

3.4 INSULATION

- A. All piping shall be insulated in accordance with manufacturer's instructions including types of insulating cements, lagging adhesives, and weather-proof mastics.
- B. All insulation shall be applied over clean, dry surfaces with all joints butted firmly together, but not until piping system has been pressure tested and any leaks corrected. Insulation shall not extend beyond flanges nor cover nameplates or code inspection stamps. Insulation shall run continuous through wall openings, ceiling openings, and pipe sleeves, unless otherwise noted.
- C. Insulate all valve bodies, flanges, and pipe couplings. Provide removable insulation sections on all devices that require access for maintenance of equipment or removal.
- D. Finished appearance of all insulation shall be smooth and continuous. Provide coating of insulated cement where needed to obtain this result. Joints shall be lapped and the integrity of vapor seals maintained in strict accordance with manufacturer's instructions. Staples and screws shall not be used to secure components of systems that are vapor sealed.

3.5 INTERIM CLEANING

- A. Care shall be exercised during fabrication to prevent the accumulation of weld rod, weld spatter, pipe cuttings and filings, gravel, cleaning rags, etc. within piping sections. All piping shall be examined to assure removal of these and other foreign objects prior to assembly. Shop cleaning may employ any conventional commercial cleaning method if it does not corrode, deform, swell, or otherwise alter the physical properties of the material being cleaned.

3.6 FINAL CLEANING

- A. Following assembly and testing and prior to final acceptance, all pipelines installed under this section shall be flushed with water and all accumulated construction debris and other foreign matter removed. Flushing velocities shall be a minimum of 2.5-feet per second. Protect connected equipment by using strainers or disconnecting the equipment. Accumulated debris shall be removed through drains two (2)-inches and larger by dropping spools and valves.

3.7 HYDROSTATIC TESTING

- A. General: Make pressure and leakage tests on all newly laid pipe. The Contractor shall provide all necessary equipment and material, make all taps in the pipe as required, and conduct the tests. The Engineer will monitor and witness the tests before the installed pipe is approved.
- B. Test Pressure: Test pressure to be 150 psi, or 1.5 times the maximum working pressure, whichever is greater, based on the elevation of the lowest point of the section under test and corrected to the elevation of the test gauge. The test duration shall be two (2) hours. The Contractor shall provide a pressure chart recorder for the duration of each test.
- C. Procedure: Before applying the specified test pressure, all air shall be expelled from the pipe. If necessary, taps shall be made at points of highest elevation and plugged afterward. At the end of the test period, the Contractor will inject a sufficient quantity of water into the pipe section to re-establish the specified pressure. The Contractor shall provide suitable means to determine the quantity of water lost by leakage during the test. The Engineer must witness the quantity of water leakage and pressure recording and sign both before approving the test.
- D. Allowable Leakage: Exposed piping shall not have any visible leakage. For buried pipelines less than 500 LF the allowable leakage shall be zero gallons. For lengths more than more than 500 LF the allowable leakage shall be less than the amount determined by the following formula:

$$L = S \times D \times \sqrt{P} / 133,200; \text{ where}$$

L = allowable leakage in gallons per hour;
 S = length of pipe tested in feet;
 D = nominal diameter of pipe in inches;
 and P = average test pressure psi gauge.

- E. Allowable Loss of Pressure: The maximum allowable drop in pressure from the test pressure shall be no greater than five percent of the test pressure.
- F. Correction of Excessive Leakage: Should any test of pipe disclose leakage greater than that allowed, locate and repair the defective joints or pipe until the leakage

PIPING AND ACCESSORIES

of a subsequent test is within the specified allowance.

3.8 PAINTING

- A. All exposed, non-insulating piping, valves, and accessories shall be painted as specified in Section PAINTING and as directed by the Engineer. Colors shall be selected by the Owner according to submitted color charts.

END OF SECTION

(Pipe Schedule Follows)

PIPING SCHEDULE									
Flow Stream Abbreviation	Service	Size (inches)	Installation (Note 1)	Pipe Material	Protective Coatings		Joints (Note 2)	Test Pressure (Note 3)	
					Interior	Exterior		Type	Pressure
PW	Potable Water	All	All	PVC	None	None	SW	H	150
SS	Sanitary Sewer	ALL	ALL	DIP	Protecto 401	Bitumastic	PU/RJ Fittings	G	NA
MXL	Mixed Liquor	All	All	DIP	Protecto 401	Bitumastic	PU/RJ Fittings	G	NA
RAS	Return Activated Sludge	All	Exp	DIP	Protecto 401	Painted	Flanged	H	150
RAS	Return Activated Sludge	All	B	DIP	Protecto 401	Bitumastic	RJ	H	150
AIR	Process Air	ALL	All	SST	None	None	W		
FM	Force Main	All	Exp	DIP	Protecto 401	Painted	Flanged	H	150
FM	Force Main	All	B	DIP	Protecto 401	Bitumastic	RJ	H	150
SUC	Suction	All	Exp	DIP	Protecto 401	Bitumastic	Flanged	H	150
DRN	Drain	All	All	PVC	None	None	PU	G	NA
SEPW	Septage Waste	All	All	DIP	Protecto 401	Bitumastic	RJ	G	NA

Notes:

1. Installations: Exp: Exposed (interior or exterior)
 Enc: Encased in Concrete
 Imm: Immersed or submerged
 B: Buried
 All: All installations

2. Joints: W: Welded
 RJ: Restrained Joint
 Thd: Threaded
 Pu: Push On
 Fl: Flanged
 SW: Solvent Welded

3. Pressure Test Type: H: Hydrostatic
 A: Low Pressure Air
 G: Gravity. Test pressure is not shown for gravity pipe. Test to highest liquid level that pipe can be subject to.

**SECTION 15200
VALVES AND ACCESSORIES**

PART 1 GENERAL

1.01 WORK INCLUDED

- A. This Section covers the Work necessary for furnishing and installing the various valves in the plant piping systems.

1.02 GENERAL

- A. Like items of equipment specified herein shall be the end products of one (1) manufacturer in order to achieve standardization for operation, maintenance, spare parts, and manufacturer's service.

1.03 SUBMITTALS DURING CONSTRUCTION

- A. Submittals during construction shall be made as required in Section GENERAL REQUIREMENTS. In addition, the following specific information shall be provided:

- 1. Valve type number.

1.04 MANUFACTURER'S SERVICE

- A. The Contractor shall provide for and receive the services of a qualified manufacturer's representative for power-actuated valves.
- B. The representatives(s) shall be present at the job site and/or classroom designated by the Owner for the minimum man-days listed for the services identified hereunder, travel time excluded:
 - 1. ½ man-day for training the Owner's personnel in the operation and maintenance of the equipment.
- C. Startup services and training of the Owner's personnel shall be at such times as requested by the Owner.

PART 2 PRODUCTS

2.1 GENERAL

- A. All valves shall be complete with all necessary operators, handwheels, operating nuts, wrenches, and other accessories or appurtenances, which are required for the proper completion of the Work. Operators and other accessories shall be sized and furnished by the valve supplier and factory mounted.

VALVES AND ACCESSORIES

- B. Valves shall be suitable for the intended service. Renewable parts including discs, packing, and seats shall be of types recommended by valve manufacturer for intended service, but not of a lower quality than specified herein.
- C. Valves shall be suitable for the exposure they are subject to, buried, interior or exterior, as applicable.
- D. Unless otherwise shown, valves shall be the same size as the adjoining pipe.
- E. All units shall have the name of the manufacturer and the size of the valve cast on the body or bonnet or shown on a permanently attached plate in raised letters.
- F. For the purpose of designating the type and grade of valve desired, a manufacturer's name and list or figure number is given in the following Specifications. Valves of equal quality by other manufacturers will be considered in accordance with the GENERAL CONDITIONS.

2.2 VALVE TYPES

- A. Valve types are specified by number. The type of valve to be used for each service and application is indicated on the Drawings by valve number callout, although not all valves are called out by number on the Drawings. See Valve Schedule at the end of this section for actuated valves.

2.3 DESIGN FEATURES

- A. Brass and Bronze Components:
 - 1. Brass and bronze components of valves and appurtenances which have surfaces in contact with the water shall be alloys containing less than sixteen (16%) percent zinc and two (2%) percent aluminum.
 - 2. Approved alloys are of the following ASTM designations:
 - a. B61, B62, B98 (Alloy UNS No. C65100, C65500, or C66100), B139 (Alloy UNS No. C51000), B584 (Alloy UNS No. C90300 or C94700), B164, B194, and B127 and C995.
 - b. Stainless steel Alloy 18-8 may be substituted for bronze at the option of the manufacturer and with the approval of the Engineer.
 - 3. All gland bolts on iron body valves shall be bronze and shall be fitted with brass nuts.
 - 4. Valve ends shall be as specified, as shown on the Drawings, and to suit the adjacent piping.

2.4 VALVE OPERATORS

- A. General: All valves shall be equipped with operators. The valve operator types, as specified herein, describe only the general characteristics of the operator. The operator shall be compatible with the valve that it will be used with and shall be of the same manufacturer, or a product that is recommended by the valve manufacturer. All valve operators shall open by turning counterclockwise.

- B. Manual Operators:
 - 1. General: Manual handwheel operators shall be provided unless otherwise shown or specified. Ferrous handwheels shall be painted red or as selected by the Owner.
 - 2. Buried Operators: Buried service operators on valves larger than 2½-inches shall have a two (2)-inch AWWA operating nut. All moving parts of the valve and operators shall be enclosed in the housing to prevent contact with the soil.

- C. Electric Operators:
 - 1. The operators shall be power-actuating devices in accordance with AWWA C540 and as specified herein. Manufacturer shall provide certified drawings and affidavit of compliance as specified in AWWA C540.
 - 2. Actuators shall be furnished and sized by the valve supplier for service shown and shall be factory mounted. They shall be sized to produce 1-1/2 times the required operating torque, but the stall torque of the motor shall not exceed the torque capacity of the valve.
 - 3. Motors shall be sized for continuous duty. Actuators shall operate the valve from fully closed to fully open or the reverse in ten (10) to sixty (60) seconds.
 - 4. Actuators shall be permanently lubricated at the factory. Gear train shall be self locking.
 - 5. Actuator controls shall be integral, operating one hundred-twenty (120)-volt, single-phase, sixty (60)-Hz ac power. Actuators shall be furnished with integral manual override. Actuator shall be furnished with integral manual travel stops and adjustable limit switches.
 - 6. Enclosures shall be NEMA 4 Watertight. (Hard anodized aluminum with epoxy coating preferred).
 - 7. Actuators for quarter-turn valves shall Limitorque Ly Series, Rotorque, Auma, or equal.

2.5 ACCESSORIES

- A. Tagging: Each valve shall be provided with a 1½-inch minimum diameter heavy brass or stainless steel tag. The tags shall be attached to the valve with key rings so that ring and tag cannot be removed. The numbers and letters shall be of block type, with ¼-inch high numbers and letters stamped thereon.
- B. Valve Boxes: Valve boxes shall be cast iron two (2) piece adjustable heavy roadway type with 5 ¼ inch diameter and appropriate length for the installation. Include cast iron lid with the work "Water" cast into the top of the lid. Extension pieces, if required, shall be the manufacturer's standard type.
- C. T-Handled Operating Wrenches: Provide one (1) galvanized and/or painted operating wrench, four (4) feet total length, Mueller No. A-24610, Clow No. F-2520, or equal.
- D. Floor Stands and Extension Stems: When required by the installations, floor stands and extension stems shall be provided for operation of valves. Floor stands shall be of the rising stem, indicating type, complete with all necessary steel extensions stems, couplings, handwheels, stem guide brackets, and special yoke attachments as required by the valves and recommended and supplied by the stand manufacturer. Stem guides shall be spaced so that the stem L/R ratio does not exceed two hundred (200). Provide all necessary anchor bolts in Type 316 stainless steel. Floor stands shall be cast iron base type, as manufactured by Clow Corporation, Mueller Company, or equal. All handwheels shall turn counterclockwise to open the valves.

2.6 AIR SERVICE VALVES:

- A. Valves for low pressure air service (less than 25 psig) shall be resilient-seated butterfly valves as manufactured by Dezurik or equal. All valve components shall be suitable for continuous operation at temperatures up to 250° F with a 25 psi minimum working pressure. Materials of construction shall be:
 - 1. Valve bodies shall be Ductile Iron
 - 2. Valve discs shall be offset to provide an uninterrupted 360 degree seating edge and shall be 316 stainless steel. The disc/shaft connection shall be splined.
 - 3. Valve shafts shall be 316 stainless steel.
 - 4. Valve seats shall fully and permanently bonded to the valve body. Seat shall be EPDM. Seats shall have integral flanged seals so flange gaskets are not required.
- B. Valves shall be flanged or wafer or lug style body.

VALVES AND ACCESSORIES

- C. Manually operated valves shall be provided with a handwheel or chainwheel as required, and shall provide for tight shut-off. A mechanical dial indicator shall be provided on the operator to continuously indicate valve positions.

2.7 PLUG VALVES

- A. Provide non-lubricated, full port opening, eccentric type plug valves having resilient faced plugs, complying with AWWA Standard C517 and other requirements specified herein.
- B. Furnish flanged or mechanical joint end connections as indicated on the Drawings.
 - 1. Unless otherwise noted on the drawings, all exposed valves shall have flanged end connections and all buried valves shall have mechanical joint end connections.
 - 2. Flanged ends to be faced and drilled to ANSI 125/150 lb. standard.
- C. Provide valves of bolted bonnet design:
 - 1. Valves 3" and larger to be designed to allow packing inspection and replacement without removing the bonnet or actuator and the packing shall be adjustable.
 - 2. Packing to be replaceable with the valve under pressure with valve open or closed with pressure on either side of the plug.
- D. Provide valves capable of drip-tight shutoff up to full rating with pressure in either direction. Pressure ratings shall be 175 psi for 3" through 12 and 150 psi for 14" and larger.
- E. Provide cast iron valve bodies complying with ASTM A 126, Class B and AWWA Standard C517.
- F. Provide one piece plugs cast of ASTM A536 ductile iron.
- G. Open Counterclockwise.
- H. All exposed nuts, bolts, springs, etc. shall be stainless steel on all valves.
- I. Provide minimum 100% full pipe area on sizes 3"-60".
 - 1. Provide rectangular port; round ports are not acceptable.
- J. Provide corrosion resistant seats complying with AWWA Standard C507-73 and AWWA Standard C517.

VALVES AND ACCESSORIES

- K. Provide valves with permanently lubricated, Type 316 stainless steel bearings in the upper and lower plug stem journals.
 - 1. Bearings to comply with AWWA Standard C517.
- L. Provide neoprene plug facings vulcanized to the plug. Plug facing bond strength shall meet test methods as described in ASTM D429 method B (75 psi test).
- M. Plug valves to be DeZurik, Pratt, or equal.

2.8 CHECK VALVES

- A. Check valves shall be 175 psi working pressure, flanged, bronze disc ring and seat ring, neoprene faced, weight and lever, cushioned swing operated type valves.
 - 1. The cushion chamber shall be attached to the side of the valve body externally and so constructed with a piston operating in a chamber that will effectively permit the valve to be operated without any hammering action.
 - 2. The shock absorption shall be by air, and the cushion chamber so arranged that the closing speed will be adjustable to meet the service requirements.
- B. The valve shall be Figure 250-D by G.A. Industries or equal. Valves shall be AWWA approved.

2.9 AIR/VACUUM VALVES (NORMAL OPERATION)

- A. Provide single body universal type with compound lever system.
 - 1. Design valve to automatically exhaust large amounts of air and gases while the pipeline or system is being filled.
 - 2. Design valve to release accumulated pockets of air while the pipeline is in operation.
 - 3. Design valve to re-open to admit air during draining or when a negative pressure exists in the system.
- B. Body to be reinforced nylon.
- C. All non-sealing internal metal components shall be 316 stainless steel.
- D. Provide valve with minimum 2" inlet, or larger, if shown on the drawings.
- F. Provide inlet Type 316 stainless steel ball valve with T-handle operator.

VALVES AND ACCESSORIES

G. All piping, nipples, etc., to be Schedule 40, Type 316L stainless steel.

H. Provide ARI, Inc. Model SAAR Short Version 0-025.

2.10 STAINLESS STEEL BALL VALVES, 4" AND SMALLER

A. Provide the following for sizes under 3":

1. Full port Type 316 stainless steel ball valves where indicated on the plans or otherwise specified herein.
2. Lever handle operator. T-handle operator where space does not allow use of lever.
3. Three-piece body that is in-line serviceable without removing the valve from the line.
4. Acceptable manufacturers:
 - a. Series "60" as manufactured by Whitey.
 - b. Apollo Series 86A as manufactured by Conbraco.
 - c. V3P-1000 as manufactured by Velan.

2.11 PVC AND CPVC BALL VALVES

A. Provide true union PVC or CPVC ball valves to match pipe material where shown on the plans.

B. Provide valves with the following features:

1. Full port design.
2. Reversible PTFE seats.
3. Adjustable seat retainer.
4. Viton double O-ring stem seals unless indicated otherwise.
5. Provide stem extension where indicated.
6. Provide Hayward True Union ball valves or equal.

2.12 VALVE BOXES

A. Provide at each buried valve.

B. Cast iron extension type, suitable for minimum cover of 3'6" over the pipe.

VALVES AND ACCESSORIES

- C. Minimum inside diameter at the top of 5", minimum riser wall thickness 1/4" and thickness at the top of 11/16".
- D. Have the word "WATER"; "SEWER"; "SLUDGE", etc., as applicable, cast into the cover.
- E. Provide Tyler Series 6850.
- F. Where depth requires more than a two-piece box use adjustable cast iron extensions.
- G. Coat box and cover with two (2) shop coats of bitumastic paint.
- H. Provide precast concrete protection ring at each valve box.

2.13 GROUNDWATER (PRESSURE) RELIEF VALVES

- A. General:
 - 1. Provide groundwater pressure relief valves where indicated.
 - 2. Class 30 cast iron cover, flap valve (horizontal), body and removable strainer.
 - 3. Open on less than one foot of head differential.
 - 4. Field replaceable rubber seat for tight shut off.
 - a. 40 durometer Neoprene.
 - b. QuadroSeal wraparound design.
 - c. Bond to body with adhesive sealant.
 - d. Secure to valve body and lid at the outside diameters.
 - 5. Provide Trumbull Industries or approved equal.
- B. Horizontal installation:
 - 1. Angle seats for positive closing.
 - 2. Provide thimble with strainer locked by lugs with rotation and secured with stainless wire.
 - 3. Provide tapped ANSI Class 125 flanged wall pipe with type 316 stainless steel studs and nuts.
 - a. 7/16" flange thickness.
 - 4. Type 316 stainless steel hinge pin.

- a. Bronze pin is not acceptable.

PART 3 EXECUTION

3.01 GENERAL

- A. Bolt holes of flanged valves shall straddle the vertical centerline of the pipe run. Prior to installing flanged valves, the flange faces shall be thoroughly cleaned. After cleaning, insert gasket and bolts, and tighten the nuts progressively and uniformly. If flanges leak under pressure, loosen or remove the nuts and bolts, reset or replace the gasket, retighten and/or reinstall the nuts and bolts, and retest the joints. Joints shall be watertight at test pressures before acceptance.
- B. Thoroughly clean threads of screwed joints by wire brushing, swabbing, or other approved methods. Apply approved joint compound to threads prior to making joints. Joints shall be watertight at test pressures before acceptance.

3.02 PLACING

- A. Generally, unless otherwise indicated on the Drawings, all valves installed in horizontal runs of pipe having center line elevations four (4)-feet six (6)-inches or less above the finish floor shall be installed with their operating stems vertical. Valves installed in horizontal runs of pipe having center line elevations between four (4)-feet six (6)-inches and six (6)-feet nine (9)-inches above the finish floor shall be installed with their operating stems horizontal. If adjacent piping prohibits this, the stems and operating handwheel shall be installed above the valve horizontal centerline as close to horizontal as possible. Valves installed in vertical runs of pipe shall have their operating stems oriented to facilitate the most practicable operation.

3.03 TESTING

- A. Valves shall be tested at the same time that the adjacent pipeline is tested. Joints shall show no visible leakage under test. Repair joints that show signs of leakage prior to final acceptance. If there are any special parts of control systems or operators that might be damaged by the pipeline test, they shall be properly protected. The Contractor will be held responsible for any damage caused by the testing.
- B. If requested by the Engineer, the valve manufacturer shall furnish an Affidavit stating the materials options furnished and/or that he has complied with these and other referenced Specifications.

END OF SECTION

SECTION 15700
HEATING, VENTILATING, AND AIR CONDITIONING

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Provide heating, ventilating, and air conditioning systems where shown on the Drawings, as specified herein, and as needed for a complete and proper installation.

1.2 SCOPE

- A. These Specifications together with the accompanying mechanical Drawings are intended to provide for the complete installation of new mechanical systems for the new building construction and existing building.
- B. The heating and air conditioning (H&AC or mechanical) contractor:
 - 1. Provide heating, air conditioning and ventilating equipment and materials as specified hereinafter and as indicated and scheduled on the Drawings.
 - 2. Provide all equipment, materials, labor and services necessary to provide complete and operating mechanical systems for the buildings.
 - 3. Pay all fees secure all licenses and permits that are required and necessary in order to perform the work set forth in these Specifications. He shall comply with all federal, state and local codes as well as requirements of the 2018 Edition of the International Building, Mechanical and Plumbing Codes and the 2009 Edition of the Energy Code, ADA, EPA, NFPA and all other authorities having jurisdiction over this work.
 - 4. Provide excavating and backfilling necessary for this work and promptly remove from the premises all excess earth, debris and trash for which responsible.
 - 5. Inform the General Contractor well in advance of the sizes and locations of all chases, openings, lintels, sleeves, etc., required for the installation of the mechanical equipment.
 - a. Failure to do so will result in the H&AC contractor bearing the cost of this phase of the work.

**HEATING, VENTILATING,
AND AIR CONDITIONING**

5. Perform all work included under this Section by skilled and capable workmen under competent supervision, employing the latest and best practices of the various trades involved.
 7. Visit the job site prior to submitting a bid for this work, in order to become familiar with all existing conditions, and to verify all items related to this contract.
 - a. No extra payments will be allowed on account of extra work made necessary because of failure to do so.
 8. H&AC contractor is responsible for determining that all products submitted for approval meet given space limitations and maintain all required clearances for proper access and service.
 9. Coordinate any changes in electrical requirements with the electrical contractor at no added cost to the Owner.
 10. Failure of the H&AC contractor to advise the General Contractor well in advance of all openings, sleeves, etc., required will result in the H&AC contractor bearing cost of this phase of the work.
- C. General Contractor will:
1. Flash all roof curbs furnished by the H&AC contractor.
 2. Do all cutting, patching and construction of chases that is necessary for the installation of the work covered under this contract.
 3. Provide all framed openings in the walls and roof for ductwork penetrations, louver openings, fan openings, etc., as applicable.
- D. All materials and equipment hereinafter specified shall be new and free from flaws and defects of any nature.
- E. Refer to the Drawings and Specifications for a complete description of any and all alternates as they pertain to the mechanical work.

1.3 QUALITY ASSURANCE

- A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

HEATING, VENTILATING, AND AIR CONDITIONING

- B. Provide materials and equipment new and free from flaws and defects of any nature.
- C. Materials specified are considered as standards of quality, which however, implies no right on the part of the General Contractor to substitute other materials and methods without written authority from the Engineer.
- D. Perform all work by skilled mechanics, under competent supervision, employing latest and best practices of the trade.
- E. Install work in accordance with recommendations of ASHRAE Guide and the equipment manufacturer.
 - 1. In the event there is any conflict or doubt, consult Engineer for clarification and approval.
- F. The phrase "or equal" means that material or equipment will be acceptable only when, in the judgment of the Engineer, they are composed of parts of equal quality, or equal workmanship and finish, designed and constructed to perform or accomplish the desired result as efficiently as the indicated brand, pattern, grade, class, make or model.
 - 1. Obtain written approval from the Engineer prior to installation.
- G. Without additional cost to the Owner, provide such other labor and materials as are required to complete the work of this Section in accordance with the requirements of governmental agencies having jurisdiction, regardless of whether such materials and associated labor are called for elsewhere in these Contract Documents.
- H. Insulation: Install all insulation in a workmanlike manner by qualified insulation mechanics in regular employ of a licensed insulation contracting firm working in the capacity of a subcontractor under the mechanical contractor. Install all insulation in strict accordance with the manufacturer's recommendations, using approved type laggings, adhesives, mastics, and other materials as applicable.

1.4 SUBMITTALS

- A. Product data: Within 60 calendar days after the General Contractor has received the Owner's Notice to Proceed, submit:
 - 1. Materials list of items proposed to be provided under this Section.
 - 2. Manufacturer's specifications and other data needed to prove compliance with the specified requirements.

**HEATING, VENTILATING,
AND AIR CONDITIONING**

3. Shop drawings showing sectional views, dimensions, end connections, and operator details.
- B. Submit for review and approval the following items of equipment and materials, as a minimum:
1. All HVAC equipment.
 2. Air distribution equipment.
 3. Ductwork materials.
 4. Ductwork insulation.
 5. Control equipment and diagrams.
- C. Vibration and seismic control products manufacturer:
1. Provide piping, ductwork and equipment isolation systems and seismic restraints as scheduled or specified with installation instructions and shop drawings for all seismic materials.
 2. Include calculations to determine restraint loads resulting from seismic forces presented in local building code or IBC, Chapter 16, Latest Edition.
 - a. Certify and stamp seismic calculations to be by an engineer in the employ of the seismic equipment manufacturer with a minimum five (5) years of experience and licensed in the project's jurisdiction.
 - b. Provide calculations for all floor or roof mounted equipment and all suspended or wall mounted equipment 20 pounds or greater.
 2. Calculations and restraint device submittal drawings shall specify anchor bolt type, embedment, concrete compressive strength, minimum spacing between anchors and minimum distances of anchors from concrete edges.
 3. Provide shop drawings indicating location of all cable restraints required for pipe and ductwork.
 5. Stamp drawings by a manufacturer's Professional Engineer registered in the State of South Carolina.

**HEATING, VENTILATING,
AND AIR CONDITIONING**

- D. Remove any item of equipment installed on this project which was not specified or approved for substitution and replace with the item specified, without any cost to the Owner.
- E. Provide operation and maintenance manuals complying with provisions of Division 1 and include the following:
 - 1. "As-Built" control drawings.
 - 2. Control supplier's certificate.
 - 3. Air balance reports.
 - 4. Mechanical equipment installation and maintenance manuals.
- F. Samples:
 - 1. When so requested by the Engineer, promptly provide samples of items scheduled to be installed in the final structure.
 - 2. When specifically so requested by the General Contractor and approved by the Engineer, approved samples will be returned to the General Contractor for installation on the work.

1.6 DRAWINGS

- A. The mechanical drawings are diagrammatic only and are intended to show the general arrangement of component parts of the HVAC systems.
- B. Coordinate work with other trades and provide all fittings, offsets, etc., necessary to avoid interferences without extra charge to the Owner.
- C. In case of doubt as to the Drawings or Specifications, call to the Engineer's attention all discrepancies, errors or omissions encountered.
 - 1. Do not proceed in uncertainty.

1.7 PERMITS, LICENSES AND FEES

- A. H&AC contractor shall obtain and pay for all permits, licenses, fees and service charges required for execution of this work.

1.8 DESIGN CONDITIONS

- A. Outdoor design conditions:

**HEATING, VENTILATING,
AND AIR CONDITIONING**

Winter season	22°F outside
Summer season	95°F dry bulb and 75°F wet bulb outside

B. Indoor design conditions:

New Electrical Room

Summer season	95°F - 104°F
Winter season	60°F ± 5°F
Ventilation (Summer for heat removal)	Approx. 39 AC/hr (intermittent)

New Blower Room

Summer season	95°F - 104°F
Winter season	45°F ± 5°F
Ventilation (Summer for heat removal)	Approx. 52 AC/hr (intermittent)

Existing Blower Bldg

Summer season	95°F - 104°F
Winter season	45°F ± 5°F
Ventilation (Summer for heat removal)	Approx. 26 AC/hr (intermittent)

1.9 TECHNICAL SERVICES

A. Provide the services of a competent engineer or mechanic to thoroughly train and instruct the Owner's personnel in the proper operation and maintenance of all mechanical items of equipment, complying with the following:

1. Start-up and training: 1 day, 1 trip.

1.10 WARRANTY

A. Comply with provisions of Division 1.
B. Guarantee mechanical systems to operate quietly, safely, and efficiently.

1.11 SPARE PARTS

A. Provide the following spare parts: One (1) extra set of drive belts for each piece of belt driven equipment.

PART 2 - PRODUCTS

2.1 ELECTRIC UNIT HEATER 'WASHDOWN TYPE' (EUH)

- A. Provide where indicated on the Drawings, stainless steel "washdown" type electric unit heater(s) of size, type and capacity as scheduled on the Drawings.
- B. Provide horizontal discharge.
- C. Furnish complete with:
 - 1. Chrome plated finned tubular type electrical heating element.
 - 2. Permanently lubricated totally enclosed heavy-duty UL fan motor with built-in overload protection.
 - 3. Propeller type fan with Teflon anodized aluminum fan blades.
 - 4. Non-metallic NEMA 4X stainless steel control enclosure for control voltage transformer.
 - 5. Integral magnetic contactor.
 - 6. Built-in automatic reset type thermal overhear switch.
 - 7. Fuses.
 - 8. Door interlock disconnect.
 - 9. Heavy duty Type 304 stainless steel shroud and discharge grille.
- D. Entire heater shall be UL listed and constructed for wet and corrosive locations.
- E. Provide wall mounted heating thermostat for each heater, T109 Series controls NEMA 4 with wire-wound resistive element type (RTD) temperature sensors using either nickel or platinum alloy as the resistive element suitable for installation in harsh environments. Install electric unit heater thermostats in stainless steel electric boxes with remote stainless steel bulbs.
- F. Provide Type 316L stainless steel wall mounting brackets for each heater, 15 KW and smaller. Wall mounting brackets for heaters over 15 KW shall be heavy duty steel with epoxy powder coat finish.

**HEATING, VENTILATING,
AND AIR CONDITIONING**

1. Support from the wall as recommended by the equipment manufacturer and as directed by the Engineer.
 2. Provide all supplementary Type 316L stainless steel, framing members, wall inserts, anchors, etc., as required to properly support each unit heater.
 3. Provide stainless steel seismic restraint devices as recommended by seismic restraint equipment supplier.
- G. Provide Markel Co. model electric unit heater(s) as scheduled on the Drawing, or equal by Chromalox, Raywall or Qmark.

2.2 ELECTRIC 'HEAVY DUTY' TYPE UNIT HEATER (EUH)

- A. Provide where indicated on the Drawings, standard type electric unit heater(s) of size, type and capacity as scheduled on the Drawings.
- B. Provide horizontal discharge.
- C. Furnish complete with:
 1. Sheathed finned tubular type electrical heating element.
 2. Permanently lubricated totally enclosed heavy-duty UL fan motor with
 3. Built-in overload protection.
 4. Propeller type fan with aluminum fan blades.
 5. Steel control enclosure for controls and control voltage transformer.
 6. Integral magnetic contactor.
 7. Built-in automatic reset type thermal overheat switch.
 8. Fuses.
 9. Disconnect switch.
 10. Safety fan guard and horizontal steel discharge grille.

**HEATING, VENTILATING,
AND AIR CONDITIONING**

- D. Entire heater shall be UL listed.
- E. Provide wall mounted heating thermostat for each heater. Provide protective wire guard for each thermostat.
- F. Provide wall mounting brackets for each heater.
 - 1. Support from the wall as recommended by the equipment manufacturer and as directed by the Engineer.
 - 2. Provide all supplementary steel, framing members, wall inserts, anchors, etc., as required to properly support each unit heater.
 - 3. Provide seismic restraint devices as recommended by seismic restraint equipment supplier.
- G. Provide Markel Co. model electric unit heater(s) as scheduled on the Drawings or equal by Chromalox Co., Raywall or Q'Mark.

2.3 VENTILATING EQUIPMENT

- A. Provide ventilating equipment for the building as indicated on the Drawings, as described below, and as specified on schedule on the Drawings.
 - 1. For roof mounted equipment, install tops of curbs (where applicable) level and a minimum of 8" above the finished roof deck.
 - 2. All roof curbs shall be seismically secured to structural members of the roof deck.
- B. Stationary wall louvers:
 - 1. Provide stationary type wall louvers of sizes as specified on the Drawings. Each louver shall be furnished complete with drainable stormproof type stationary blades at 37.5 degree angle on 5-1/8" centers maximum, channel type frame for recessed installation or flanged type frame for flush installation as indicated on "A" drawings and as directed by the onsite Engineer, 1/2" mesh aluminum bird screen, extruded aluminum construction, and Kynar 500 finish on entire assembly of a custom color to be selected by the Architect/Engineer. Furnish wall louvers to General Contractor for installation.
 - 2. Stationary wall louvers shall be 4" thick minimum, and shall be Ruskin Mfg. Co. Model ELF-375DX louvers, or equal by Air Balance Co.

C. Motorized parallel blade low leakage backdraft dampers:

1. Install a parallel blade heavy duty backdraft damper in a heavy gauge aluminum duct sleeve mounted behind louvers where indicated on the Drawings. Parallel blade dampers shall have an aluminum frame constructed of .125" thick extruded aluminum with .125" thick extruded aluminum blades, extruded vinyl blade edge seals, flexible metal compression type jamb seals, 1/2" diameter steel pivot pins and shafts for attaching multiple damper actuators in the airstream where applicable. Actuators shall be 120 volt, furnished and properly sized by the damper manufacturer. Provide end switches for actuators where indicated on schedule on drawings.
3. Backdraft damper and sleeves shall be furnished with a Kynar 500 finish of a custom color selected by the Architect/Engineer.
4. Install heavy gauge aluminum expanded metal guards over the rear of the motorized backdraft dampers. Expanded metal guards shall be furnished by the louver manufacturer and shall be equal to McNichols Co. 1-1/2"#.081 S with an open free area of 85%. Expanded metal shall be installed in removable frames for mounting on the rear of louver/damper assemblies and shall be furnish with Kynar 500 finish to match louvers and dampers.
5. Parallel blade backdraft dampers shall be Ruskin Mfg. Co. Model CD-51-PB low leakage dampers, or equal by Air Balance Co.
5. When indicated on schedule on drawings provide Ruskin Mfg. Co. Model CD-60 Class 1A PB low leakage control dampers with airfoil blades with colors, finishes and features as specified above.

D. Counterbalanced backdraft dampers:

1. Furnish and install where indicated on the Drawings counterbalanced backdraft dampers:
 - a. Heavy duty dampers with frame constructed of .125" thick extruded aluminum and blades constructed of .07" thick extruded aluminum with vinyl blade edge seals mechanically locked into blade edge.
 - b. Bearings to be corrosion resistant synthetic type.
 - c. Linkage to be 1/2" wide tie bar connected to stainless steel pivot pins.
 - d. Damper blades to have adjustable zinc plated counterbalance bars.

**HEATING, VENTILATING,
AND AIR CONDITIONING**

- e. Design for maximum 3500 fpm spot velocity and 2500 fpm maximum system velocity.
 - f. Provide with a Kynar 500 finish to match louver finish.
- 2. Provide Ruskin Mfgr. Co. Model CBD6.
 - 3. Install aluminum expanded metal guards over the rear of the counterbalanced backdraft dampers.
 - a. Expanded metal guards to be furnished by the louver manufacturer or equal to McNichols Co. 1-1/2"#.081 S with an open free area of 85%.
 - b. Expanded metal to be installed in removable frames for mounting on the rear of louver/damper assemblies.
 - c. Furnish with Kynar 500 finish to match louvers and dampers.
 - 4. Dampers to be installed in aluminum sleeves on rear of stationary louvers furnished by the HVAC contractor and installed by the General Contractor.
- E. Sidewall Exhaust Fans - Centrifugal Type (SWEF):
- 1. Provide belt driven or direct drive centrifugal type sidewall exhaust fans of sizes and capacities as specified on schedule on the Drawings.
 - 2. AMCA sound and air performance certified.
 - 3. Provide complete with a spun aluminum housing, 1/2" mesh aluminum bird screen, fan motor with built-in thermal overload protection for each fan motor 1/2 horsepower and smaller, magnetic starter (furnished by the Electrical Contractor) with thermal overload protection of each fan motor 3/4 horsepower and larger, disconnect switch mounted under ventilator cover, wall switch and/or thermostat where indicated on Drawings, gravity automatic aluminum backdraft damper, damper frame, ball or roller type L50 life bearings mounted in cast iron pillow blocks with grease fittings, cast iron pulleys with adjustable motor sheaves and drives sized for a minimum of 150% of driven horsepower and other accessories as applicable. When indicated on schedule on drawings, provide gravity back draft damper.
 - 4. Mount the entire fan and motor assembly on vibration isolators to reduce noise transmission.

**HEATING, VENTILATING,
AND AIR CONDITIONING**

5. Coat entire exhaust fan, bird screen and backdraft damper with "Hi-Pro Poly" corrosion coating on aluminum surfaces and "Hi-Pro-Z" coating on steel surfaces in custom colors selected by the Architect/Engineer.
6. Where indicated on the schedule on the drawings sidewall centrifugal fans shall be furnished a variable speed motor (electronic commutation) 'vari-green' motor and controller for variable or two speed operation.
7. Starters for exhaust fans interlocked with motorized dampers shall have auxiliary contacts for interlocking the damper motors to operate in step with the respective wall fans. Coordinate starter requirements with the Electrical Contractor.
8. Provide sidewall centrifugal type exhaust fans as manufactured by Greenheck Corp, models as indicated on schedule on Drawings, or approved equal.

F. Sidewall Exhaust Fan - Propeller Type (SWPF):

1. Furnish and install in the exterior wall of the building where indicated on the plans, a belt-driven propeller type sidewall exhaust fan(s) of size and capacity as schedules on the Drawings:
 - a. Steel wall panel and drive support frame.
 - b. Propeller type fan assembly.
 - c. Reinforcing gussets welded to fan blades.
 - d. Fan blades welded to a steel hub.
 - e. Single-speed fan motor.
 - 1) Built-in thermal overload protection for each fan motor 1/2 H. P. and smaller.
 - 2) Magnetic starter with thermal overload protection for each fan motor 3/4 H. P. and larger.
 - 3) Fan motor disconnect switch.
 - f. L10 bearing life.
 - g. Flush type single-speed wall switch (as applicable) where indicated on plans.
 - h. Steel wall housing.
 - i. Flush mounted gravity or motorized discharge shutter as indicated on the schedule on the Drawings.
 - j. Steel wire protective guard attached to rear of wall housing.
 - k. Other accessories as applicable.
2. Furnish starter for fan. Starters for exhaust fans interlocked with motorized dampers shall have auxiliary contacts for interlocking the damper motors to operate in step with the respective wall fans.

**HEATING, VENTILATING,
AND AIR CONDITIONING**

3. Coat entire exhaust fan, wall housing, motor guard and damper/shutter with "Hi-Pro Poly" corrosion coating on aluminum surfaces and "Hi-Pro-Z" coating on steel surfaces in custom colors selected by the Architect/Engineer.
4. Propeller type sidewall exhaust fan(s) shall be GREENHECK models as scheduled on the Drawings.

G. Roof Upblast Exhaust Fans (REF):

1. Furnish and install on the roof of the building where indicated on the plans, a direct drive or belt-driven centrifugal type upblast roof exhaust fan of size and capacity as specified on schedule on drawings.
2. Fan shall be furnished complete with a spun aluminum housing, 1/2" mesh aluminum bird screen, fan motor with built-in thermal overload protection for each fan motor 1/2 H.P. and smaller, magnetic starter with thermal overload protection with each fan motor 3/4 H.P. and larger, disconnect switch mounted under ventilator cover, aluminum spark-proof fan wheel assembly, fan motor and belt mounted out of the air stream, and gravity or motorized backdraft damper as indicated on drawings. Motorized dampers shall be VCD-23 low leakage type with end switches.
3. Install exhaust fan on galvanized pre-fabricated custom transition roof curb. Curb shall be sized to fit over existing roof opening and structural framing and transition to mate with roof fan. Roof curb shall be installed on roof with top of curb level. Top of curb shall be a minimum of 8" above the finished roof.
4. Coat entire exhaust fan, bird screen, backdraft damper and roof curb with "Hi-Pro Poly" corrosion coating on aluminum surfaces and "Hi-Pro-Z" coating on steel surfaces in custom colors selected by the Architect/Engineer.
5. Where indicated on the schedule on the drawings roof exhaust fans shall be furnished a variable speed motor (electronic commutation) 'vari-green' motor and controller for variable or two speed operation.
6. Starters for exhaust fans interlocked with motorized dampers shall have auxiliary contacts for interlocking the damper motors to operate in step with the respective roof fans. Starters shall be provided by the Electrical Contractor. Coordinate starter requirements with the Electrical Contractor.

**HEATING, VENTILATING,
AND AIR CONDITIONING**

7. Roof Upblast Exhaust Fan(s) shall be GREENHECK models as scheduled on the plans or approved equal.
- H. Starters (when required):
1. All starters required for the ventilating equipment shall be furnished and installed by the Electrical Contractor and comply with Division 16.
 2. Starters shall be combination type furnished with "Hand-Off-Automatic" switches, so that the various items of equipment may be operated manually or automatically.
 3. Coordinate ventilating equipment starter requirements with the Electrical Contractor.
- I. General: Ductwork, turning vanes, grilles, dampers, and other applicable items that are to be installed in conjunction with the ventilating equipment are specified elsewhere.

2.4 EQUIPMENT SUPPORTS

- A. Properly support ductwork and equipment from the roof, wall or floor construction with steel brackets, threaded rods or strap hangers constructed of stainless steel.
- B. Securely attach brackets, hanger rods, or strap hangers to structural components of the building.
- C. Provide all supplementary steel, framing members, hanger rods, vibration isolators, inserts, etc., to properly support all ductwork and equipment.
- D. All steel equipment supports, brackets, hanger rods, strap hangers, inserts, fasteners, supplemental steel, nuts, bolts, etc. shall be minimum Type 316 stainless steel.
- E. Do not support mechanical items of equipment and ductwork from "X" bracing or bridging between joists or trusses.
- F. Electric unit heaters shall be supported by stainless steel brackets attached to the wall as recommended by the heater manufacturer. Provide stainless steel seismic restraint devices for unit heaters as directed by the seismic restraint equipment supplier.
- G. Above Ceiling or Ceiling Mounted Equipment:

HEATING, VENTILATING, AND AIR CONDITIONING

1. Unless noted otherwise, all horizontal air handler(s), in-line fan(s), cabinet ceiling fan(s), ductless heat pump air handlers, kitchen hood(s) and electric cabinet heater(s) shall be supported from the members of the roof construction with stainless steel hanger rods of sizes as recommended by the equipment manufacturers. Hanger rods shall be attached to stainless steel angles or channels of adequate size, which in turn shall be welded or bolted to the members of the roof construction. H&AC Contractor shall furnish and install all supplementary steel, framing members, hanger rods, inserts, etc., as required to properly support all ceiling mounted equipment. Mechanical items of equipment and ductwork shall not be supported from "X" bracing or bridging between joists or trusses.
2. Cabinet ceiling fan(s) shall not be supported from the ceiling tiles or ceiling grid system.

2.5 VIBRATION ISOLATORS AND SEISMIC RESTRAINTS

- A. Mount all mechanical equipment 3/4 horsepower and over listed in the Vibration Isolation/Seismic schedule on vibration isolators to prevent the transmission of objectionable vibration and vibration induced sound to the building structure.
- B. All isolation materials, flexible connectors and seismic restraints shall be of the same manufacturer.
- C. Unless otherwise specified, restrain all mechanical and plumbing equipment, pipe and ductwork to resist seismic forces.
 1. Provide restraint devices to meet the seismic requirements as defined in the latest issue of the IBC or local jurisdiction building code.
- D. The isolators and seismic restraint systems listed herein are as manufactured by Amber / Booth.
 1. Mason Industries, Kinetics, or approved equals which meet all the requirements of the Specifications, are acceptable.
 2. Manufacturer must be a member of the Vibration Isolation and Seismic Control Manufacturers Association (VISCMA).
- E. Seismic restraint shall not be required for the following:
 1. Hanging, wall mounted, and flexibly supported mechanical and plumbing components that weigh 20 pounds (89 N) or less, where $I_p =$

HEATING, VENTILATING, AND AIR CONDITIONING

- 1.0 and flexible connections are provided between the components and associated ductwork piping.
2. High deformability piping (steel, copper, aluminum with welded, brazed, ground, or screwed connections) designated as having an $I_p = 1.5$ and a nominal pipe size of 1" (25 mm) or less where provisions are made to protect the piping from impact or to avoid the impact of larger piping or other mechanical equipment.
 - a. Brace any combination of piping supported on a trapeze where the total weight exceeds 10 lb/ft.
 3. High deformability piping (steel, copper, aluminum with welded, brazed, ground, or screwed connections) and limited deformability piping (cast iron, FRP, PVC) designated with an $I_p = 1.0$ and a nominal pipe size of 1" and less in the mechanical equipment room or 2" and less outside the mechanical equipment room.
 4. PVC or other plastic or fiberglass vent piping.
 5. HVAC ducts suspended from hangers that are 12" or less in length from the top of the duct to the supporting structure and the hangers are detailed to avoid significant bending of the hangers and their connections.
 - a. Positively attach duct to hanger with minimum #10 Type 316 stainless steel screws within 2" from the top of the duct.
 5. HVAC duct with an $I_p = 1.5$ that have a cross-section area less than 4 square feet.
 6. HVAC ducts with an $I_p = 1.0$ that have a cross sectional area of less than 6 square feet.
 8. Equipment items installed in-line with the duct system (e.g., fans, heat exchangers, and humidifiers) with an operating weight less than 76 pounds.
 - a. Rigidly attach equipment to duct at inlet and outlet.
- F. All isolators, bases and seismic restraints exposed to the weather shall utilize stainless steel springs and stainless steel components.
- G. Nuts, bolts, washers, screws, and other pertinent fasteners are to be Type 316 stainless steel.

**HEATING, VENTILATING,
AND AIR CONDITIONING**

- H. Isolators for outdoor mounted equipment to provide adequate restraint for the greater of either wind loads required by local codes or withstand a minimum of 30 lb/s.f. applied to any exposed surface of the equipment.
- I. Equipment manufacturers to provide certification that their equipment is capable of resisting expected seismic loads without failure.
- J. Equipment manufacturers to provide suitable attachment points and/or instructions for attaching seismic restraints.
- K. Vibration isolators:
 - 1. Specification W: A pad type mounting consisting of two layers of ribbed elastomeric pads with a 1/2" poro-elastic vibration absorptive material bonded between them.
 - a. Provide Amber / Booth Type NRC.
 - 2. Specification D: An elastomeric hanger consisting of a rectangular stainless steel box capable of 200% minimum overload without visible deformation, 30 degree rod misalignment and an elastomeric isolation element designed for approximately 1/2" deflection.
 - a. Provide Amber / Booth Type BRD.
 - 3. Specification E: A combination spring and elastomeric hanger consisting of a rectangular stainless steel box capable of 200% minimum overload without visible deformation, 30 degree rod misalignment, stainless coil spring, spring retainers and elastomeric element designed for approximately 1/2" deflection.
 - a. Provide Amber / Booth Type BSRA.
 - 4. Specification SB: A unitized adjustable open spring isolator and a welded stainless steel housing designed to resist seismic forces in all directions.
 - a. Restraint surfaces that engage under seismic motion shall be cushioned with a resilient elastomer to protect equipment.
 - b. Restraints shall allow a maximum of 1/4" movement before engaging and shall allow for the spring to be changed if required.
 - c. Entire assembly shall be rated to exceed the applied seismic load.
 - d. Provide Amber / Booth Type SWSR.
- L. Seismic restraints - Specification SC:
 - 1. A restraint assembly for suspended equipment, piping or ductwork consisting of high strength stainless steel aircraft cable.
 - 2. Cable must have Underwriters Laboratories listed certified break strength and color-coded for easy field verification.

**HEATING, VENTILATING,
AND AIR CONDITIONING**

3. Secure cable to structure and brace component through bracket or stake eye specifically designed to exceed cable restraint rated capacity.
4. Break strengths must be per ASTM E8 procedures.
5. Provide Type SRB, stainless steel.
6. Provide Type 316 stainless steel brackets, stake eyes, connectors, inserts, bolts, nuts, washers, etc., used to connect the seismic restraint cables to equipment, piping and ductwork and to the building structure.
 - a. Refer to Section 02751 of the Specifications.

M. Seismic restraints - Specification SL:

1. A restraint assembly for floor mounted equipment consisting of welded stainless steel interlocking assemblies welded or bolted securely to the equipment or the equipment bases and to the supporting structure.
2. Restraint assembly surfaces which engage under seismic motion shall be lined with a minimum of 1/4" thick resilient elastomeric pad to protect equipment. Restraints shall be field adjustable and be positioned for 1/4" clearance as required to prevent interference during normal operation.
3. Restraint assembly shall have minimum rating of two times the catalog rating at 1 g. as certified by independent laboratory test.
4. Restraint shall be Amber / Booth Type ER.

N. Rooftop unit rails and isolation systems - Specification SB:

1. A unitized adjustable open spring isolator and a welded steel housing designed to resist seismic forces in all directions.
2. Cushion restraint surfaces which engage under seismic motion with a resilient elastomer to protect equipment.
3. Restraints shall allow a maximum of 1/4" movement before engaging and shall allow for the spring to be changed if required.
4. Entire assembly shall be rated to exceed the applied seismic load.
5. Provide Amber / Booth type SWSR.

- O. Rooftop unit curbs and isolation systems:
1. Specification X: Non-isolated seismically rated rooftop curb system that is flashed into roofing membrane.
 - a. Provide air and watertight curb.
 - b. Provide a neoprene sponge seal at the top rigid enough to provide continuous perimeter support for rooftop unit.
 - c. Provide means to positively anchor to concrete deck, or bolt or weld directly to structural steel to withstand seismic loading.
 - d. Provide a means by which contractor supplied insulation may be installed for thermal insulation and acoustic attenuation.
 - e. Accommodate roof pitch shown on the Drawings.
 - f. Design with cross-bracing required to withstand the greater of seismic forces or wind loading per local building code.
 - g. Provide Amber / Booth Type RTC.
 2. Specification Z: Seismically rated rooftop isolation curb system that is flashed into roofing membrane.
 - a. Do not use standard unit curb.
 - b. Provide air and watertight upper curb with a neoprene sponge seal at the top and rigid enough to provide continuous perimeter support for the rooftop unit.
 - c. Support the upper curb by Type C isolators welded or bolted to continuous structural support that is positively anchored to a concrete deck or bolted or welded to the structure to withstand seismic loading.
 - d. Provide an EPDM nylon reinforced airtight weatherproof seal to consolidate the upper and lower curbs.
 - e. Provide weatherproof access doors at each isolator to allow isolator adjustment.
 - f. Isolation curb to provide a means by which insulation may be installed for thermal insulation and acoustic attenuation.
 - g. Curbs shall accommodate the roof pitch shown on the Drawings.
 - h. Design with cross-bracing required to withstand the greater of seismic forces or wind loading per local building code.
 - i. Provide Amber / Booth Type RTIC.
 3. Flexible pipe connections:
 - a. Isolate refrigerant piping as indicated on the piping details on the Drawings using Style BF "Spring-Flex" bronze seamless corrugated hoses with bronze braiding, copper tube sweat ends and lengths as recommended by the vibration isolator manufacturer.
 - b. Comply with the manufacturer's instructions for the installation and load application of vibration isolation materials and products.

HEATING, VENTILATING, AND AIR CONDITIONING

- c. Adjust to ensure that units do not exceed rated operating deflections or bottom out under loading and are not short-circuited by other contacts or bearing points.
 - d. Remove space blocks and similar devices (if any) intended for temporary support during installation or shipping.
4. Locate isolation hangers as near the overhead support structure as possible.
 - a. Adjust leveling devices as required to distribute loading uniformly on isolators.
 - b. Shim units where leveling devices cannot be used to distribute loading properly.
 - c. Install isolated inertia base frames and steel bases on isolator units as indicated so that a minimum of 1" clearance below base will result when supported equipment has been installed and loaded for operation.
 5. Install seismic rated roof curbs directly to building structural steel or concrete roof deck.
 - a. Installation on top of steel deck or roofing material is not acceptable.
 - b. Shimming of seismic rated curbs is not allowed.
 6. Construct and install housekeeping pads per ASHRAE's "A Practical Guide to Seismic Restraint".
 - a. Minimum of 1/2" thicker than the maximum embedment required of any anchor but not less than 6".
 - b. Size to provide minimum edge distances for all installed anchors.
 - c. Anchor to the floor structure in an approved manner.
- P. Application of seismic restraints:
1. Protect all floor mounted isolated equipment with Type SB or Type C unitized isolator and restraint or with separate Type SL restraints (minimum of 4).
 2. Protect floor mounted non-isolated equipment by properly sized anchor bolts with elastomeric grommets provided by the isolation manufacturer.
 3. Protect all suspended equipment and vessels with Specification SC restraints.
 - a. Install cables to prevent excessive seismic motion arrange to prevent engagement during normal operation.
- Q. Ductwork:

**HEATING, VENTILATING,
AND AIR CONDITIONING**

1. Protect in all planes by SC restraints.
2. Isolator / Seismic supplier to determine locations.
3. Equipment Isolation and Seismic Schedule:
 - a. Fa = If Site Class is unknown, use the greater value of either Site Class D or E.
 - b. Project Seismic Factors: Ss = 1.0 (Lake City, SC).

Project Seismic Factors: Ss = 1.00		Fa = Unknown		
Equipment Tag	Component Ip	Isolation Specification	Seismic Rest Spec	Isolation Deflection
Electric Unit Heaters	1.5	None	Spec SC Note c, d	N/A
Ductwork	1.5	None	Spec SC Note c, d	N/A
Sidewall Exhaust Fans	1.5	None	Note a, c	N/A

4. Notes:
 - a. Anchor bolts for non-isolated and internally isolated equipment to be sized by the seismic restraint supplier.
 - 1) If required, provide Spec SL snubbers, Spec SC cable kits or anchor bolts.
 - b. Anchor curb to roof structural system as directed by the seismic equipment supplier.
 - 1) Seismically secure rooftop unit to the roof curb as directed by the seismic equipment supplier.
 - c. All mechanical equipment and materials installed in this building must have a component Ip factor of 1.5.
 - d. Provide seismic restraint devices for mechanical unit as directed by the seismic equipment supplier.
 - 1) Provide Type 316 stainless steel restraint devices and hardware.

2.6 DUCTWORK

- A. Duct dimensions shown on the Drawings are inside dimensions unless otherwise noted.

**HEATING, VENTILATING,
AND AIR CONDITIONING**

- B. Oversize to allow for installation of duct liner insulation.
 - 1. Follow duct dimensions indicated on the Drawings as closely as possible.
 - 2. Provide offsets, vary shape or alter run if required to meet structural or other interferences.
 - 3. Where shape of duct varies, alter dimensions to provide equal static pressure drop per unit length.
- C. Cover or otherwise protect all fan and duct openings from dirt and debris during construction.
 - 1. Clean systems prior to final inspection.
- D. Duct to be air tight, smooth on inside and neatly finished on outside.
- E. Unless otherwise specified, construct all ductwork shown on the Drawings of Type 304 mill finish stainless steel with gauges, seams, joints and reinforcing for ductwork in accordance with ASHRAE Guide and SMACNA Manual for low pressure ductwork.
 - 1. Construct all hangers, supports, straps, screws, mounting hardware, etc., of Type 316 stainless steel.
 - 2. Provide all transverse duct connections using aluminum flanged, bolted and gasketed type connectors by Ward Industries or Ductmate Co.
 - 3. All longitudinal duct joints in ductwork installed on exterior of building shall be located on the bottom of the ductwork.
- F. Construct all metal sleeves for louver/damper assemblies of heavy gauge aluminum material as indicated on the Drawings and in accordance with SMACNA Standards for aluminum ductwork.
 - 1. Provide aluminum angle trim frames around sleeves on interior side of building and other locations where indicated on the Drawings.
 - 2. Sleeves, aluminum angle frames and expanded metal guards shall have Kynar 500 finish to match louvers and dampers.
- G. General:
 - 1. Provide reinforcing and supports for all ductwork per SMACNA Standards.

HEATING, VENTILATING, AND AIR CONDITIONING

2. Support metal ductwork with approved stainless steel type straps, rods, or angles of adequate size secured to building construction as required.
3. Mechanical items of equipment and ductwork shall not be supported from "X" bracing or bridging between joists, beams or trusses. Provide seismic restraint devices for ductwork as directed by the seismic restraint equipment supplier.
4. Install double vane type aluminum turning vanes at all square and 45 degree elbows in all supply and return ductwork.
5. All ductwork shall be installed level and plumb.

2.7 AIR DISTRIBUTION EQUIPMENT

- A. Furnish and install air distribution equipment for the building as indicated on the Drawings.
- B. Provide Metal Aire Co. models, types, and finishes as specified, or approved equals by Krueger Mfg. Co., Price Co., Carnes Co., or Titus.
- C. Construct air distribution equipment of all aluminum materials, including balancing dampers.
- D. Air distribution equipment installed in rated ceiling assemblies shall be constructed of painted steel and furnished with ceiling radiation dampers and blankets specified hereinafter. Refer to drawings for locations.
- E. Install turning vanes equal to Barber-Colman Co. "Airturns" at all square elbows in the low-pressure ductwork. Turning vanes and runners shall be constructed of aluminum.
- F. Install air turning devices equal to Barber-Colman Co. "Deflectrols" or Krueger Mfg. Co. "Extractors" in the ductwork at all low-pressure duct takeoffs, registers, and diffusers as applicable. Turning vanes and air turning devices shall be constructed of aluminum.
- G. Paint interior of all exposed ductwork located behind the air distribution equipment, using two coats of flat black paint.
- H. Metal back pans of all supply diffusers and sidewall register boots shall be insulated as specified hereinafter to reduce possibility of condensation.

2.13 KYNAR 500 FINISH

**HEATING, VENTILATING,
AND AIR CONDITIONING**

- A. All Kynar 500 finished products specified herein are to be provided with a 2-coat, 70% Kynar finish in compliance with AAMA 2605 and with a minimum dry film thickness of 1.2 mils.
- B. Finishes shall be of a color selected by the Architect/Engineer.
- C. Provide a minimum ten (10) year warranty on the finish.

2.14 PAINTINGS AND COATINGS

- A. Comply with Section 09900.
- B. Unless otherwise specified, all machinery and factory finished equipment such as pumps, fans, air handling units, air conditioning units, and other items of manufacture shall be hot dipped galvanized or will have a factory applied finish per the equipment schedule, color as standard with the manufacturer.
 - 1. Components fabricated from stainless steel do not require a coating finish unless otherwise specified.
- C. Repair all defects, blemishes, holidays and the like apparent in manufacturer's coatings and ensure that the materials used for such repair are compatible with the manufacturer's standard color, coatings and practices.
 - 1. Prepare surfaces per the coating supplier.
 - 2. Do not paint over nameplates.
- D. Provide touch up paint for the various types of equipment furnished.
 - 1. Deliver unopened paint to the Owner at completion of the project.
 - 2. Provide sufficient amount to cover 15% of the applicable painted surfaces or one (1) pint, whichever is greater.
- E. Correct any holidays, runs, sags, blisters, or inclusions in the coating.
 - 1. With the approval of the Engineer, correct small areas no more than 4" x 4" in the field.
 - 2. Return to the coater for repair of larger faults.
 - 3. Remove the faulty material by sanding and in the case of blisters, feather the edges.

PART 3 - EXECUTION

3.1 SURFACE CONDITIONS

- A. Examine the areas and conditions under which work of this Section will be performed. Correct conditions detrimental to timely and proper completion of the Work. Do not proceed until unsatisfactory conditions are corrected.

3.2 COORDINATION

- A. Coordinate as required with other trades to assure proper and adequate provision in the work of those trades for interface with the work of this Section. The H&AC contractor shall be responsible for coordinating any changes due to mechanical equipment substitutions with electrical contractor and shall bear any additional cost due to such change.

3.3 PREPARATION

- A. Holes in concrete:
 - 1. Provide sleeves, accurately dimensioned and shaped to permit passage of items of this Section.
 - 2. Deliver all such sleeves, with accurate setting drawings and setting information, to the trades providing the openings or surfaces through which such items must penetrate, and in a timely manner to assure inclusion in the work.
- B. Flashing: Where items of this Section penetrate the roof or outer walls, the General Contractor shall provide all base flashing and counterflashing required at such penetration to insure waterproof integrity of opening.

3.4 LABELING OF EQUIPMENT

- A. Permanently label all mechanical items of equipment installed with bakelite or with stainless steel nameplates for identification purposes.
- B. Securely attach nameplates to the respective items of equipment with stainless steel fasteners.
- C. Numbering of the various items to correspond with the numbering sequence used on the Drawings.

3.5 AS-BUILT DRAWINGS

**HEATING, VENTILATING,
AND AIR CONDITIONING**

- A. The Mechanical Contractor shall maintain on the job site one complete set of the mechanical drawings.
- B. Indicate all changes authorized by the Engineer as to the locations, sizes, etc., of piping, ductwork and other mechanical equipment in red pencil as the work progresses.
- C. Deliver the "Red-lined" set of "As-Built" drawings to the Engineer. Refer to Section 01720 (Project Record Documents) for additional instructions.

3.6 ELECTRICAL WORK

- A. The Electrical Contractor will provide the following for the mechanical equipment:
 - 1. A source of power as required for each electric motor and for each electrical heating and cooling item of equipment installed under the mechanical contract, including final wiring connections to motor terminals or to terminals in a control panel mounted on each respective unit.
 - 2. Circuit breaker protection as required for each electric motor and for each electrical heating and cooling item of equipment installed under the mechanical contract.
 - 3. Wiring each electric motor and each electrical heating and cooling item of equipment (where applicable) through a magnetic starter (furnished by the Electrical Contractor).
 - 4. 120 volt power wiring for each damper actuator at intake louvers or dampers (when applicable).
 - 5. 120 volt control wiring of exhaust fans through starters or variable frequency drives, actuators and end switches, wall switches and/or thermostats as applicable.
 - 6. Interlock wiring between exhaust fans and damper actuators on rear of intake louvers. Coordinate requirements with Electrical Contractor.
 - 7. All low voltage (24 volt) control wiring shall be by the Mechanical Contractor.
- B. Should the Mechanical Contractor propose to use any item of mechanical equipment that has different electrical requirements from those specified on the

HEATING, VENTILATING, AND AIR CONDITIONING

schedules on the Drawings or elsewhere, the General Contractor shall be responsible for coordinating these changes with the electrical contractor.

- C. The electrical contractor will do all power wiring and 120 volt control and interlock wiring for the mechanical equipment as described above, and the H&AC contractor shall do all low voltage (24 volt) control and interlock wiring, unless otherwise specified or indicated on the Drawings.
- D. Refer to Section 16400 (Electrical) of the Specifications to determine the exact extent of electrical work provided for the mechanical equipment.
 - 1. Verify the current characteristics before ordering any equipment for this project.
 - 2. Failure to confirm voltage requirements for mechanical equipment shall result in the H&AC contractor bearing any cost associated with changes stemming from incorrect voltages on this project.
- E. Mechanical Contractor shall provide all other wiring, not covered above, that is necessary for complete and operating heating, ventilating and air conditioning systems for the building(s), including all control wiring, interlock wiring, conduit, relays, controls, starters, variable frequency drives, thermostats, disconnect switches, circuit breakers, control conduit and outlet boxes, wiring of all applicable control items of equipment, and other electrical work as required.
 - 1. Comply with Section 16400.
 - 2. The Mechanical Contractor shall coordinate all electrical and control requirement for the HVAC equipment and controls with the Electrical Contractor during the submittal process prior to beginning any construction.
- F. Provide all wiring, control and power in conduit as specified under Section 16400 of the Specifications conceal in finished areas and occupied spaces, unless otherwise approved.
 - 1. All wiring, control and power, shall be run in PVC coated rigid electrical conduit as specified under Section 16400 of the Specifications.
 - 2. Seal all openings around electrical conduit located in partitions, walls and floors using 3M Brand fire protection products specifically approved for the particular usage and fire rating (where applicable) and install in strict accordance with the manufacturer's recommendations.
- G. Comply with the latest edition of the National Electrical Code and meet all local requirements.

**HEATING, VENTILATING,
AND AIR CONDITIONING**

- H. All electrical equipment shall bear UL labels where applicable.
- I. Starters (when required):
 - 1. All starters as applicable for the mechanical equipment shall be provided by the Electrical Contractor and shall comply with Section 16400.
 - 2. Starters shall be combination type furnished with "Hand-Off-Automatic" switches, so that the various items of equipment may be operated manually or automatically.
 - 3. Coordinate all mechanical equipment starter requirements with the Electrical Contractor.

3.7 TEMPERATURE CONTROLS

- A. Provide a complete system of electrical and electronic temperature controls for the mechanical equipment as specified below and as manufactured by Siemens Co., Johnson Controls, Trane Co., Alerton Controls., or Automated Logic.
- B. Provide all control wiring in conduit as specified under Section 16400 of the Specifications
 - 1. Conceal in finished areas and occupied spaces, unless otherwise approved.
 - 2. All wiring, control and power, shall be run in PVC coated rigid electrical conduit as specified under Section 16400 of the Specifications.
 - 3. Seal all openings around control conduit located in partitions, walls and floors using 3M Brand fire protection products specifically approved for the particular usage and fire rating (where applicable), and installed in strict accordance with the manufacturer's recommendations.
- C. All electrical/control work required shall comply with the latest edition of the National Electrical Code and shall meet all local requirements.
- D. All electrical equipment shall bear UL labels where applicable.
- E. Sequences of Operation

Refer to the Mechanical Drawings for Sequences of Operation for all items of Mechanical Equipment.

**HEATING, VENTILATING,
AND AIR CONDITIONING**

F. General:

1. Room thermostats/sensors:
 - a. Install all room thermostats, sensors and switches at 5'-6" height above finished floors unless otherwise directed by the Owner.
 - b. Provide room thermostats and temperature sensors mounted on exterior walls with insulated mounting plates.
 - c. Fan and heater thermostats shall be heavy duty metal type provided with concealed adjustment and exposed thermometers.
 - I. Provide wire-wound resistive element type (RTD) temperature sensors using either nickel or platinum alloy as the resistive element.
 - II. End to end (element to readout display) accuracy of $\pm 0.5^{\circ}\text{F}$.
 - d. Provide protective stainless steel wire metal guards for all electric unit heater thermostats and fan thermostats.
 - e. Heater equipment thermostats shall have low temperature settings down to at least 40°F . with an upper range of approximately 70°F .
 - f. Ventilating fan thermostats shall have a cooling range from approximately 50°F . to 100°F .
2. 120 volt control wiring of exhaust fans through VFD's, microprocessor controllers, starters, end switches, wall switches and/or thermostats shall be provided by the Electrical Contractor.
3. Controls installation shall be by a licensed Controls Contractor.
4. Control submittals including, but not limited to: wiring diagrams, product literature, sequences of operation, etc. shall be submitted to the Engineer for review and approval before ordering and/or installing any control items.
5. Provide installation by trained technicians who are employees of the Control Contractor.
6. Control Contractor shall install, adjust, calibrate, and place in satisfactory operation entire control systems for the various buildings.
 - a. Label all items of control equipment with bakelite nameplates.
7. Provide "As-Built" control drawings and include in the Operation and Maintenance Manuals.

3.8 PERFORMANCE TESTS

- A. Testing and balancing of the air systems shall be done by an independent test and balance agency as specified in a subsequent paragraph.
- B. Provide competent personnel and necessary testing instruments and equipment to check, test, operate and balance the mechanical systems.
 - 1. Tests shall be of sufficient duration to prove adequacy and satisfactory performance of all items of equipment.
- C. Clean all equipment and nameplates and lubricate all motors and bearings.
- D. Provide temporary air filters in all equipment upon initial start-up.
 - 1. Replace and clean the filters regularly until project is accepted.
 - 2. Prior to final inspection and acceptance, install one clean set of air filters furnished by the various equipment manufacturers inside the respective mechanical items of equipment.
 - 3. Two (2) years' worth of extra air filters for all mechanical equipment shall be delivered to the Owner prior to final acceptance of the project.
- E. Adjust and set all thermostats and other control items of equipment and submit to the Engineer record copies of the certification that all specified control items of equipment have been installed, calibrated, programmed, and are operating properly.
- F. Adjust and set with instruments the specified air quantity at each piece of mechanical equipment, register, grille, and diffuser in the buildings as specified below and as required to maintain relatively uniform space temperatures throughout the areas of each zone.
 - 1. Record data and submit copies of test and balance reports to the Engineer for review.
- G. Check all safety relief valves, high limit controls, freeze protection controls, airflow switches and all other safety devices for proper functioning.

3.9 TESTING AND BALANCING OF MECHANICAL SYSTEMS

- A. The Mechanical Contractor shall employ the services of a licensed independent testing and balancing agency, which is NEBB or AABC certified, to do all testing and balancing of the air systems installed under this contract as specified below

HEATING, VENTILATING, AND AIR CONDITIONING

and as required. Test and balance procedures shall comply with ASHRAE Standard 111.

- B. Work to be performed shall include but is not necessarily limited to the following items:
 - 1. Record the discharge air temperature for all electric unit heaters.
 - 2. Adjust and record the air quantities for each exhaust fan as specified on schedule on drawings. Adjust motor speeds, VFD's and drives and sheaves as required to achieve the proper air flow. Measure and record the fan RPM, external and total static pressures and CFM.
 - 3. Adjust all counter-balance backdraft dampers on the rear of stationary louvers to ensure blades open completely when fans are operating and close completely when fans are off.
 - 4. Adjust all gravity backdraft dampers/shutters on the discharge of sidewall and roof exhaust fans to ensure blades open fully when fans are operating and close completely when fans are off.
 - 5. Adjust linkage on all motorized backdraft dampers on the rear of stationary louvers to ensure blades open completely when fans are operating and close completely when fans are off.
- C. Testing and balancing report for each mechanical unit, including exhaust fans, electric unit heaters, etc. shall include the equipment manufacturer, model number, serial number, nameplate amperage and actual running amperage for each motor, design and actual air quantities as applicable, and temperatures and static pressures as listed above, spaces served by the mechanical unit, and other pertinent data as applicable.
- D. Submit record copies of all testing and balancing reports for the systems to the Engineer and include copies of these reports in the Operation and Maintenance Manuals.

3.10 TRAINING OWNER'S PERSONNEL

- A. The contractor shall furnish the services of a competent engineer or mechanic to thoroughly train and instruct the Owner's personnel in the proper operation and maintenance of all mechanical items of equipment installed under this contract.
- B. The contractor shall obtain and deliver to the Engineer copies of the following statement signed by the Owner's Maintenance Superintendent or his authorized representative:

**HEATING, VENTILATING,
AND AIR CONDITIONING**

"This is to certify that our personnel have been thoroughly trained and instructed in the proper operating and maintenance procedures for all mechanical equipment installed under this contract for the new and existing buildings."

Signed: _____

Title: _____

Date: _____

END OF SECTION

**SECTION 16160
VARIABLE FREQUENCY DRIVES**

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes variable frequency drives (VFDs) for use on ac circuits rated 600 V and less.
- B. The VFDs shall be suitable for use with two new 25hp sludge pumps (RAS Pump No. 3 and No. 4).
- C. Related Sections include the following:
 - 1. Division 16 Section
 - 2. Section 11312

1.3 SUBMITTALS

- A. Shop Drawings: For each variable frequency drive.
 - 1. Include dimensioned plans, elevations, sections, and details, including required clearances and service space around equipment. Show tabulations of installed devices, equipment features, and ratings. Include the following:
 - a. Features, characteristics, ratings, and factory settings of each variable frequency drive unit.
 - b. Harmonic correction calculations.
 - c. Cable Terminations
 - 2. Wiring Diagrams: Power, signal, and control wiring for class and type of variable frequency drive. Provide schematic wiring diagram for each drive.
- B. Qualification Data: For manufacturer.

VARIABLE FREQUENCY DRIVES

- C. Field quality-control test reports.
- D. Operation and Maintenance Data: For variable frequency drives, all installed devices, and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 1.
 - 1. Routine maintenance requirements for variable frequency drives and all installed components.
 - 2. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.

1.4 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A qualified manufacturer. Maintain, within 100 miles of Project site, a service center capable of providing training, parts, and emergency maintenance and repairs.
- B. Source Limitations: Obtain variable frequency drives through one source from a single manufacturer.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- D. Comply with NFPA 70.
- E. Variable frequency drives are to be built to the latest NEMA standards.
- F. The variable frequency drive shall be designed, manufactured and tested in facilities registered to the ISO 9001 standard.
- G. Product Selection for Restricted Space: Drawings indicate maximum dimensions for variable frequency drives, including clearances between variable frequency drives, and for adjacent surfaces and other items. Comply with indicated maximum dimensions and clearances.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. In accordance with manufacturers recommendations and other divisions of these specifications.

1.6 COORDINATION

VARIABLE FREQUENCY DRIVES

- A. Coordinate features of variable frequency drives and accessory devices with pilot devices and control circuits to which they connect.
- B. Coordinate features, accessories, and functions of each variable frequency drive with ratings and characteristics of supply circuit, motor, required control sequence, and duty cycle of motor and load.

1.7 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Spare Fuses: Furnish one spare for every five installed, but no less than one set of three of each type and rating.
 - 2. Indicating Lights: Two of each type installed.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Allen Bradley Powerflex 520

2.2 VARIABLE FREQUENCY DRIVES (VFD)

- A. Description: NEMA ICS 2, pulse-width-modulated, variable frequency controller; listed and labeled as a complete unit and arranged to provide variable speed of an NEMA MG 1, Design B, 3-phase, induction motor by adjusting output voltage and frequency.
 - 1. Provide unit suitable for operation of premium-efficiency motor as defined by NEMA MG 1.
- B. Design and Rating: Match load type such as fans, blowers, and pumps; and type of connection used between motor and load such as direct or through a power-transmission connection.
- C. Output Rating: 3-phase; 6 to 60 Hz, with voltage proportional to frequency throughout voltage range.
- D. Unit Operating Requirements:
 - 1. Input ac voltage tolerance of 380 to 500 V, plus or minus 10 percent.

VARIABLE FREQUENCY DRIVES

2. Input frequency tolerance of 50/60 Hz, plus or minus 6 percent.
 3. Minimum Efficiency: 96 percent at 60 Hz, full load.
 4. Minimum Displacement Primary-Side Power Factor: 96 percent.
 5. Overload Capability: 1.1 times the base load current for 60 seconds; 2.0 times the base load current for 3 seconds.
 6. Starting Torque: 100 percent of rated torque or as indicated.
 7. Speed Regulation: Plus or minus 1 percent.
 8. Ambient Temperature: 0 to 40 deg C.
- E. Isolated control interface allows controller to follow control signal over an 11:1 speed range.
1. Electrical Signal: 4 to 20 mA at 24 V.
- F. Internal Adjustability Capabilities:
1. Minimum Speed: 5 to 25 percent of maximum rpm.
 2. Maximum Speed: 80 to 100 percent of maximum rpm.
 3. Acceleration: 2 to a minimum of 22 seconds.
 4. Deceleration: 2 to minimum of 22 seconds.
 5. Current Limit: 50 to a minimum of 110 percent of maximum rating.
- G. Self-Protection and Reliability Features:
1. Input transient protection by means of surge suppressors.
 2. Under- and overvoltage trips; inverter over-temperature, overload, and overcurrent trips.
 3. Motor Overload Relay: Adjustable and capable of NEMA 250, Class 10, 20, or 30 performance.
 4. Notch filter to prevent operation of the controller-motor-load combination at a natural frequency of the combination.
 5. Instantaneous line-to-line and line-to-ground overcurrent trips.

6. Loss-of-phase protection.
 7. Reverse-phase protection.
 8. Short-circuit protection.
 9. Motor over-temperature fault.
- H. Each VFD shall be equipped with a communication interface to plant control system PLC which will allow for remote control, reset, programming, and viewing of all VFD data from the HMI interface and the plant control system.
- I. Automatic Reset/Restart: Attempts three restarts after controller fault or on return of power after an interruption and before shutting down for manual reset or fault correction. Restarting during deceleration shall not damage controller, motor, or load.
- J. Power-Interruption Protection: Prevents motor from re-energizing after a power interruption until motor has stopped.
- K. Status Lights: Door-mounted LED indicators as shown on control diagrams.
- L. Panel-Mounted Operator Station: Start-stop and auto-manual selector switches with manual speed control potentiometer and elapsed time meter.
- M. Indicating Devices: Meters or digital readout devices and selector switch, mounted flush in controller door and connected to indicate controller output current, voltage, and frequency.
- N. Integral Disconnecting Means: NEMA AB 1, molded-case switch with lockable handle.
- O. Remote Indicating Circuit Terminals: Mode selection, controller status, and controller fault.
- P. Provide a HAND-OFF-AUTO three-position selector switch and manual speed pot on the door of each VFD enclosure to facilitate in manual operation.
- Q. Provide 5% input line reactors and output reactors for each VFD supplied.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and surfaces to receive variable frequency drives for compliance with requirements, installation tolerances, and other conditions affecting performance.

VARIABLE FREQUENCY DRIVES

1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLICATIONS

- A. Select features of each controller to coordinate with ratings and characteristics of supply circuit and motor; required control sequence; duty cycle of motor, controller, and load; and configuration of pilot device and control circuit affecting controller functions.
- B. Select horsepower rating of controllers to suit motor controlled.

3.3 INSTALLATION

- A. Comply with mounting and anchoring requirements specified in Division 16 Section "Electrical Supports and Seismic Restraints."

3.4 IDENTIFICATION

- A. Identify variable frequency drive and control wiring according to Division 16 Section "Electrical Identification."
- B. Operating Instructions: Frame printed operating instructions for variable frequency drives, including control sequences and emergency procedures. Fabricate frame of finished metal, and cover instructions with clear acrylic plastic. Mount on front of variable frequency drives.

3.5 CONTROL WIRING INSTALLATION

- A. Install wiring between motor-control devices according to Division 16 Section "Conductors and Cables."
- B. Bundle, train, and support wiring in enclosures.

3.6 CONNECTIONS

- A. Conduit installation requirements are specified in other Division 16 Sections. Drawings indicate general arrangement of conduit, fittings, and specialties.
- B. Ground equipment according to Division 16 Section "Grounding and Bonding."

3.7 FIELD QUALITY CONTROL

- A. Prepare for acceptance tests as follows:
 1. Test each variable frequency drive for proper operation with driven equipment.

VARIABLE FREQUENCY DRIVES

- B. Manufacturer's Field Service: Engage a factory-authorized service representative to perform the following:
 - 1. Inspect VFDs, wiring, components, connections, and equipment installation. Test and adjust controllers, components, and equipment.
 - 2. Report results in writing.

3.8 ADJUSTING

- A. Set field-adjustable settings for application. Coordinate I/O with System Integrator.

3.9 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain components of variable frequency drives. Refer to Division 1.

END OF SECTION

**SECTION 16260
STANDBY ELECTRIC POWER SYSTEM**

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Work included: Provide an engine driven standby electric generator system where shown on the Drawings, as specified herein, and as needed for a complete and proper installation including, but not necessarily limited to:
1. Diesel engine.
 2. Engine instruments and controls.
 3. Alternator.
 4. Control panel.
 5. Exhaust silencer.
 6. Weather-protective, sound attenuated, non- walk-in enclosure.
 7. Associated accessories and other items and services required to complete the system whether particularly mentioned or not.
 8. Fuel tank (filled on site).
- B. Related work:
1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions and Sections in Division 1 of these Specifications.
 2. Section 16400 - Electrical.
- C. Applicable Standards
1. NFPA 70: National Electrical Code
 2. NFPA 110: Standard for Emergency and Standby Power Systems
 3. UL508: Standard for Industrial Control Equipment
 4. UL2200: Standard for Stationary Engine Generator Assemblies

STANDBY ELECTRIC POWER SYSTEM

5. UL142: Standard for Steel Aboveground Tanks for Flammable and Combustible Liquids
6. CSA C22.2 No. 14: Industrial Control Equipment
7. CSA C282: Emergency Electrical Power Supply for Buildings
8. CSA C22.2 No. 100: Motors and Generators
9. EN61000-6: Electromagnetic Compatibility
10. EN55011: Limits and Methods of Measurement of Radio Disturbance Characteristics of Industrial, Scientific and Medical (ISM) Radio-frequency Equipment
11. FCC Part 15 - Radio Frequency Devices - Subpart B-Unintentional Radiators
12. ISO 8528: Reciprocating Internal Combustion Engine Driven Alternating Current Generating Sets
13. IEC 61000: Electromagnetic Compatibility

1.2 QUALITY ASSURANCE

- A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this section.
- B. Referenced manufacturers are Caterpillar or Cummins, and are named to establish standards of quality. Equal products of other manufacturers conforming to these specifications may be provided as outlined in the bid form and as approved by the Engineer.
- C. The system shall be factory assembled and tested by the manufacturer of the generating system or be assembled and tested by an authorized representative of the manufacturer using an engine or generator made by the system manufacturer so that the system will have one source of supply and responsibility. The performance of the generating set series shall be certified by an independent testing laboratory as to the set's full power rating, stability and voltage and frequency regulation.
- D. The manufacturer of the generating system shall maintain a thoroughly stocked authorized parts and service facility within 100 miles of the installation.
- F. Technical services:

STANDBY ELECTRIC POWER SYSTEM

1. Provide a service engineer, complying with requirements of Section 01660 to complete the initial start-up, make proper and complete adjustments of all adjustable devices, load switches, etc., and to also verify and approve all connections prior to any test operation of said equipment.
 - a. One 2-day trip.
2. Confirmation in writing by the manufacturer's authorized representative of said services shall be submitted to Engineer.

1.3 SUBMITTALS

- A. Comply with pertinent provisions of Division 1.
- B. Product data: Within 30 calendar days after the Contractor has received the Owner's Notice to Proceed, submit:
 1. Materials list of items proposed to be provided under this Section.
 2. Manufacturer's specifications and other data needed to prove compliance with the specified requirements.
 3. Shop Drawings in sufficient detail to show fabrication, installation, anchorage, and interface of the work of this Section with the work of adjacent trades.
 4. Manufacturer's recommended installation procedures which, when approved by the Engineer, will become the basis for accepting or rejecting actual installation procedures used on the Work.
- C. Upon completion of the work of this Section, and as a condition of its acceptance, deliver to the Engineer five copies of an operation and maintenance manual compiled in accordance with the provisions of Division 1.

1.5 WARRANTY

- A. Comply with provisions of Division 1 and the following.
- B. Provide a standard two-year warranty on all labor, materials, and equipment of the generating system.
 1. Upon placing the generator in service provide a 30-day initial operating period.
 2. The warranty will begin upon successful completion of the initial operating period.

1.6 EXTENDED SERVICE AGREEMENT

- A. There shall be one source responsibility for warranty; parts and service through a local representative with factory trained service personnel. Extended Warranty Coverage shall be provided for a period of 4 years and shall include no deductible. Extended Warranty Coverage provides for 100 percent of usual and customary parts and labor costs for failures due to defects in materials and workmanship to the “as shipped consist” from the factory, excluding filters, fluids, vee belts, hoses, power take-offs, paint, batteries and clutches. Provide for a rental power unit due to unscheduled failures causing unexpected downtime to the customer in excess of 48 hours from the time of diagnoses. All repairs will be performed by factory trained dealer service personnel, and allows for repairer travel and mileage for all repairs up to 8 hours and 320 miles per incident.
 - 1. Upon placing the generator in service provide a 30-day initial operating period.
 - 2. The warranty will begin upon successful completion of the initial operating period.

1.7 RULES AND PERMITS

- A. The entire installation shall be in accordance South Carolina Department of Health and Environmental Control (SCDHEC) Regulations, NFPA, and all local codes.
- B. The Engineer will obtain all permits and inspections required by local or state laws.
- C. Furnish the Owner with certificate of inspection and final approval from all authorities having jurisdiction.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Provide new and current system equipment consisting of:
 - 1. Engine driven electric generating set to provide standby power.
 - 2. Engine start-stop control system mounted on the generating set.
 - 3. Mounted accessories as specified.

2.2 SYSTEM

STANDBY ELECTRIC POWER SYSTEM

- A. Provide generator rated for continuous standby service at 500 KW (minimum), 625 KVA at 0.8-power factor, 277/480 volt, 3-phase, 4-wire wye. Continuous standby service constitutes full load operation without interruption for a minimum period of 14 days.

2.3 ENGINE

- A. Provide fuel filter and fuel transfer pump at engine.
- B. Provide water-cooled with mounted radiator, fan and water pump.
- C. Provide intake and exhaust valves made of heat resisting alloy steel with exhaust valve seat inserts.
- D. Supply full pressure lubrication by lube oil pumps.
- E. Provide air cleaner, fuel and oil filters with replaceable elements, and lube oil cooler.
- F. Govern engine speed by electronic governor to maintain the alternator frequency within one (1) hertz from no load to full load alternator output.
- G. Provide remote, 2-wire starting by a solenoid shift, electric starter.
- H. Directly connect the starter to the engine flywheel housing.

2.4 ALTERNATOR

- A. Provide brushless, 4-pole, revolving field design with temperature compensated solid-state voltage regulator and rotating rectifier exciter system.
 - 1. Provide rotor driven through a semi-flexible driving flange to ensure permanent alignment.
 - 2. Provide alternator with frequency regulation not exceeding 3 Hz from no load to rated load.
 - 3. Provide alternator with voltage regulation within +/-2% of rated voltage, from no load to full rated load.
 - 4. Provide alternator with recovery to stable operation occurring within 2 seconds.
 - a. Stable operation is defined as operation with terminal voltage remaining constant +/-1% of rated voltage.

STANDBY ELECTRIC POWER SYSTEM

5. Provide alternator with a rheostat providing a minimum of +/-5% voltage adjustment from rated value.
6. Provide alternator with temperature rise within NEMA MG1-22 definition.
7. Provide alternator utilizing 3-phase filtered sensing voltage regulation and having an independent power supply for the excitation system (i.e. permanent magnet generator, Auxiliary Winding, Regulator Exciter Principle (AREP) and series boost type excitation system).
8. Provide alternator with a sub-transient reactance of 0.12 per unit, or lower, based on steady-state rating.
9. Provide alternator with Class H insulation.
10. Provide alternator producing a voltage waveform for proper operation of variable frequency PWM drives that produce line to neutral total harmonic distortion to 5% maximum with a maximum 3% distortion in any single harmonic order.
11. Equip alternator with a 208 volt, single-phase space heater.

2.5 CONTROLS

- A. Provide a fully solid-state, microprocessor based, generator control panel wired, tested and shock mounted on the generating set by the manufacturer of the generating plant.
- B. Provide the following functionality integral to the control panel:
 1. A minimum 64 x 240 pixel (28mm x 100mm) white backlight graphical display with text based alarm/event descriptions.
 2. A minimum of 3-line data display.
 3. Audible horn for alarm and shutdown with horn silence switch.
 4. Standard ISO labeling
 5. Multiple language capability
 6. Remote start/stop control
 7. Local run/off/auto control integral to system microprocessor
 8. Cooldown timer

STANDBY ELECTRIC POWER SYSTEM

9. Speed adjust
 10. Lamp test
 11. Push button emergency stop button
 12. Voltage adjust
 13. Voltage regulator V/Hz slope - adjustable
 14. Power Factor Control for paralleling units
 15. Password protected system programming
- C. Provide the panel with the following Digital indications:
1. AC voltage, 3-phase (L-L and L-N)
 2. AC amps (3-phase and total)
 3. KW (total and per phase)
 4. KVA (total)
 5. KVAR (total)
 6. 6 KWHR (total)
 7. KVARHR (total)
 8. PF (average total and 3-phase)
 9. % of rated (total)
 10. Frequency
 11. DC voltage
 12. System diagnostic
 13. Excitation voltage
 14. Excitation current
 15. 15 Engine oil pressure

STANDBY ELECTRIC POWER SYSTEM

16. Engine oil temperature
 17. Engine coolant temperature
 18. Engine RPM
 19. Battery volts
 20. Engine hours
 21. Engine crank attempt counter
 22. Engine successful start counter
 23. Service maintenance interval
 24. Real time clock
 25. Oil filter differential pressure
 26. Fuel temperature
 27. Fuel pressure
 28. Fuel filter differential pressure
 29. Fuel consumption rate
 30. Total fuel consumed
 31. Engine intake manifold temperature
 32. Engine intake manifold pressure
 33. Engine crankcase pressure
 34. Air filter differential pressure
 35. Boost pressure
 36. Oil filter differential pressure
- D. Provide alarm indication and subsequent shutdown for the following conditions (Store in the control panel the first and last occurrences of all alarms and shutdowns with a time, date, and engine hour stamp):

STANDBY ELECTRIC POWER SYSTEM

1. Low oil pressure alarm/shutdown
2. High coolant temperature alarm/shutdown
3. Loss of coolant shutdown
4. Overspeed shutdown
5. Overcrank shutdown
6. High intake manifold temperature alarm/shutdown
7. High exhaust manifold temperature alarm/shutdown
8. High crankcase pressure alarm/shutdown
9. High air inlet temperature alarm/shutdown
10. Emergency stop depressed shutdown
11. Low coolant temperature alarm
12. Low battery voltage alarm
13. High battery voltage alarm
14. Control switch not in auto position alarm
15. Battery charger failure alarm
16. Generator over voltage
17. Generator under voltage
18. Generator over frequency
19. Generator under frequency
20. Generator reverse power
21. Generator overcurrent
22. Loss of excitation alarm/shutdown
23. Instantaneous over excitation alarm/shutdown

STANDBY ELECTRIC POWER SYSTEM

24. Time over excitation alarm/shutdown
 25. Rotating diode failure
 26. Loss of sensing
 27. Loss of PMG
- E. Provide the ability to accept six (6) programmable digital input signals.
- F. Provide accessible through a single electronic service tool all engine, voltage regulator, control panel and accessory units. Provide the following maintenance functionality:
1. Engine running hours display
 2. Service maintenance interval (running hours or calendar days)
 3. Engine crank attempt counter
 4. Engine successful starts counter
 5. 20 events are stored in control panel memory
 6. Programmable cycle timer that starts and runs the generator for a predetermined time. The timer shall use 14 user-programmable sequences that are repeated in a 7-day cycle. Each sequence shall have the following programmable set points:
 - a. Day of week
 - b. Time of day to start
 - c. Duration of cycle
- G. Provide Modbus RTU remote communications as standard via RS-485 half duplex with configurable baud rates from 2.4k to 57.6k.
- H. Provide Remote Monitoring Software with the following functionality”
1. Access to all data and events on generator set communications network
 2. Remote control capability for the generator set
 3. Ability to monitor up to 12 generator sets

STANDBY ELECTRIC POWER SYSTEM

4. Ability to communicate via Modbus RTU or remote modem
- I. Provide an annunciator to meet the requirements of NFPA 110, Level 1.
1. Network directly to the generator set control
 2. Include a lamp test pushbutton, alarm horn and alarm acknowledge pushbutton
 3. Provide the following individual light indications for protection and diagnostics:
 - a. Overcrank
 - b. Low coolant temperature
 - c. High coolant temperature warning
 - d. High coolant temperature shutdown
 - e. Low oil pressure warning
 - f. Low oil pressure shutdown
 - g. Overspeed
 - h. Low coolant level
 - i. EPS supplying load
 - j. Control switch not in auto
 - k. High battery voltage
 - l. Low battery voltage
 - m. Battery charger AC failure
 - n. Emergency stop
 - o. Spare
 - p. Spare
- J. Equip unit with factory mounted terminal blocks and strips for all power, signal and control wiring connections.

STANDBY ELECTRIC POWER SYSTEM

2.6 GENERATING SET MOUNTING

- A. Equip generator set with vibration isolators and mount on a welded steel base that will provide suitable mounting to any level surface.
- B. Equip unit with a reinforced sheet steel, minimum 16 gauge, sound attenuating, non-walk-in weather-protective housing.
 - 1. Reinforce to be vibration-free in the operating mode.
 - 2. Provide housing with lockable removable panels on each side of the housing to access generator with a hinged door to access instrument panel.
 - 3. Provide housing complete with accessories listed below, be rust treated and painted standard color of manufacturer.
 - 4. Provide peaked roof for drainage.
 - 5. Provide corrosion resistant fasteners.
 - 6. Extend coolant and oil drain line connections outside of enclosure.
 - 7. Insulate enclosure to limit unit noise to 75 db at 7m.
 - 8. Mount enclosure over an integral welded steel base fuel tank complete with all fuel fittings, level indicator, vent, exterior lockable fill port and drains, etc., and necessary galvanized steel support framing so that the weight of the generator is not supported by the tank. Size tank to run the generator at full load for a minimum of 2 days.
 - a. Enclose tank in a welded steel secondary containment vessel having an audible spill alarm system powered from the generator battery system and alarmed on the generator control panel.
 - b. All welds, cuts, openings, etc., in the steel material, shall be cold galvanized as a minimum after fabrication.
 - 9. Provide tank underwriter's labeled (UL).

2.7 ACCESSORIES

- A. Provide the plant with all accessories needed for proper operation to include, but not be limited to:

STANDBY ELECTRIC POWER SYSTEM

1. A critical type silencer of schedule 40 steel mounted inside enclosure.
 2. Stainless steel flexible exhaust connection.
 3. Sufficient exhaust piping of aluminized schedule 40 steel pipe and fittings, including end rain cap.
 4. Lace-up type insulation blankets to completely insulate muffler and interior exhaust piping.
 5. Provide a 10-amp, automatic "float" type battery charger to maintain the batteries at normal capacity.
 - a. Provide 120V input with 24 VDC output to battery(s)
 - b. Provide cables, battery rack, AC compensation, current limit, DC ammeter to show battery voltage, equalizing switch, fused AC input and DC output, complete isolation of AC input and DC output.
 - c. Design as not to discharge the battery in event of failure.
 6. Provide engine mounted, thermostatically controlled, immersion type heater to ensure a minimum coolant temperature of 120° F in a minimum ambient temperature of -15° F.
 - a. Operate on a 208 volt, single-phase AC power.
 7. Engine Block Heaters sized per manufacturer's requirements. Any required increase of feeder circuits, different from that as shown on drawings, is the responsibility of the Contractor to provide and install at no additional cost to the Owner.
- B. Radiator coolant shall be all weather, all season, environment friendly 50% solution antifreeze.
- C. Provide adequate fuel to fill tank
- D. Overcurrent Protection:
1. Furnish the engine/generator set with overcurrent output protection per the latest edition of NEC 445-4 at the engine/generator set.
 2. Provide circuit breakers with solid-state adjustable instantaneous and short time delay features, GE or approved equal.

STANDBY ELECTRIC POWER SYSTEM

3. Provide Ground-Fault Protection of service entrance disconnects 1000 amperes or more at 277/480V per NEC 70 Part 230-95.
- E. Generator accessories shall be wired to a single connection point by the supplier. The contractor shall provide a 60 amp, 208v, 3phase branch circuit to feed all accessories.

2.8 IDENTIFYING SIGNS

- A. Provide identifying signs as shown on drawings and as specified herein for proper installation and in accordance with latest edition of National Electrical Code.
 1. Sign design is based on use of standard products manufactured by Seton Name Plate Company of New Haven, CT and is named to establish standards of quality.
 2. Provide the products upon which design is based or provide equal products of another manufacturer approved in advance by the Engineer.
 3. Provide sign material as 60 mils. thick press polished high performance vinyl plastic.
 4. Provide sunlight fade resistance.
 5. Overcoat with Tedlar.
 6. Provide rounded corners.
 7. Provide 14" x 10" sign.
 8. Main heading to read: "CAUTION", white letters on red background with black border. Subtitle to have black letters on white background.
 9. Mount with stainless steel screws at location as directed in field.
 10. Sign schedule:

AREA	SIGN SUBTITLE	NO. SIGNS PER AREA
Service Entrance	Standby Emergency Generator Onsite	1
System Ground Connection Point	Normal Service and Standby Emergency Generator Connected to Grounding Electrode	1

11. Install sign in strict accordance with the manufacturer's recommendations as approved by the Engineer, using only the approved mounting materials, and locating all components firmly into position, level and plumb.

STANDBY ELECTRIC POWER SYSTEM

12. Locate where directed by the Engineer.
13. Mounting hardware to be Type 316 stainless steel.
14. Where adequate sign supports are not available, fabricate sign stand using Type 316 stainless steel channel and fittings.

PART 3 - EXECUTION

3.1 SURFACE CONDITIONS

- A. Examine the areas and conditions under which work of this Section will be performed. Correct conditions detrimental to timely and proper completion of the Work. Do not proceed until unsatisfactory conditions are corrected.

3.2 INSTALLATION

- A. Coordinate as required with other trades to assure proper and adequate provision in the work of those trades for interface with the work of this Section.
- B. Install the work of this Section in strict accordance with the manufacturer's recommendations as approved by the Engineer.
- C. Put all components through at least five complete cycles of operation, adjust as required, and verify that the complete system functions at optimum operating level.

3.3 TESTING AND INSPECTION

- A. Provide personnel and equipment, make required tests, and secure required approvals from the Engineer and governmental agencies having jurisdiction.
- B. Make written notice to the Engineer adequately in advance of each of the following stages of construction:
 1. In the underground condition prior to placing concrete floor slab, when all associated electrical work is in place.
 2. When all rough-in is complete, but not covered.
 3. At completion of the work of this Section.
- C. An operational test of the standby power system shall be conducted by a representative of the manufacturer of this equipment in the presence of the Engineer

STANDBY ELECTRIC POWER SYSTEM

and the operating personnel. It shall be demonstrated during these tests that the voltage sensitive and time delay devices perform at their specified settings.

- D. Perform 2 hour load bank test for generator at full load. Submit test results.
- E. When material and/or workmanship are found to not comply with the specified requirements, within three days after receipt of notice of such non-compliance remove the non-complying items from the job site and replace them with items complying with the specified requirements, all at no additional cost to the Owner.

3.4 PROJECT COMPLETION

- A. Upon completion of the work of this Section, thoroughly clean all exposed portions of the system installation, removing all traces of soil, labels, grease, oil and other foreign material, and using only the type cleaner recommended by the manufacturer of the item being cleaned.
- B. Thoroughly indoctrinate the Owner's operation and maintenance personnel in the contents of the operations and maintenance manual required to be submitted under Part 1.3 of this Section of these Specifications.

3.5 COMPUTATIONS

- A. The plant will include the following loads on the generator:

Step Number	Motor Load	Motor Control	Residual Load
1	1 @ 25 HP	FVNR	30 kW
2	1 @ 25 HP	FVNR	
3	1 @ 150 HP	RVSS	
4	1 @ 150 HP	RVSS	
5	1 @ 60 HP	RVSS	
6	1 @100 HP	RVSS	

- B. Base computations on reduced-voltage solid-state starters with current limiting setting of 300%.
- C. The manufacturer shall submit computations indicating that the unit furnished will satisfactorily operate with equipment to be connected as stated above.
- D. Maximum voltage drop of 20%.

END OF SECTION

SECTION 16400
ELECTRICAL

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Work included: Provide a complete electrical system as indicated on the Drawings, as specified herein, and as needed for a complete and proper installation including, but not necessarily limited to:
1. Main service, main breakers, automatic transfer switches, main switchboards, motor control centers and transformers.
 2. Feeder system, in conduit.
 3. Branch circuit panels for power and lighting.
 4. Branch circuit wiring, in conduit, for lighting, receptacles, junction boxes and motors.
 5. Hangers, anchors, sleeves, chases, supports for fixtures, and other electrical materials and equipment in association therewith.
 6. Lighting fixtures and lamps.
 7. Wiring system, in conduit, for equipment and controls provided under other Sections of these Specifications including, but not necessarily limited to, Equipment and Mechanical Sections.
 8. Motor starters and controls for motors provided under the Contract, but for which motor starters and controls are not otherwise provided.
 9. Transient voltage surge suppressor.
 10. Other items and services required to complete the systems whether particularly mentioned or not.
- B. Related work:
1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division 1 of these Specifications.
 2. Section 16260 - Standby Electric Power System.

1.2 ABBREVIATIONS

A	Ampere (Amps)	MCA	Minimum Circuit Amps
AFF	Above Finished Floor	MCC	Motor Control Center
AFG	Above Finished Grade	MCM	1000 Circular Mils (KCMIL)
AHJ	Local Authority Having Jurisdiction	MOCP	Maximum Over-current Protection
AIC	Amps Interrupting Current	N	Neutral
AFCI	Arc-Fault Circuit Interrupter	NEC	2002 National Electrical Code
ANSI	The American National Standards Institute	NEMA	National Electrical Manufacturers Association
BF	Ballast Factor	NFPA	National Fire Protection Association
Bkr.	Breaker	NIC	Not in Contract
C	Conduit	OSHA	Occupational Safety and Health Act
Ckt.	Circuit	PF	Power Factor
CRI	Color Rendering Index	PLC	Programmable Logic Controller
CU	Copper Conductor	PVC	Polyvinyl Chloride Conduit
DETD	Dual Element Time Delay Fuse	RGSC	Rigid Galvanized Steel Conduit
Disc.	Disconnect	RMS	Root Mean Square
Dn	Down	RTU	Remote Terminal Unit
EMT	Electrical Metallic Tubing	SCADA	Supervisory Control and Data Acquisition
FLA	Full Load Amps	SCCR	Short-Circuit Current Rating
FPM	Fuse per Manufacturer Requirements	SPD	Surge Suppression Device
FS	Federal Specifications	Sym	Symmetrical
G or Gnd.	Ground	THD	Total Harmonic Distortion
GFCI	Ground-Fault Circuit Interrupter	TSP	Twisted Shielded Pair
GFP	Ground-Fault Protection	TST	Twisted Shielded Triplet
HD	Heavy Duty	TVSS	Transient Voltage Surge Suppressor
HP	Horsepower	UL	Underwriters Laboratories Inc.
IBC	International Building Code	UON	Unless Otherwise Noted
IEEE	The Institute of Electrical and Electronics Engineers	V	Volts
IMC	Intermediate Metallic Conduit	W	Watts
KVA	Kilovolt-Amps	WFC	Watertight Flexible Conduit
KW	Kilo Watt	WG	Wire Guard
KA	Kilo Amps	XFMR	Transformer
LCCF	Lamp Current Crest Factor		

1.3 QUALITY ASSURANCE

- A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section. These shall include, but not be limited to, an electrical supervisor who is a licensed master electrician, a field foreman with a minimum journeyman electrician's license and adequate electricians and helpers.

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- B. Without additional cost to the Owner, provide such other labor and materials required to complete the work of this Section in accordance with the requirements of governmental agencies having jurisdiction, regardless of whether such materials and associated labor are called for elsewhere in these Contract Documents.
- C. Electrical subcontractor shall furnish a 100 percent performance bond and a 100 percent payment bond to the Contractor as security for the faithful performance of this Section, as security for the payment of all persons performing labor on the project under this Section and furnishing materials in connection with this Section. The performance bond and payment bond shall be in separate instruments.

1.4 SUBMITTALS

- A. Comply with pertinent provisions of Division 1.
- B. Product data: Within 30 calendar days after the Contractor has received the Owner's Notice to Proceed, submit:
 - 1. Materials list of items proposed to be provided under this Section.
 - 2. Manufacturer's specifications, other data and shop drawings needed to prove compliance with the specified requirements. Provide the following approval drawings:
 - a. Main breakers
 - b. Automatic transfer switches.
 - c. Switchboards.
 - d. Panels.
 - e. Motor control centers.
 - f. Transformers.
 - g. Wiring devices and cover plates.
 - h. Conduit and fittings.
 - i. Conductors.
 - j. Lighting fixtures.
 - k. Motor starters.
 - l. Safety/Disconnect switches.
 - m. Transient Voltage Surge Suppressor.

ELECTRICAL

- n. Special systems.
 - 3. Manufacturer's recommended installation procedures which, when approved by the Engineer, will become the basis for accepting or rejecting actual installation procedures used on the Work.
- C. Samples:
- 1. When so requested by the Engineer.
 - 2. When specifically requested by the Contractor and approved by the Engineer, approved samples will be returned to the Contractor for installation on the Work.
- E. Manual: Upon completion of this portion of the Work and as a condition of its acceptance, provide operation and maintenance manuals in accordance with the provisions of Division 1. Include within each manual:
- 1. Copy of the approved Record Documents for this portion of the Work.
 - 2. Copies of all circuit directories.
 - 3. Copies of all warranties and guaranties.

1.5 WARRANTY

- A. Provide standard one (1) year warranty on all labor and materials.
- B. Provide a five (5) year warranty on all LED fixtures.
- C. Provide minimum five (5) year warranty on Surge Protection Devices, incorporating unlimited replacements of suppressor parts if destroyed by transients during the warranty period.
- D. Provide a two (2) year parts and labor warranty on automatic transfer switch components.

1.6 RULES AND PERMITS

- A. The entire installation shall be in accordance with the latest edition of the NEC, OSHA, and all local codes.
- B. Apply and pay for all permits and inspections required by local or state laws.
- C. Furnish the Owner with certificate of inspection and final approval from all authorities having jurisdiction.

1.7 DRAWINGS

- A. The drawings and specifications are complementary to each other and what is called for by one shall be as binding as if called for by both. The drawings are diagrammatic and are to be followed as closely as the construction will permit.
- B. The drawings show the general location of outlets, conduits and circuit arrangement. Because of the small scale of the drawings, it is not possible to indicate all of the detail involved. The Contractor shall carefully investigate the structural and finish conditions affecting all his Work and shall arrange such work accordingly, furnishing such fittings, junction boxes and accessories as may be required to meet such conditions.

1.8 ELECTRICAL SERVICE

- A. From the utility company, establish requirements for transformer pad(s), metering, connections, etc., and make provisions for them; providing and installing all lugs, connectors, grounding, etc., required for a complete installation.
 - 1. Coordinate work with both the electric utility company and the Owner, and schedule the installation of the service in accordance with the construction schedule such that there will be no delays in equipment startup and placing the facilities in operation.
- B. Local Utility Company is the Duke Energy. Contact Kerry Harrington at (843) 355-2609, Kerry.Harrington@duke-energy.com.

1.9 ELECTRICAL OUTAGE

- A. Coordinate all outages with the Owner, 72 hours prior. Schedule all outages such that they will not interfere with normal plant operation and that there will be no delays in equipment startup and placing the facilities in operation.

1.10 SPARE PARTS

- A. Provide the following spare parts to Owner in neatly packaged box marked with contents:
 - 1. Keys: One (1) set of spare panelboard/switchboard keys with lists to Owner.
 - 2. Fuses: One (1) box fuses for each type and size installed on the project.
 - 3. Fuse Puller: One (1) fuse puller to Owner capable of removing all types of fuses installed on job.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Provide only materials that are new, of the type and quality specified. Where Underwriters' Laboratories, Inc. have established standards for such materials, provide only materials bearing the UL label. Materials called for are to be considered as standard that, however, implies no right on the part of the Contractor to substitute other materials and methods without written authority from the Engineer.
- B. Temporary power:
 - 1. In addition to providing temporary power as described in Section 01500 of these Specifications, provide and pay the costs for installing permanent electrical meter or meters.
 - 2. When all equipment is in place and connected, and the Engineer determines the project is ready for final checkout, arrange to have the permanent metering installed in the Owner's name. At this point, the Owner will be responsible for all charges.
- C. Where any material or operation is specified by reference to published specifications or standards or the specifications or standards of any other organization; the referenced specification or standard shall be as much a part of this Section as if quoted in full herein.
- D. Products specified in this section shall be made in America as defined by the American Recovery and Reinvestment Act.

2.2 RACEWAYS

- A. Applicable Standards:
 - 1. ANSI C80.1: Rigid Steel Conduits, Zinc-Coated.
 - 2. ANSI C80.3: Electrical Metallic Tubing, Zinc Coated.
 - 3. ANSI C80.5: Rigid Aluminum Conduits.
 - 4. ANSI C80.6: Intermediate Metallic Conduits.
 - 5. ANSI/NEMA FB1: Fittings and Supports for Conduit and Cable Assemblies.
 - 6. UL 6: Rigid Steel Conduit - Zinc Coated.

ELECTRICAL

7. UL 651-2002: Schedule 40 PVC and schedule 80 Rigid PVC Conduit.
 8. UL 514B: Flexible conduit fittings.
 9. NEMA RN 1: Polyvinyl-Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit.
 10. NEMA FB 1: Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing and Cable.
 11. ASTM F512: Polyvinyl Chloride (PVC) Conduit.
 12. ASTM D870: Standard Practice for Testing Water Resistance of Coatings Using Water Immersion.
 13. ASTM D1151: Standard Practice for Effect of Moisture and Temperature on Adhesive Bonds.
 14. FS WW-C 581E: Federal Specification for Rigid Galvanized Steel Conduit.
 15. FS-WW-C-563A: Federal Specification for Electrical Metallic Tubing.
 16. FS-WW-C-540C: Federal Specification for Rigid Aluminum Conduit.
 17. FS WW-C 566: Federal Specification for Flexible Metal Conduit.
- B. Acceptable Manufacturers:
1. Wheatland.
 2. Allied Tube.
 3. Perma-Cote; Division of Robroy.
 4. Ocal.
 5. Carlon.
- C. Provide conduit and fittings conforming to the above standards.
- D. Rigid galvanized steel conduit and fittings – types:
1. Provide threaded type fittings and form 8 conduit bodies with material to match conduit. Provide PVC coated fittings for PVC coated rigid galvanized steel conduit installations.
 2. Provide rigid galvanized steel conduit with external 40-mil PVC coating and internal, 2-mil urethane surface.

ELECTRICAL

3. Provide seal fittings for rigid galvanized steel conduit where indicated on the plans equal to Crouse-Hinds series EYSX. Provide PVC coated seal fittings for PVC coated rigid galvanized steel conduit installations.
 4. Provide sealing compound and fiber by Crouse-Hinds or approved equal:
 - a. Sealing Compound: Chico A.
 - b. Sealing Fiber: Chico X.
 5. Provide USA manufactured base materials for PVC coated fittings, hangers, straps, etc.
- E. Provide hot-dipped, galvanized, watertight type fittings for liquid tight flexible conduit as manufactured by O-Z/Gedney or approved equal. Provide PVC coated fittings for PVC coated rigid galvanized steel conduit installations.
- F. Conduit/Cable supports – properties:
1. Provide 316 stainless steel supports for all exposed metallic conduit as manufactured by Unistrut or approved equal.
 2. Provide fiberglass supports for all exposed non-metallic conduit/cable as manufactured by Aickinstruct or approved equal.
 3. Provide one-hole, PVC coated, malleable iron conduit straps with back spacer for all PVC coated rigid galvanized steel conduit.
 4. Provide PVC coated beam clamps with uncoated 316 stainless steel nuts and bolts for all PVC coated rigid galvanized steel conduit.
- G. All conduits to conform to the following specifications:
1. Installations under concrete slab: Schedule 40 PVC.
 2. Exposed outdoor locations: Rigid aluminum conduit.
 3. Exposed Interior locations: Rigid aluminum conduit.
 4. Concealed Interior Locations: Schedule 40 PVC
 5. Installations in concrete-encased duct banks: Schedule 40 PVC.
 6. Installations underground exposed to earth: Rigid aluminum conduit with PVC or other coating.

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7. Rigid aluminum conduit shall be used at all locations (underground and within structures) as raceways for shielded process instrumentation wiring, shielded control wiring, and I/O wiring.

2.3 CONDUCTORS

A. Applicable standards:

1. NEMA WC 3: Rubber-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy.
2. NEMA WC 5: Thermoplastic-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy.
3. UL 44 - 2002: Rubber-Insulated Wires and Cables.
4. UL 83 - 1999: Thermoplastic-Insulated Wires and Cables.
5. UL 854 - 2002: Service Entrance Cables.

B. Acceptable Manufacturers:

1. Okonite.
2. Pirelli.
3. Southwire.
4. Superior Essex.
5. Belden.

C. Conductor types:

1. Low voltage conductors (0 to 600V):
 - a. For secondary service entrance, feeders, underground, under floor, in damp or wet locations, and to any process associated equipment provide copper, 600V, 90°C, Type XHHW.
 - b. For all other low voltage conductors, provide copper, 600V, 75°C, Type THWN.
 - c. Provide stranded conductors for sizes #12 and larger.

ELECTRICAL

- d. Provide same type of equipment grounding conductors as specified above.
 - e. Provide all branch circuit wiring installed within ballast compartment of light fixtures rated 90°C, Type THHN.
 - f. Analog Control/Communications (2/C or 3/C) - Provide tinned copper, polyethylene insulated, twisted pair or triplet, aluminum-polyester, overall shield with 20-gauge drain.
 - g. Provide analog signal conductors sized as shown on drawings with minimum size of 18-gauge.
 - h. For all discrete signal conductors, provide copper stranded, 600V, Type THWN with a minimum size of #14, unless otherwise noted.
 - i. For all control conductors installed in underground conduits provide cable listed as suitable for direct burial.
2. Splices, Connections and Terminations (0 to 600V):
 - a. For #8 AWG, use solderless pressure connectors with insulating covers for copper wire splices and taps. Use insulated spring wire connectors with plastic caps for #10 AWG and smaller.
 - b. Use insulated, mechanical connectors for copper wire splices and taps, #6AWG and larger, ILSCO or approved equal. Tape connectors with electrical tape to prevent moisture infiltration.

2.4 GROUNDING AND BONDING

A. Applicable standards:

1. UL 467-1998: Grounding and Bonding Equipment.
2. NFPA 70: National Electrical Code.
3. ANSI/IEEE 32: Requirements, Terms and Test Procedures for Neutral Grounding Devices.
4. IEEE 80: Guide for Safety in Substation Grounding.
5. IEEE 81: Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System.
6. NETA ATS: Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems (International Electrical Testing Associates).

ELECTRICAL

- B. Grounding electrodes (Rod type):
 - 1. Acceptable Manufacturers:
 - a. LTV Copperweld.
 - b. Line Material.
 - 2. Material: Copper-clad steel.
 - 3. Diameter: $\frac{3}{4}$ ".
 - 4. Length: 10'-0"
 - 5. Type: Sectional.
- C. Mechanical connectors:
 - 1. Acceptable Manufacturers:
 - a. Burndy.
 - b. Robbins.
 - c. Harger.
 - 2. Material: Bronze.
- D. Exothermically-welded connections:
 - 1. Acceptable Manufacturers:
 - a. Cadweld.
- E. Grounding Electrode Conductor:
 - 1. Material: Bare, soft-drawn, stranded, copper.
 - 2. Minimum size: Meet NEC 70 requirements.
- F. Bonding Material:
 - 1. Material: Bare, soft-drawn, stranded, copper.
 - 2. Minimum size: Meet NEC 70 requirements.
- G. Regulatory requirements:
 - 1. Products: Listed and classified by UL as suitable for the purpose specified and indicated.

- H. Ground Access Wells:
 - 1. Provide 12" x 12" x 12" polymer concrete ground access well where indicated on plans.
 - 2. Provide engraved cover with "ground" indicator.
 - 3. Rated for a minimum of 20,000 lbs.
 - 4. Provide Harger GAW series or approved equal.
- I. Provide Ground-Fault Protection of service entrance disconnects 1000 amperes or more at 277/480V per NEC 70 Part 230-95. Refer to plans for additional locations or requirements.

2.5 TRANSIENT VOLTAGE SURGE PROTECTION

- A. Applicable standards:
 - 1. UL 1449 4th Edition - Transient Voltage Surge Suppressor.
 - 2. IEEE C62.41 - IEEE Recommended Practice on Surge Voltages in Low Voltage AC Power Circuits.
 - 3. IEEE C62.45 - IEEE Guide on Surge Testing for Equipment Connected to Low-Voltage AC Power Circuits.
 - 4. UL 67 - Panelboards (when mounted in panelboards).
 - 5. UL 891 - Dead-Front Switchboards (when mounted in switchboards).
 - 6. NEMA LS1 - National Electrical Manufacturer's Association - 1992, R2000.
 - 7. MIL STD. 220A - Test Methods of Insertion Loss.
- B. Acceptable Manufacturers:
 - 1. Advanced Protection Technologies, Inc. (APT).
 - 2. American Power Conversion Corporation (APC).
 - 3. EFI Electronics.
 - 4. Eaton.
 - 5. Current Technology.

ELECTRICAL

6. Leviton.

C. Surge Suppression Device (SPD):

1. Manufacturer's published UL 1449 Fourth Edition test results shall reflect SPD connected lead length of 6" or greater.
2. Provide SPD devices with a minimum EMI/RFI filtering of -50dB at 100 kHz using MIL-STD-220A methodology.
3. Provide a SPD unit with a short circuit current rating clearly marked and install at a point on the system where the available fault current is in excess of that rating.
4. Provide dedicated circuit breaker/disconnect for the SPD.
5. Provide SPD with one set of NO/NC dry contacts.
6. Provide SPD with protection-indicating LED's that are visible without opening enclosure.
7. Provide NEMA 4X SS Enclosure where installed outside.
8. Provide SPD that meets or exceeds the following criteria:

a. Maximum UL Suppression Voltage Rating (SVR) and Maximum Operating Voltage (MCOV):

System Voltage	L-N	L-G	N-G	L-L	MCOV
208/120V 3Ø	330	330	330	700	150
480/277V 3Ø	700	700	600	1200	320

b. Minimum Surge Capacity and modes of protection:

SPD Location	Modular Parallel Protection	Modes of Protection	RFI Filtering	Surge Capacity Per Mode
Service Entrance \geq 800A	Yes	L-N, N-G	Yes	320kA
Switchboard \geq 800A	Yes	L-N, N-G	Yes	240kA
Distribution Panel $>$ 400A, $<$ 800A	Yes	L-N, N-G	Yes	160kA
Distribution Panel \leq 400A	No	L-N, N-G	No	120kA
Motor Control Center \geq 2000A	Yes	L-N, N-G	Yes	320kA
Motor Control Center $>$ 600A, $<$ 2000A	Yes	L-N, N-G	Yes	240kA
Motor Control Center \leq 600A	Yes	L-N, N-G	Yes	160kA
Branch Circuit Panels $>$ 200A	No	L-N, N-G	No	120kA
Branch Circuit Panels \leq 200A	No	L-N, N-G	No	80kA

2.6 OUTLET BOXES

A. Applicable standards:

1. ANSI/NEMA OS 1: Sheet-steel Outlet Boxes, Device Boxes, Covers and Box Supports.
2. ANSI/NEMA OS 2: Nonmetallic Outlet Boxes, Device Boxes, Covers and Box Supports.
3. NEMA 250: Enclosures for Electrical Equipment (1000 Volts Maximum).
4. NEMA FB 1: Type FD, Cast Ferroalloy Boxes.
5. UL 508: UL Standard for Safety Industrial Control Equipment.

B. Types and properties:

1. Outlet boxes:
 - a. Sheet metal outlet boxes (ANSI/NEMA OS1; galvanized steel, with 1/2" male fixture studs where required).
 - b. Nonmetallic outlet boxes (ANSI/NEMA OS2).
 - c. Cast boxes (NEMA FB1; deep type, gasketed cover, threaded hubs).

C. Pull and junction boxes:

1. Sheet metal boxes:
 - a. Indoor location installations:
 - 1) Provide the type specified in ANSI/NEMA OS1, 316 stainless steel unless stated otherwise on drawings.
 - 2) Provide hinged-type enclosure for enclosures larger than 12 inches in any dimension.
 - b. Indoor location installations: Provide hinged-type enclosure for enclosures larger than 12 inches in any dimension.
2. Cast aluminum boxes:
 - a. Outdoor and wet location installations: Conform to NEMA 250; Type 4 and Type 6, flat-flanged, surface-mounted junction box, UL listed as rain tight, cast aluminum box cover with ground flange, neoprene

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gasket, and stainless steel cover screws as manufactured by Cooper Crouse-Hinds.

3. Non-metallic boxes:
 - a. Above ground location installations: Conform to UL 508, NEMA type as shown on drawings, molded fiberglass polyester, with removable hinged cover, neoprene gasket, and stainless steel cover screws as manufactured by Hoffman.
 - b. In Ground location installations: Conform to UL 508, NEMA type as shown on drawings, pre-cast polymer concrete, with removable, heavy-duty bolted cover, and stainless steel cover screws as manufactured by Strongwell.

D. Outlet box schedule, unless otherwise noted:

1. Interior boxes:
 - a. Galvanized extensions and rings.
 - b. Ganged where two or more devices occur at the same location.
 - c. One-piece type.
 - d. Studs for lighting fixtures, when required.
 - e. Lugs or ears to secure covers or plaster rings.
 - f. As required, covers or plaster rings.
 - g. Small exposed boxes - galvanized cast type with hubs.
 - h. Large exposed and exterior boxes - NEMA 4X type.
2. Ceiling boxes, minimum 4" x 4" x 2-1/8" deep, or 4" octagon x 2-1/8" deep, of one-piece construction, except where otherwise specified herein or when larger size is required by code.
3. Provide masonry type boxes in block walls.
4. Provide concrete type in poured slabs.
5. Provide non-metallic boxes for underground installations.

E. Box locations:

1. Provide electrical boxes as shown on Drawings, and as required for splices, taps, wire pulling, equipment connections, and code compliance.

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- a. Electrical box locations shown on Contract Drawings are approximate unless dimensioned.
- b. Verify the location of all boxes and outlets prior to rough in.
- c. Locate the boxes to allow access.
- d. Locate and install boxes such that headroom is maintained and a neat appearance is presented.

2.7 HANDHOLES

A. Applicable standards:

1. ANSI/SCTE 77: Specification for Underground Enclosure Integrity.
2. ASTM C1028: Standard Test Method for Determining the Static Coefficient of Friction of Ceramic Tile and Other Like Surfaces by the Horizontal Dynamometer Pull-Meter Method.
3. ASTM C478-03a" Standard Specification for Pre-cast Reinforced Concrete Manhole Sections.
4. ASTM A615: Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.B. Handholes:
 1. Acceptable Manufacturers:
 - a. Quazite.
 2. Provide 24" x 36" x 24" (minimum) underground enclosures constructed of polymer concrete and tested to a minimum of 20,000 PSI, unless noted otherwise on plans. Provide larger enclosures where required to meet code.
 3. Provide enclosures with heavy-duty cover tested to a minimum of 20,000 PSI, having a minimum coefficient of friction of 0.50. Provide cover engraved with "Electric".
 4. Provide enclosures with divider, pulling eyes and cable racks.
 5. Provide enclosures equal to Quazite PG series with HA type cover.

2.8 WIRING DEVICES

A. Applicable standards:

1. FS W-C-596: Electrical Power Connector, Plug, Receptacle, and Cable Outlet.
2. FS W-S-896: Switch, Toggle.

ELECTRICAL

3. NEMA WD 1: General Purpose Wiring Devices.
 4. NEMA WD 2: Semiconductor Dimmers for Incandescent Lamps.
 5. NEMA WD 5: Specific Purpose Wiring Devices.
 6. UL 943: Standard for Ground Fault Circuit Interrupters.
- B. Acceptable Manufacturers:
1. Hubbell.
 2. Pass and Seymour.
 3. General Electric.
 4. TayMac.
 5. Lutron.
 6. Leviton.
- C. Wall Switches:
1. Provide wall switches for lighting circuits and motor loads under 1/2 HP conforming to NEMA WD; FS W-S-896; AC-general use snap switch with toggle handle, rated 20 amperes and 120-277VAC.
 2. Provide switch with gray handle.
 3. For exterior applications, provide cast box and weatherproof actuating lever toggle switch cover.
 4. Provide switches with occupancy sensors where noted on the drawings.
- D. Receptacles:
1. Provide convenience and straight-blade receptacles conforming to NEMA WD 1, locking blade receptacles conforming to NEMA WD 5, and convenience receptacle configuration conforming to NEMA WD 1; Type 5-20, gray plastic face.
 2. Provide specific-use receptacle configuration conforming to NEMA WD 1 type as indicated on the drawings, and with a brown plastic face.
 3. Provide GFCI duplex convenience receptacles with integral ground fault current interrupters and gray plastic face.
- E. Wall Plates:

ELECTRICAL

1. Provide type 304 stainless steel oversized (jumbo) interior wall plates.
2. Provide continuous-use rated exterior device cover. Provide cover constructed entirely of UV stabilized high impact polycarbonate material with gasket, stainless steel mounting screws and UL listed for wet location continuous-use. Provide cover equal to TayMac Specification Grade series.
3. Design plates to fit the device or devices on which they are used.

2.9 LIGHTING

A. Applicable standards:

1. FS W-F-414: Fixture, Lighting.

B. Provide fixtures as scheduled on the drawings.

2.10 DISCONNECT/SAFETY SWITCHES

A. Applicable standards:

1. ANSI/UL 198C: High intensity capacity fuses; current limiting types.
2. ANSI/UL 198E: Class R fuses.
3. FS W-F-870: Fuse holders (for plug and enclosed cartridge fuses).
4. FS W-S-865: Switch, box (enclosed), surface-mounted.
5. NEMA KS 1: Enclosed switches.

B. Acceptable manufacturers – disconnect/safety switches:

1. ABB.
2. Eaton.
3. Schneider Electric.

C. Disconnect/Safety Switches:

1. Fusible (safety) switch assemblies: NEMA KS 1; type HD, quick-make, quick-break, load interrupter enclosed knife switch with externally operable handle interlocked to prevent opening front cover with switch in ON position.

ELECTRICAL

- a. Provide override screw to permit opening front cover with switch in ON position.
 - b. Provide the handle lockable in OFF position.
 - c. Provide fuse clips designed to accommodate Class R fuses.
 - d. Provide enclosure types as indicated on Drawings.
2. Non-fusible (disconnect) switch assemblies: NEMA KS 1; type HD; quick-make, quick-break, load interrupter enclosed knife switch with externally operable handle interlocked to prevent opening front cover with switch in ON position.
 - a. Provide override screw to permit opening front cover with switch in ON position.
 - b. Provide the handle lockable in OFF position.
 - c. Provide enclosure types as indicated on Drawings.
- D. Fuses:
1. Fuses 600 Amperes and Less: Current limiting type.
 2. Fuse Interrupting Rating: 200,000 RMS symmetrical amperes.
- E. Acceptable manufacturers - fuses:
1. Gould-Shawmut.
 2. Bussman.
- F. XXX/Y/ZZ/fAAA: Indicates device or equipment shall be supplied with a disconnect/safety switch. "XXX" indicates frame size; "Y" indicates number of poles; "ZZ" indicates enclosure NEMA rating ("3R" = NEMA 3R, "4X" = NEMA 4X); and "fAAA" indicates fuse size ("FPM" = fuse per manufacturer requirements), no text indicates non-fused disconnect switch.

2.11 ENCLOSED CIRCUIT BREAKERS

- A. Applicable standards:
1. FS W-C-375: Circuit Breakers, Molded Case, Branch Circuit and Service.
 2. NEMA AB 1-93: Molded Case Circuit Breakers and Molded Case Switches.
 3. UL-489: Molded Case Circuit Breakers and Circuit Breaker Enclosures.

ELECTRICAL

4. UL-50: Cabinets and Boxes.
5. NEMA-250: Enclosures for Electrical Equipment.

B. Acceptable manufacturers:

1. ABB.
2. Eaton.
3. Schneider Electric.

C. Enclosed Circuit Breakers:

1. Enclosed Molded-Case Circuit Breaker: NEMA AB 1, lockable handle. Handle lockable in OFF position. Provide enclosures type as indicated on Drawings.
2. Provide frame size, trip rating, number of poles, and auxiliary devices as indicated, interrupting capacity rating to meet available fault current, 35,000 RMS symmetrical amperes minimum, with appropriate listing when utilized for switching fluorescent lighting, heating, air-conditioning and refrigeration equipment.
3. Provide shunt-trip where indicated, 120V, 60Hz.
4. Provide interchangeable trip units, on circuit breakers 200 amps and larger, with trip units interchangeable within frame size.

2.12 PANELBOARDS

A. Applicable standards:

1. FS W-C-375: Circuit Breakers, Molded Case, Branch Circuit and Service.
2. FS W-F-870: Fuse Holders (for Plug and Enclosed Fuses).
3. FS W-F-115: Power Distribution Panel.
4. FS W-S-865: Enclosed Knife Switch.
5. NEMA AB 1: Molded Case Circuit Breakers.
6. NEMA PB 1: Panelboards.
7. NEMA PB 1.1: Instructions for Safe Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less.

ELECTRICAL

8. NEMA PB 1.2: Application Guide for Ground-fault Protective Devices for Equipment.
 9. UL 67: Panelboards.
- B. Acceptable manufacturers:
1. ABB.
 2. Eaton.
 3. Schneider Electric.
- C. Power Distribution panelboards:
1. Panelboards: NEMA PB 1; circuit breaker type.
 2. Enclosure: NEMA PB 1, Type 12, unless shown otherwise on the Drawings.
 3. Panelboard mounting as shown on the Drawings.
 4. Provide cabinet front with concealed trim clamps, and hinged door with flush lock. Finish in manufacturer's standard gray enamel.
 5. Provide panelboards with tin plated, copper bus, ratings as scheduled.
 6. Provide copper ground bus in all panelboards. Minimum integrated short circuit rating: As shown in panel schedules.
 7. Molded case circuit breakers: NEMA AB 1; provide bolt-in-type circuit breakers with integral thermal and instantaneous magnetic trip in each pole.
 8. Provide circuit breakers UL listed as type HACR for air conditioning equipment branch circuits.
 9. Molded case circuit breakers with current limiters: AB 1; provide circuit breakers with replaceable current limiting elements, in addition to integral thermal and instantaneous magnetic trip in each pole.
 10. Provide panelboards with typed directory as shown on panel schedules.
 11. Provide panelboards keyed alike.
- D. Branch circuit panelboards:
1. Lighting and appliance branch circuit panelboards: NEMA PB 1; circuit breaker type.
 2. Enclosure: NEMA PB 1; Type 12, unless shown otherwise on the Drawings

ELECTRICAL

3. Cabinet size: 5-3/4" deep; 20" wide.
4. Panelboard mounting as shown on the Drawings.
5. Provide cabinet front with concealed trim clamps, concealed hinge and flush lock all keyed alike. Finish in manufacturer's standard gray enamel.
6. Provide panelboards with tin plated, copper bus, ratings as scheduled on Drawings.
7. Provide copper ground bus in all panelboards.
8. Minimum integrated short circuit rating: As shown in panel schedules.
9. Molded case circuit breakers: NEMA AB 1; bolt-on type thermal magnetic trip circuit breakers, with common trip handle for all poles.
 - a. Provide circuit breakers UL listed as Type SWD for lighting circuits.
10. Provide UL Class A ground fault interrupter circuit breakers where scheduled on Drawings.
11. Provide panelboards with typed directories as shown on panel schedules.
12. Provide panelboards keyed alike.

2.13 MOTOR CONTROL CENTERS

A. Applicable standards:

1. ANSI/NFPA 70: National Electrical Code.
2. ANSI C84.1: Voltages Tolerances for North America.
3. ANSI/CSA C22.2: Industrial Control Equipment.
4. IEC 721: Classification of Environmental Conditions.
5. NEMA ICS 2: Motor Control Centers Not Rated More Than 600 Volts AC.
6. NEMA 250: Enclosures for Electrical Equipment.
7. UL 508: UL Standard for Safety Industrial Control Equipment.
8. UL 508C: UL Standard for Safety Power Conversion Equipment.
9. UL 845: UL Standard for Safety for Motor Control Centers.

B. Acceptable manufacturers:

ELECTRICAL

1. ABB.
 2. Eaton.
 3. Schneider Electric.
- C. Provide motor control centers manufactured from ISO 9001 or ISO 9002 certified facilities and having a documented record of at least ten major installations within the last five years.
- D. Provide NEMA Type 1A (gasketed general purpose) enclosure except as otherwise indicated.
- E. Provide motor control wiring as Class I, Type B as defined in NEMA ICS 2 unless otherwise indicated.
- F. Provide motor control centers complete with voltage, phase, amperes, number of conductors, and frequency as shown on Drawings.
- G. Provide provisions for future extension in all motor control centers.
- H. Where MCC is shown on the plans with a main breaker, provide with electronic trip unit, including long (L), short (S), instantaneous (I) and ground fault (G).
- I. Provide control center vertical sections bolted together to form a unit assembly. Break units into convenient shipping splits for ease of handling, as determined by the manufacturer, Contractor and/or Engineer, and be complete with adequate lifting means and floor sills.
- J. Provide structures as totally enclosed, dead-front, freestanding assemblies, 90 inches high and 21 inches deep for front-mounted units.
- K. Provide pull box compartments for horizontal wiring at the top and bottom of the control centers.
- L. Provide front-accessible incoming line compartment but isolated from main bus and other compartments.
- M. Provide a vertical wiring compartment with separate hinged doors in each controller section, isolated from starter units.
- N. Provide each unit compartment with an individual front door interlocked mechanically with the unit circuit breaker to prevent unintentional opening of the door while the breaker is closed. Provide a means for releasing the interlock for intentional access to the interior at any time.

ELECTRICAL

- O. Provide padlocking arrangements that permit locking the unit disconnect device off with at least three padlocks with door closed or open.
- P. Mount unit operating handle on disconnect not on the door.
- Q. Provide disconnect switch with indication of "on" or "off" with door open or closed.
- R. Provide insulated bar or button on outside of enclosure for resetting overload relays.
- S. Provide each structure with a main horizontal tin-plated copper bus, with minimum ampacity of 600 amperes or rated as shown on the drawings.
- T. Provide a copper Vertical bus feeding unit compartments with a minimum rating of 300 amperes and securely bolted to the horizontal main bus.
- U. Provide horizontal and vertical busses rated at 65 degrees C temperature rise over a 40 degree C ambient in compliance with UL standards.
- V. Effectively isolate the vertical buses to prevent any fault-generated gases to pass from one phase to another.
- W. Provide the vertical bus with a shutter mechanism to provide complete isolation of the vertical bus when a unit is removed. Provide access for inspection and maintenance from the front.
- X. Provide neutral bus sized as shown on drawings, minimum fully rated, continuous throughout the control center.
- Y. Provide neutral lugs of appropriate size and quantity to accept incoming service and branch circuits.
- Z. Provide a full-length copper ground bus run rated for minimum of 300 amperes run along bottom of unit.
- AA. Provide copper vertical ground bus that makes contact with the plug-in units before the bus stabs engage the vertical bus.
- BB. Provide bus assembly bracing to withstand the mechanical stress caused by fault currents of 42,000 RMS symmetrical amperes.
- CC. Provide group mounted, molded case branch feeder breakers unless shown otherwise on drawings.
- DD. Provide center sections of same depth, front and rear-align.

ELECTRICAL

- EE. Provide adequate cable supports throughout the center.
- FF. Provide 30mm heavy-duty pilot lights, push buttons, switches, etc.
- GG. Properly identify and label all termination points and wiring so denoted on shop drawings for ease of maintenance.
- HH. Provide motor starter units through NEMA Size 5 of the draw-out type with a positive guide rail system and stab shrouds to absolutely ensure alignment of stabs with the vertical bus.
- II. Provide draw-out units with a tin-plated stab assembly for connection to the vertical bus. No wiring to these stabs shall extend into the bus compartment.
- JJ. Equip units with side-mounted, positive latch pull-apart type control terminal blocks rated 600 volts.
- KK. Provide knockouts for the addition of future terminal blocks.
- LL. All control conductors to be 14-gauge minimum.
- MM. Paint all surfaces with #49 medium light gray per ANSI standard Z55.1-967 (60-70 gloss) unless specified otherwise.
- NN. Apply the paint using an electro-deposition process to ensure a uniform paint coat with high adhesion.
- OO. Paint control station plates and escutcheon plates a contrasting gray.
- PP. Paint all unit interior saddles white for better visibility inside the unit.
- QQ. Provide a minimum 2.0 mils in thickness for all paint.
- RR. Test paint finish to UL 50 per ASTM B117 (5% ASTM Salt Spray) with no greater than 0.125 in (3 mm) loss of paint from a scribed line.
- SS. Provide finish suitable for indoor and outdoor environments.
- TT. Provide outdoor units (NEMA 3R and 4X) with necessary space heaters with thermostat and one 20-amp GFCI duplex receptacle.

2.14 MOTOR CONTROLLERS

- A. Motor starter designations:

ELECTRICAL

1. FVNR: Full Voltage Non-reversing (default type if none shown).
 2. FVR: Full Voltage Reversing.
 3. RVSS: Reduced Voltage Solid State.
 4. RVAT: Reduced Voltage Auto Transformer.
- B. Provide each combination motor starter with magnetic circuit protection (MCP), rated for 65,000 AIC symmetrical at 480V.
- C. Provide FVNR, FVR, RVAT, and RVSS motor starters as 600V, NEMA-type, electrically operated, electrically held, three-pole assemblies with arc extinguishing characteristics and silver-to-silver renewable contacts.
- D. Make provisions for a total of eight (8) NO or NC auxiliary contacts.
- E. Provide each starter with a time delay relay adjustable from 0 to 3 minutes, 6-digit running time meter, a fused control power transformer, two (2) indicating lights (one red for running, green for ready), HOA selector switch, and two (2) NO contacts, unless otherwise scheduled on the drawings.
- F. Provide device panel with space to accommodate six (6) oil-tight pilot-control devices or indicating ammeters, voltmeters, or elapsed time meters.
- G. Provide ambient compensated type overload protection for starters in NEMA 3R or 4X outdoor enclosures.
- H. Provide thermal bimetallic ambient compensated type overload relay assembly, unless indicated otherwise.
- I. Provide the overload relay with built-in push-to-test button, electrically isolated NO-NC contacts and single-phase sensitivity.
- J. RVSS
1. Equip each RVSS combination motor starter with built-in electronic overload protection, phase loss/phase imbalance and phase reversal sensing.
 2. Provide adequate inputs/outputs for start/stop control and run indication.
 3. Provide paralleling run bypass contactor that energizes when the motor reaches 90% of full speed and closes/opens under one (1) times the motor current contacts.
- K. For motor controllers housed in separate enclosure, provide 30mm heavy-duty pilot

lights, push buttons, switches, etc.

- L. Provide NEMA rated, FVNR, combination motor starters for motors 25HP and less and NEMA rated, reduced voltage, combination motor starters, type as shown, for motors greater than 25HP.

2.15 SWITCHBOARDS

A. Applicable standards:

1. ANSI/IEEE C12.16: Solid State Electricity Metering.
2. ANSI/CSA C22.2: Industrial Control Equipment.
3. ANSI C57.13: Instrument Transformers.
4. NEMA AB 1: Molded Case Circuit Breakers and Molded Case Switches.
5. NEMA PB 2: Dead-front Distribution Switchboards, File E8681.
6. NEMA PB 2.1: Proper Handling, Installation, Operation and Maintenance of Dead-front Switchboards Rated 600 Volts or Less.
7. NEMA PB 2.2: Application Guide for Ground Fault Protective Devices for Equipment.
8. UL 489: Molded Case Circuit Breakers.
9. UL 891: Dead-Front Switchboards.
10. UL 508: UL Standard for Safety Industrial Control Equipment.

B. Acceptable manufacturers:

1. ABB.
2. Eaton.
3. Schneider Electric.

- C. Provide units rated for 3-phase, 4-wire wye, 60 Hz operation, voltage as shown on Drawings. Provide unit enclosures as shown on drawings with NEMA 1 as a minimum, NEMA 3R for outdoor units.

- D. Provide all outdoor units with space heaters with thermostat.

- E. Provide freestanding, self-supporting, front and rear accessible steel structure bolted together to form one complete rigid unit, front and rear aligned.

ELECTRICAL

- F. Provide adequate number of anchor boltholes to allow attachment of the base directly to the floor and/or concrete pad.
- G. Provide removable lifting eyes.
- H. Provide all panel covers with captive screws.
- I. Provide front doors with greater than 90 degree swing for safety and ease of accessibility.
- J. Provide front doors with a lockable handle. Provide door locks keyed alike to operate from a single key. Supply one key for each lock.
- K. Provide main bus of tin plated copper, rated as shown on drawings. Support main riser bus with high impact non-tracking insulating material.
- L. Support main and riser bus with high impact non-tracking insulating material, and brace to withstand mechanical forces of 65,000 minimum amperes RMS symmetrical.
- M. Provide minimum interrupting ratings as shown on drawings.
- N. Label and identify all termination points and wiring and denote on shop drawings for ease of maintenance.
- O. Provide vertical and horizontal code steel isolation barriers so no live bussing will be accessible in compartments that require access for maintenance, fuse replacement, manual operation of breakers or relay setting. Provide barriers with grommets in openings for passing of cables.
- P. Provide cable supports throughout the unit.
- Q. Provide a full-length copper ground bus in unit.
- R. Provide neutral bus sized as shown on drawings, minimum fully rated, continuous throughout the control center. Provide neutral lugs of appropriate size and quantity to accept incoming service and branch circuits.
- S. Provide a removable strap in the main neutral bus ahead of all feeder neutral connections and just behind the grounding electrode connection, secondary service neutral connection, and unit ground connection. Allow access to removable strap from the front of the unit.

ELECTRICAL

- T. Provide main breaker with electronic trip unit, including long (L), short (S), instantaneous (I) and ground fault (G). Factory set to the following: L = 1.0, S = 4.0, I = 7.0, G = 0.2.
- U. Provide group mounted, molded case branch feeder breakers.
- V. Provide engraved laminated plastic nameplates having white letters on black backgrounds, identifying all major components, vertical sections and circuit breakers.
 - 1. Attach with self-tapping, 316 stainless steel screws.
 - 2. 5/32" - minimum letter height.
 - 3. 1/2" high letters for switchboard designation.
- W. Unit enclosures shall be cleaned and phosphatized and have two (2) final finish coats of corrosion resistant, non-chalking gray color paint.
- X. Provide front accessible transformers equipped with current limiting fuses. Provide space heaters with thermostat in outdoor units.
- Y. Provide unit layouts, sizing and arrangements as indicated on One-Line Diagram, plans and in Equipment Schedule.

2.12 AUTOMATIC TRANSFER SWITCH-Furnished by Generator Supplier

- A. Applicable standards:
 - 1. UL 1008: Standard for Automatic Transfer Switches.
 - 2. NFPA 70: National Electrical Code.
 - 3. NFPA 99: Essential Electrical Systems for Health Care Facilities.
 - 4. NFPA 110: Emergency and Standby Power Systems.
 - 5. IEEE 446: IEEE Recommended Practice for Emergency and Standby Power Systems for Commercial and Industrial Applications.
 - 6. NEMA ICS10-2005: AC Automatic Transfer Switches.
- B. Acceptable manufacturers:
 - 1. American Switch Company (ASCO).
 - 2. Caterpillar.
- C. The following specifications are based on the Caterpillar series power transfer switch and should be considered as a minimum for features and quality.

ELECTRICAL

- D. Provide a stand-alone automatic transfer switch rated for site voltage. Provide unit enclosures as shown on drawings with NEMA 1 enclosures for indoor units and NEMA 4X 304 stainless steel for outdoor units.
- E. Provide switch as true double throw, mechanically held, electrically operated, utilizing a reliable field proven, single-solenoid operator with contacts easily accessible for inspection and preventive maintenance.
- F. Provide 3-pole switch with solid neutral as shown on drawings.
- G. Provide amperage and voltage ratings as shown on drawings.
- H. Provide the following features:
 - 1. Microprocessor Controls.
 - 2. Optically isolated RS-485 Serial Communication Interface.
 - 3. In-phase Monitor.
 - 4. Selective Load Disconnect.
 - 5. Engine Exerciser.
 - 6. Solid Neutral.
 - 7. Switch Position Lights.
 - 8. Source Availability Lights.
 - 9. Source Availability Contacts.
 - 10. Test Switch.
 - 11. Time Delay Bypass Switch.
 - 12. One (1) NO and one (1) NC Contacts Rated 10 amps 250VAC.
 - 13. 60 or 50 Hz Selectable.
 - 14. 3- phase or 1- phase Selectable.
 - 15. Two (2) NO and two (2) NC Auxiliary Contacts.
 - 16. Manual Transfer Option.
 - 17. Strip Heater with Thermostat.
 - 18. Deluxe Exerciser.
 - 19. Time Delay Adjustments:
 - a. Override Momentary Normal Outage - 1-3 Seconds.
 - b. Transfer to Emergency - 0-5 Minutes.
 - c. Override Momentary Emergency Outage - 4 Seconds.
 - d. Retransfer to Normal - 1 Second - 30 Minutes.
 - e. Unloaded Running Time Cool Down - 5 Minutes.
 - 20. Voltage and Frequency Settings:
 - a. Normal Source Voltage:
 - 1) PU - 90%-95%.
 - 2) DO - 70%-85%.
 - b. Emergency Source Voltage:
 - 1) PU - 90%.
 - 2) DO - 75%.

- c. Emergency Source Frequency:
 - 1) PU - 95%.
 - 2) DO - 85%.

2.18 METERING

A. Circuit Monitor:

- 1. Provide integral, flush mounted digital monitoring package, listed per UL 508, CSA recognized under C22.2, and CE compliant.
- 2. Provide monitor with the ability to communicate via RS-485, Ethernet, DeviceNet, or Remote I/O protocols as specified or to connect to any host device with a compatible port.
- 3. Provide all necessary hardware, e.g., gateway, etc., to allow communications compatibility with the network utilized. Each metering package shall have the ability to be installed in parallel with other meters made by the same manufacturer so that loss of communication with one meter does not prohibit the other meters from communicating with the host device.
- 4. Provide monitor with the following quantities:
 - a. Current, per-phase and neutral.
 - b. Volts, phase-to-phase and phase-neutral.
 - c. Real Power (kW), per phase and three-phase total.
 - d. Reactive Power (kVAR), per phase and three-phase total.
 - e. Apparent Power (kVA), per phase and three-phase total.
 - f. Power Factor (true), per-phase and three-phase total.
 - g. Frequency.
 - h. Demand Current, per-phase and neutral, present and peak.
 - i. Real Power Demand (kWd), three-phase total, present and peak.
 - j. Reactive Power Demand (kVARd), three-phase total, present and peak.
 - k. Apparent Power Demand (kVAd), three-phase total, present and peak.
 - l. Real Energy (kWh), three-phase total.

ELECTRICAL

- m. Reactive Energy (kVARh), three-phase total.
 - n. Apparent Energy (kVAh), three-phase total.
 - o. Energy Accumulation modes, signed, absolute, energy in, energy out.
 - p. Date and time Stamping, peak demands, power up/restart and resets.
5. Provide circuit monitor with an Ethernet Communications Card with the following:
- a. Provide connection to Ethernet backbone via standard RJ-45 port for connection of unshielded twisted pair cable (UTP) or LC fiber optic connection for multimode fiber (100BaseFX).
 - b. Provide indicating LED's for the Ethernet connections to assist in trouble-shooting. Indicators are required for TRANSMIT, RECEIVE and LINK status for Ethernet, and TRANSMIT, RECEIVE for the RS-485 communications.
 - c. Provide support for other compatible devices through one 2-wire or 4-wire RS-485 communication port via standard daisy-chain connections. The RS-485 serial port shall operate up to 38.4k baud.
 - d. Provide full TCP/IP compliant thereby allowing the power monitoring software access to power monitoring information from anywhere on the local area network (LAN) or via the Wide Area Network (WAN).

2.19 ENERGY EFFICIENT DRY TYPE TRANSFORMERS (600V MAX.)

- A. Applicable standards:
- 1. NFPA 70: National Electrical Code.
 - 2. NEMA ST20: Dry Type Transformers for General Applications.
 - 3. UL 1561: Standard for Safety for Dry-Type General Purpose and Power Transformers.
 - 4. UL 506: Specialty Transformers.
 - 5. NEMA TP1: Guide for Determining Energy Efficiency for Distribution Transformers.

ELECTRICAL

6. NEMA TP2: Standard Test Method for Measuring the Energy Consumption of Distribution Transformers.
 7. ANSI C89: Specialty Transformers.
- B. Acceptable manufacturers:
1. ABB.
 2. Eaton.
 3. Schneider Electric.
- C. Refer to Drawings for actual layout and location of equipment and components; current ratings of devices, bus bars, and components; voltage ratings of devices, components and assemblies; and other required details.
1. Provide dry-type general-purpose transformers rated as indicated in drawings.
 2. Provide UL listed transformers 750kVA and smaller.
 3. All insulating materials are to exceed NEMA ST20 standards and be rated for 220°C UL component recognized insulation system.
 4. Provide transformers 15kVA and larger with 150°C temperature rise above 40°C ambient.
 5. Provide transformers 25kVA and larger with a minimum of 4 - 2.5% full capacity primary taps. Verify exact voltages and taps with plans or the transformer schedule.
 6. Locate dry type transformers in well-ventilated areas, free from excess humidity, dust and dirt and away from hazardous materials. Ambient temperature of area will be between -30°C and +40°C. Protect indoor locations to prevent moisture from entering enclosure.
 7. Provide weather shields, wall mounting brackets and ceiling mounted brackets as required for installation location.
 8. Provide aluminum coils.
- D. Transformer Construction:
1. Provide transformer coils of the continuous wound construction and impregnated with non-hygroscopic, thermosetting varnish.
 2. All cores to be constructed with low hysteresis and eddy current losses.

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3. Magnetic flux densities are to be kept well below the saturation point to prevent core overheating.
 4. For transformers greater than 500kVA, clamp cores utilizing insulated bolts through the core laminations to ensure proper pressure throughout the length of the core. Bolt the completed core and coil to the base of the enclosure. Isolate by means of rubber vibration-absorbing mounts.
 5. Provide no metal-to-metal contact between the core and coil and the enclosure except for a flexible safety ground strap. Sound isolation systems requiring the complete removal of all fastening devices will not be acceptable.
 6. Visibly ground the core of the transformer to the enclosure by means of a flexible grounding conductor sized in accordance with applicable UL and NEC standards.
 7. Provide ventilated transformer enclosures fabricated of heavy gauge, sheet steel construction.
 8. Finish the entire enclosure utilizing a continuous process consisting of degreasing, cleaning and phosphatizing, followed by electrostatic deposition of polymer polyester powder coating and baking cycle to provide uniform coating of all edges and surfaces.
 9. Provide UL recognized coating for outdoor use.
 10. Provide ANSI 49 coating color.
- E. Provide low loss type transformers with minimum efficiencies per NEMA TP1 when operated at 35% of full load capacity. Test efficiency in accordance with NEMA TP2.

Single Phase		Three Phase	
kVA	Efficiency	kVA	Efficiency
15	97.7%	15	97.0%
25	98.0%	30	97.5%
37.5	98.2%	45	97.7%
50	98.3%	75	98.0%
75	98.5%	112.5	98.2%
100	98.6%	150	98.3%
167	98.7%	225	98.5%
250	98.8%	300	98.6%
333	98.9%	500	98.7%

ELECTRICAL

Single Phase		Three Phase	
kVA	Efficiency	kVA	Efficiency
		750	98.8%

- F. Provide transformers with sound levels warranted by the manufacturer and not to exceed the following:

kVA	Sound Level	kVA	Sound Level
15-50	45dB	501-700	62dB
51-150	50dB	701-1,000	64dB
151-300	55dB	1,001-1,500	65dB
301-500	55dB	1,501-2,000	66dB

- G. Load Taps:

1. Provide three phase transformers with the following high voltage load tap arrangements unless noted otherwise in plans:
 - a. Up through 15 KVA - no taps.
 - b. 25 through 300kVA - 6-2.5% taps, 2-above and 4-below nominal.
 - c. 500 through 750kVA - 4-3.5% taps, 2-above and 2-below nominal.
 - d. Over 750kVA - 2-5% taps, 1-above and 1-below nominal.
2. Provide single phase transformers with the following high voltage load tap arrangements unless noted otherwise in plans:
 - a. Up through 15 KVA - no taps.
 - b. 25 through 250kVA - 6-2.5% taps, 2-above and 4- below nominal.

- H. Testing

1. Provide transformers with the following production tests:
 - a. Applied Potential.
 - b. Induced Potential.
 - c. No Load Losses.
 - d. Voltage Ratio.

ELECTRICAL

- e. Polarity and Phase Rotation.
 - f. Continuity.
 - g. Sound Level.
 - h. Basic Impulse Insulation Level.
2. Provide the following manufacturer performed tests on units identical to the design type being supplied to this specification. Provide test data sheets to prove performance of these tests, when requested.
- a. Sound Levels.
 - b. Temperature Rise Tests.
 - c. Full-Load Losses.
 - d. Regulation.
 - e. Impedance.

2.20 CONCRETE SUPPORT FOUNDATIONS

- A. Install each freestanding unit of electrical equipment on a 4" thick, 3000 PSI wire mesh reinforced concrete pad or curb with 36" clear on front side and 12" clear on all remaining sides, unless otherwise noted on drawings. Provide 3/4" chamfer all sides.

2.21 MISCELLANEOUS MATERIALS

- A. Provide support framing, channel and associated accessories of 316 stainless steel conforming to the Drawings and to Sections 05990 and 06800 of these specifications, except in areas containing chemicals, whereby fiberglass reinforced plastic only shall be utilized.
- B. Provide and install equipment racks for panels as shown on the drawings and as described in the specifications, with the following as a minimum:
1. Provide cross members consisting of two (2) horizontal pieces of pre-drilled 1-1/2" x 1-1/2" mounting channel, manufactured by Kindorff.
 2. Attach all struts with spring-loaded nuts and associated hardware provided by manufacturer of strut, and specifically designed for this purpose.
 3. Use 316 stainless steel stud nuts, manufactured by Kindorff.

ELECTRICAL

4. Support the mounting channel "cross bars" vertically by C-channels, 3" x 2" x 8'.
 5. Mount channels a maximum of 24" apart, center-to-center, quantity as required to accommodate equipment.
 6. Provide a foundation buried 36" underground and secured with 3000 PSI concrete pad, sized as shown on plans with a minimum of 36" clear walking space in front of control panels and 12" on sides and rear of panel.
 7. Provide 3/4" chamfer on all concrete edges.
- C. Provide 316 stainless steel (bolts, nuts, washers, U-bolts, anchors, threaded rods, etc.) attachment hardware.

2.22 PROTECTIVE DEVICE COORDINATION STUDY AND ARC FLASH ANALYSIS

- A. The Contractor shall provide the required data for preparation of the studies. The Engineer performing the system studies shall furnish the Contractor with a listing of the required data immediately after award of the contract.
- B. The Contractor shall expedite collection of the data to assure completion of the studies as required for final approval of the distribution equipment shop drawings and/or prior to release of the equipment for manufacture.
- C. Perform the short circuit study with the aid of a digital computer program and in accordance with the latest applicable IEEE, NEC and ANSI standards.
- D. In the short circuit study, provide the following:
 1. Calculation methods and assumptions.
 2. Base per unit quantities selected.
 3. One-line diagrams.
 4. Source impedance data including power company system characteristics.
 5. Typical calculations.
 6. Tabulations of calculation quantities and results, conclusions, and recommendations.
 7. Calculate short circuit interrupting and momentary (when applicable) duties for an assumed 3-phase bolted fault at each supply switchgear lineup, unit substation primary and secondary terminals, low-voltage switchgear lineup,

ELECTRICAL

switchboard, motor control center, distribution panelboard, pertinent branch circuit panelboard, and other significant locations throughout the system.

8. Provide a ground fault current study for the same system areas, including the associated zero sequence impedance data. Include in tabulations fault impedance, X to R ratios, asymmetry factors, motor contribution, short circuit kVA, and symmetrical and asymmetrical fault currents.
- E. In the protective device coordination study, provide the following:
1. Time-current curves graphically indicating the coordination proposed for the system, centered on conventional, full-size, log-log forms.
 2. Include with each curve sheet a complete title and one-line diagram with legend identifying the specific portion of the system covered by that particular curve sheet.
 3. Include a detailed description of each protective device identifying its type.
 4. Tabulate recommended device tap, time dial, pickup, instantaneous, and time delay settings.
 5. Include the following on the curve sheets:
 - a. Power company relay and fuse characteristics.
 - b. System medium-voltage equipment relay and fuse characteristics.
 - c. Low-voltage equipment circuit breaker trip device characteristics.
 - d. Pertinent transformer characteristics.
 - e. Pertinent motor and generator characteristics.
 - f. Characteristics of other system load protective devices.
 - g. Include at least all devices down to largest branch circuit and largest feeder circuit breaker in each motor control center, and main breaker in branch panel board.
 - h. Include all adjustable settings for ground fault protective devices.
 - i. Include manufacturing tolerance and damage bands in plotted fuse characteristics.
 - j. Show transformer full load and 150, 400, or 600 percent currents, transformer-magnetizing inrush, ANSI transformers withstand parameters, and significant symmetrical and asymmetrical fault currents.

ELECTRICAL

- k. Terminate device characteristic curves at a point reflecting the maximum symmetrical or asymmetrical fault current to which the device is exposed.
- F. Coordinate each primary protective device required for a delta-wye connected transformer so that its characteristic or operating band is within the transformer characteristics; including a point equal to 58 percent of the ANSI withstand point to provide secondary line-to-ground fault protection. Where the primary device characteristic is not within the transformer characteristics, show a transformer damage curve. Separate transformer primary protective device characteristic curves from associated secondary device characteristics by a 16 percent current margin to provide proper coordination and protection in the event of secondary line-to-line faults. Separate medium-voltage relay characteristic curves from curves for other devices by at least a 0.4-second time margin.
- G. Include complete fault calculations as specified herein for each proposed and ultimate source combination. Note that source combinations may include present and future supply circuits, large motors, or generators as noted on Drawing one-lines.
- H. Submit qualifications of individual(s) who will perform the work for approval prior to commencement of the studies. Provide studies in conjunction with equipment submittals to verify equipment ratings required. Submit a draft of the study to Engineer for review prior to delivery of the study to the Owner. Make all additions or changes as required by the reviewer.
- I. Utilize equipment load data for the study obtained by the Contractor from Contract Documents, including Contract Addendums issued prior to bid openings.
- J. Include fault contribution of all motors in the study. Notify the Engineer in writing of circuit protective devices not properly rated for fault conditions.
- K. Evaluate proper operation of the ground relays in 4-wire distributions with more than one main service circuit breaker, or when generators are provided, and discuss the neutral grounds and ground fault current flows during a neutral to ground fault.
- L. For motor control circuits, show the MCC full-load current plus symmetrical and asymmetrical of the largest motor starting current and time to ensure protective devices will not trip during major or group start operation.
- M. Study Report:
 - 1. Summarize the results of the power system study in a final report. Submit six (6) bound copies of the final report.

ELECTRICAL

2. Include the following sections in the report:
 - a. Descriptions, purpose, basis and scope of the study.
 - b. Tabulations of circuit breaker, fuse and other protective device ratings versus calculated short circuit duties, and commentary regarding same.
 - c. Protective device time versus current coordination curves, tabulations of relay and circuit breaker trip settings, fuse selection, and commentary regarding same.
 - d. Fault current calculations including a definition of terms and guide for interpretation of computer printout.
- N. Contractor shall commission an Arc Flash Hazard Analysis for each piece of electrical equipment in accordance with OSHA 29 CFR Part 1910, NEC, NFPA 70E, and IEEE 1584 and shall submit an Arc Flash Hazard Analysis report as specified herein.
- O. Arc Flash Hazard Analysis calculations shall lead to a selection of a level of Personal Protective Equipment (PPE) that is a balance between the calculated incident energy exposure and the work activity being performed, while meeting the following concerns:
 - Provide adequate protection.
 - Avoid the need for more protection than is warranted.
- P. Results of the Arc Flash Hazard Analysis shall be used to identify the flash-protection boundary and the incident energy at assigned working distances throughout any position or level in the overall electrical generation, transmission, distribution, or utilization system.
- Q. The analysis shall include, but shall not be limited to, the following:
 - A tabulation of the symmetrical RMS bolted fault current available and X/R ratio at each piece of electrical equipment.
 - A tabulation of the arc fault current available at each piece of electrical equipment.
 - A list containing the incident energy and the flash-protection boundary for all electrical equipment.
 - A list containing each piece of electrical equipment, its corresponding incident energy, hazard rating, and the required Personal Protective Equipment.
- R. An Engineering and Testing Services firm acceptable to Engineer shall conduct the Arc Flash Hazard Analysis.

ELECTRICAL

- S. The Arc Flash Hazard Analysis shall be performed using the latest version of EasyPower or SKM Power*Tools for Windows software, without exception.
- T. After the final version of the study and analysis are completed and accepted, Contractor shall provide two (2) copies of the electronic file to Owner.
- U. Contractor shall be responsible for submitting complete and accurate arc flash analysis information in the Arc Flash Hazard Report. The report shall be submitted to Engineer for review before the final report is prepared. Contractor shall ensure that calculated values for flash-protection boundary, working distance, incident energy, and required Personal Protective Equipment is submitted and provide substantiation that the information will be prominently displayed on electrical equipment.
- R. The Arc Flash Hazard Analysis report shall be bound in a standard 8-1/2 by 11 inch three-ring binder and shall be submitted in accordance with the Submittals Section. Final selection of required Personal Protective Equipment shall be subject to review and acceptance by Engineer.
- S. After approval of the Arc Flash Hazard Report, Contractor shall furnish and install arc flash warning labels on the applicable electrical equipment. All electrical equipment shall be provided with the appropriate ANSI compliant arc flash labeling. Labels shall include the flash protection boundary distance, incident energy, and minimum required Personal Protective Equipment.

PART 3 - EXECUTION

3.1 SURFACE CONDITIONS

- A. Examine the areas and conditions under which work of this Section will be performed. Correct conditions detrimental to timely and proper completion of the Work. Do not proceed until unsatisfactory conditions are corrected.

3.2 PREPARATION

- A. Coordination:
 - 1. Coordinate as necessary with other trades to assure proper and adequate provision in the work of those trades for interface with the work of this Section.
 - 2. Coordinate the installation of electrical items with the schedule for work of other trades to prevent unnecessary delays in the total Work.

ELECTRICAL

3. Where lighting fixtures and other electrical items are shown in conflict with locations of structural members and mechanical or other equipment, provide required supports and wiring to clear the encroachment.
- B. Data indicated on the Drawings and in these Specifications are as exact as could be secured, but their absolute accuracy is not warranted. The exact locations, distances, levels, and other conditions will be governed by actual construction and the Drawings and Specifications should be used only for guidance in such regard.
- C. Where outlets are not specifically located on the Drawings, locate as determined in the field by the Engineer. Where outlets are installed without such specific direction, relocate as directed by the Engineer and at no additional cost to the Owner.
- D. Verify all measurements at the building. No extra compensation will be allowed because of differences between work shown on the Drawings and actual measurements at the site of construction.
- E. Branch circuit wiring and arrangement of home runs have been designed for maximum economy consistent with adequate sizing for voltage drops and other considerations. Install the wiring with circuits arranged exactly as shown on the Drawings, except as otherwise approved in advance by the Engineer.

3.3 ELECTRICAL SERVICE

- A. Verify location of utility transformer pad and install per utility company specifications, providing all materials and labor required for a complete installation. Verify location of utility company secondary delivery point and report any discrepancies to the Engineer immediately.

3.4 TRENCHING AND BACKFILLING

- A. Perform trenching and backfilling associated with the work of this Section in strict accordance with the provisions of Section 02221 of these Specifications.

3.5 CONDUCTORS

- A. Install no conductor smaller than #12 AWG unless otherwise indicated.
- B. Provide copper conductors.
- C. Provide conductors as shown on the plans or as specified herein.
- D. Provide continuous wiring from outlet to outlet, identified by color and marked with size, grade and manufacturer.

ELECTRICAL

- E. Provide continuous wiring without joints, through pull boxes.
- F. Provide minimum of #10 AWG conductors on branch circuits, which exceed 100' at 120 volts and 200' at 277 volts from panel to load center.
- G. Terminate #14 AWG stranded conductors where indicated for control, using insulated compression-type spade lugs.
- H. Terminate #12 AWG stranded conductors using insulated compression-type spade lugs.
- I. Install an equal number of conductors for each phase of a circuit in the same raceway or cable.
- J. The conductor lengths for parallel circuits must be made equal.
- K. Neatly train and lace all wiring inside boxes, equipment, and panel boards.
- L. Connect circuits sharing a common neutral to different phases regardless of the numbering.
- M. Provide phase, neutral, and ground conductors as required to accommodate metering installed. Any additional conductors required for meter to function properly shall be installed at the Contractor's expense.

3.6 COLOR CODE AND MARKERS

- A. Provide color-coding for #12 and #10 conductors as follows:

	480-Volt	120/208(240)-Volt
Phase "A"	Brown	Black
Phase "B"	Orange	Red
Phase "C"	Yellow	Blue
Neutral		White
Ground	Green	Green

Mark all conductors #8 and larger and all feeders with plastic tape to match the above color-coding.

- B. Mark all 480-volt equipment with red laminated plastic nameplates having one-half inch (1/2") engraved lettering, reading "DANGER 480-VOLTS". Attach plate to equipment with stainless steel screws.

ELECTRICAL

- C. Mark conductors within panelboards with self-sticking label bearing the number corresponding to the circuit number on the drawings. Connect these conductors to corresponding breaker in panel. Mark circuit numbers in outlet boxes only where color-coding is repeated by having two or more conductors of the same color.
- D. Mark equipment, panelboards, cabinets, control devices, starters, switches, etc. by means of black, white core laminated nameplates having ¼" engraved lettering. Provide designations as indicated on the drawings. Attach plates to equipment with stainless steel screws.

3.7 SPLICES, CONNECTIONS, AND TERMINATIONS IN 600V. CONDUCTORS

- A. Provide final connections and/or terminations for all wiring indicated on the electrical drawings and in this division of the specifications. Equipment supplied under other divisions of the specifications that require electrical connections under this division shall be provided with Engineer approved wiring and termination diagrams.
- B. Splice only in accessible junction boxes.
- C. Thoroughly clean wires before installing lugs and connectors.
- D. Terminate spare conductors with electrical tape.

3.8 RACEWAYS AND FITTINGS

- A. When PVC coated conduit systems are utilized, the raceway manufacturer prior to installation shall certify the Contractor. Submit certification to the Engineer in writing.
- B. When PVC coated conduit systems are utilized, provide inspection and certification of the complete raceway installation in writing by an authorized representative of the PVC coated materials supplier.
 - 1. During the construction process, at regular intervals, and prior to any raceway being covered, the representative shall inspect the system until it is confirmed that it meets the manufacturer's intended requirements.
 - 2. Remove and reinstall any portion of the conduit installation that does not meet the intended installation methods at no additional cost to the Owner.
- C. Provide certification to insure that all PVC overlapping connections, conduit threading, thread coating, sealing, etc., has been performed in accordance with manufacturer's recommended procedures.
- D. Apply cold galvanizing compound to all field-cut threads prior to installation.

ELECTRICAL

- E. In general, follow the raceway installation layout shown on the plans, however, this layout is diagrammatic only, and where changes are necessary due to structural conditions, other apparatus or other causes, make such changes without any additional cost to the Owner.
- F. Cut all conduits square using a saw or pipe cutter and de-burr cut ends.
- G. Install the conduit to the shoulder of fittings and couplings and fastened securely.
- H. Use conduit hubs, or sealing locknuts, for fastening conduit to cast boxes and for fastening conduit to sheet metal boxes in damp or wet locations.
- I. No more than the equivalent of three 90-degree bends may be installed between boxes.
- J. Use conduit bodies to make sharp changes in direction, as around beams.
- K. Use hydraulic one-shot conduit bender or factory elbows for bends in conduit larger than 2" size.
- L. Avoid Moisture traps where possible; where moisture traps are unavoidable, there must be a junction box with drain fitting provided at the conduit low point. Use suitable conduit caps to protect installed conduit against entrance of dirt, concrete, plaster, mortar, and moisture.
- M. Size all conduits for conductor type installed with $\frac{3}{4}$ " being the minimum size conduit allowed.
- N. Arrange conduit to maintain headroom and present a neat appearance.
- O. Route any exposed conduit and conduit above accessible ceilings parallel and perpendicular to walls and adjacent piping.
- P. Provide at all times a minimum of 6" clearance between conduit and piping and a 12" clearance between conduit and heat sources such as flues, steam pipes, and heating appliances.
- Q. Arrange all conduit supports to prevent distortion of alignment by conductor pulling operations.
- R. Fasten conduits above finished ceilings using straps, lay-in adjustable hangers, clevis hangers or bolted split stamped hangers.

ELECTRICAL

1. Do not fasten conduit with wire or perforated pipe straps. All wire that was used for temporary conduit support during construction must be removed before conductors are pulled.
 2. All conduits must be supported at a maximum distance of 5' on centers.
- S. Group conduits in parallel runs where practical using a conduit rack.
- T. Make all underground conduit joints watertight by applying manufacturer's recommended thread compound. Thread compound must be conductive and be compatible with conduit and conductor-jacket material.
- U. Provide suitable pull string or #12 AWG insulated conductor in empty conduit, except sleeves and nipples.
- V. Maintain minimum 12" clearance between all conduits containing signal circuits and conduits containing power circuits.
- W. Install expansion-deflection joints where conduit crosses building expansion or seismic joints.
- X. Where conduit penetrates fire-rated walls and floors, the opening around the conduit must be sealed with UL listed foamed silicone elastomer compound.
- Y. Install exposed raceways either parallel or perpendicular to building walls.
- Z. Install raceways exposed on walls or free standing perpendicular to the floor.
- AA. Install exposed raceways on channel so as to provide a minimum spacing of 1/2" between raceway and the surface to which it is mounted.
- BB. Bends:
1. Where emerging from walls, ceilings, floor or concrete slabs, all conduit bends shall be made entirely within the structure (i.e.: the conduit shall emerge perpendicular to the surface and the bend shall be covered).
 2. Make all 90-degree conduit turns with factory-bent, rigid galvanized steel, long radius elbows.
 3. Utilize rigid galvanized steel, long radius elbows on all 90 degree conduit bends of 2" and larger.
- CC. Install no metal conduit in contact with the earth or concrete slab unless protected with PVC coating.

ELECTRICAL

- DD. Provide necessary sleeves and chases where conduits pass through floors and walls, and provide other necessary openings and spaces, arranging for in proper time to prevent unnecessary cutting in connection with the Work.
- EE. Perform cutting and patching in accordance with the provisions for the original Work.
- FF. Refer to Section 02221 for minimum cover of underground conduits.
- GG. Sealing Conduit:
1. Install watertight conduit hubs on all conduits terminating in the top or sides of NEMA 3R, 4 or 4X enclosures.
 2. Use a sealing locknut having an integral gasket on conduits terminating in the bottom of NEMA 3R, 4 or 4X enclosures.
 3. Seal all conduits terminating in NEMA 3R, 4 or 4X enclosures with duct seal.
 4. Seal watertight all conduits terminating in NEMA 6 or watertight rated enclosures.
 5. Install sealing compound and fiber, per manufacturer's recommendation, in hazardous location conduit sealing fittings. Tighten plugs per manufacturer's recommended torque.
- HH. Make motor lead connections and connections to other electrical equipment subject to vibration, or where indicated with flexible weatherproof type steel core conduit with wrapping and cover, factory assembled.
- II. Conduit installations in hazardous locations as defined by Article 500 of the NEC must conform to the special requirements of Articles 501, 502, and 503 of the NEC.
- JJ. Chapter 9 of the NEC shall apply unless larger raceways are specified.
- KK. Ensure all threads are fully installed into fittings, boxes, enclosures and equipment per NEC and UL listing requirements to provide mechanical integrity, grounding and sealing. Provide fittings and adapters to ensure full length of conduit or conduit fitting threads are installed per code and listing requirements.
- LL. Liquidtight flexible metal conduit shall be supported and securely fastened within 12 inches of each box, cabinet, conduit body or other conduit body termination and shall be supported and secured at intervals not to exceed 4-1/2 feet. Flexible metal conduit shall not exceed 6 feet in length except for luminaire connections as allowed per the NEC.

3.9 CONDUIT SUPPORTS

- A. Seal all ends of non-metallic conduit support with manufacturer's recommended sealer.
- B. Provide UL listed vinyl end caps for all ends of strut-type metallic conduit supports.
- C. Provide all miscellaneous materials and supports as required by the NEC and these specifications to provide support for conduits, raceways, boxes, fittings and equipment.

3.10 GROUNDING AND BONDING

- A. Ground and bond the electrical system and motors in accordance with Article 250 of the NEC.
- B. Install electric bond around panels, cabinets, pull boxes, enclosures, etc., to incoming and outgoing sub-feed raceways by use of grounding type bushings.
- C. Install rod electrodes at locations indicated. Install additional rod electrodes as required to achieve specified resistance to ground.
- D. Provide grounding electrode conductor(s) and connect as shown on drawings.
- E. Bond together metal siding not attached to grounded structure; bond to ground.
- F. Provide separate, insulated, green equipment grounding conductor within each feeder and branch circuit raceway. Terminate each end on suitable lug, bus, or bushing.
- G. Provide grounding type bushings for conduits 1" or larger and bond to ground bar or lug of enclosure.
- H. Bond neutral and ground at service entrance only.
- I. Provide exothermic-type weld grounding connections that are buried or otherwise normally inaccessible, and excepting specifically those connections for which access is required for periodic testing.
- J. Make each grounding connection strictly in accordance with the manufacturer's written instructions. Failure to follow manufacturer's written instructions shall result in immediate rejection.

ELECTRICAL

- K. Welds which have "puffed up" or which show convex surfaces, indicating improper cleaning, are not acceptable. Provide grounding connection devices compatible with the conductor(s) and/or rods being joined.
- L. Maximum acceptable resistance to earth ground is 25 Ohms. Provide testing of the service entrance system ground and verify the resistance to earth ground is within the specified requirements. If the existing service entrance ground does not meet the specified requirements, install additional rod electrodes as required to achieve specified resistance to ground.
- M. Interface with lightning protection system where applicable.
- N. Provide 1" PVC sleeve where bare ground cables emerge from slab to connect to equipment.

3.11 TRANSIENT VOLTAGE SURGE PROTECTION

A. Factory Installed:

1. Install SPD on the load side of the main circuit breaker.
2. Provide circuit breaker disconnect for SPD as shown on plans.
3. Install SPD in accordance with manufacturer instructions.
4. Minimum lead length 6".
5. Provide factory installed SPDs as shown on one-line diagrams.

B. Field Installed:

1. Connect SPD ground to service entrance grounding electrode conductor or to equipment grounding conductor if SPD located downstream of service entrance equipment. Confirm SPD installed per manufacturer's recommendation.
2. Install SPD on the load side of the main circuit breaker.
3. Install SPD in accordance with manufacturer instructions.
4. Maximum lead length 12".
5. Provide externally mounted SPDs as shown on one-line diagram.

3.12 METERING

A. Circuit Monitoring:

ELECTRICAL

1. Flush mount in unit at a minimum height of 54".
 2. Provide a Circuit Monitor in the main switchgear.
- B. Networking Start-up:
1. Provide on-site start-up and training of the circuit-monitoring network in the project bid.
 2. Include a complete working demonstration of the circuit-monitoring network with simulation of possible operating conditions that may be encountered.
 3. Include any documentation and hands-on exercises necessary to enable electrical operations personnel to assume full operating responsibility for the power-monitoring network after completion of the training period.4. Include 1 day start-up assistance and 2 days training to include 2 trip(s).

3.13 OUTLET BOXES

- A. Do not install boxes back-to-back in walls. Install the boxes at a minimum of 6" apart except in acoustic-rated walls with a minimum separation of 12".
- B. Locate boxes in masonry walls such that only the cutting of the masonry unit corner is required. Coordinate masonry cutting such that neat openings for the boxes can be achieved.
- C. Provide knockout closures for unused openings.
- D. Support boxes independently of the conduits.
- E. Use multiple gang boxes where more than one device is mounted together; do not use sectional boxes. Provide barriers to separate wiring of different voltage systems.
- F. Install boxes in the walls without damaging wall insulation.
- G. Install outlets to locate luminaires as shown on plans. In inaccessible ceiling areas, position outlets and junction boxes within 6" of recessed luminaires, to be accessible through luminaire ceiling opening.
- H. Provide recessed outlet boxes in finished areas; secure boxes to interior wall and partition studs, accurately positioning to allow for surface finish thickness.
- I. Use stamped steel stud bridges for flush outlets in hollow stud wall, and adjustable steel channel fasteners for flush ceiling outlet boxes.

ELECTRICAL

- J. Align wall mounted outlet boxes for switches, thermostats, and similar devices.
- K. Provide cast outlet boxes in locations (exposed to the weather) and indoor wet locations.
- L. Size all boxes in strict accordance with Article No. 370 of the NEC, except that no box will be less than the minimum specified.
- M. Check the location of all outlets to see that the outlets will clear any new or existing wall fixture, shelving, work tables, sinks, bulletin boards, etc. and the outlet will fit the area intended.
- N. Set floor boxes level and flush with finish flooring material. Use cast iron floor boxes for installations in slab on grade.
- O. Locate pull and junction boxes above accessible ceilings or in unfinished areas. Support pull and junction boxes independently of conduit.
- P. Install underground boxes as shown on drawings with top of box approximately 2" above finished grade. Install bottom of box over 12" of gravel to allow for adequate drainage.

3.14 CONVENIENCE OUTLETS AND SWITCHES

- A. Install wall switches at 48" above the floor level and 6" from edge of door jam on strike side, unless otherwise noted on Drawings.
- B. Install wall switches with the OFF position down.
- C. Install convenience receptacles at 18" above the floor level or 6" above counter or backsplash.
- D. Install convenience receptacles with the grounding pole on top.
- E. Install all specific-use receptacles at heights shown on Contract Drawings.
- F. Install decorative plates on switch, receptacle, and blank outlets in finished areas using jumbo size plates for outlets installed in masonry walls.
- G. Install galvanized steel plates on outlet boxes and junction boxes in unfinished areas, above accessible ceilings, and on surface-mounted outlets.
- H. Install devices and wall plates flush and level.

3.15 LIGHTING FIXTURES

- A. Replace all non-operational fixtures at completion of work.
- B. Touch up luminaire and pole finish at completion of work with manufacturer's color- respective touch up kit.
- C. Securely ground all lighting fixture housings.
- D. Align luminaires and clean lenses and diffusers at completion of work.
- E. Clean excess paint, dirt, and debris from installed luminaires.

3.16 POWER EQUIPMENT

- A. Provide power and control wiring for motor starters and safety switches as shown on the Drawings.
- B. Connections to miscellaneous building equipment:
 - 1. Wire to, and connect to, all items of building equipment not specifically described but to which electrical power is required.
 - 2. Coordinate as necessary with other trades and suppliers to verify types, numbers, and locations of equipment.

3.17 MOUNTING OF SWITCHBOARDS, CONTROL PANELS AND ELECTRICAL EQUIPMENT

- A. Install all equipment per the manufacturer's recommendations and the contract drawings.
- B. Install surface-mounted panelboards plumb, in conformance with NEMA PB 1.1.
- C. Install disconnect switches with centerline at 48" above finished floor, grade, etc. unless otherwise noted.
- D. Secure switchboard assemblies to foundation or floor channels.
- E. Secure disconnect switches to channel frames with spring-type fasteners and hardware intended for this specific use where wall mounted, unless otherwise indicated.
- F. Mount floor and wall mounted equipment utilizing Type 316 stainless steel anchors and fasteners of the size and number recommended by the manufacturer.

ELECTRICAL

- G. Provide necessary hardware to secure the assembly in place.
- H. Provide 316 stainless steel fasteners for all other installation types.
- I. Inspect switchboards and panel boards for physical damage, proper alignment, anchorage, and grounding. Check proper installation and tightness of connections for circuit breakers, fusible switches, and fuses.
- J. Install and check all equipment in accordance with the manufacturer's recommendations.
- K. Ensure that equipment mounting pad locations are level to within 0.125 inches per three foot of distance in any direction. Notify Engineer immediately if any discrepancies are found in the field.
- L. Ensure that all equipment bus bars are torqued to the manufacturer's recommendations.
- M. Assemble all equipment shipping sections, remove all shipping braces and connect all shipping split mechanical and electrical connections.
- N. Provide filler plates for unused spaces in panelboards and switchboards.
- O. Provide typed circuit directory with protective plastic sleeve secured to inside of panel door for each branch circuit panelboard.
- P. Provide Micarta type labels located adjacent to each breaker operator, delineating equipment served for each circuit breaker in all switchboards.
- Q. Measure steady state load currents at each switchboard and panelboard feeder. Should the voltage difference measured at the equipment between any two phases exceed 20 percent, rearrange circuits to balance the phase loads within 20 percent. Take care to maintain proper phasing for multi-wire branch circuits.
- R. Measure and recording Megger readings phase-to-phase, phase-to-ground, and neutral-to-ground (four wire systems only).

3.18 UNIT RESPONSIBILITY

- A. Switchboards, panelboards, motor control centers, relays, switches, starters, etc. furnished under this Section of the specifications shall be supplied by the same manufacturer so as to give unit responsibility and ease of maintenance.

3.19 HEATING, VENTILATING AND AIR CONDITIONING

ELECTRICAL

- A. Provide all power wiring for the plumbing, heating, ventilating and A.C. systems as shown on the drawings and according to an approved wiring diagram furnished by the Mechanical Contractor.
- B. Make all connections to equipment required for proper operation.
- C. Consult the mechanical drawings in detail for exact locations of all equipment.

3.20 TESTING AND INSPECTION

- A. Provide personnel and equipment, make required tests, and secure required approvals from the Engineer and governmental agencies having jurisdiction.
- B. Provide written notice to the Engineer adequately in advance of each of the following stages of construction:
 - 1. In the underground condition prior to placing concrete floor slab, when all associated electrical work is in place.
 - 2. When all rough-in is complete, but not covered.
 - 3. At completion of the work of this Section.
- C. When material and/or workmanship are found to not comply with the specified requirements, replace items within three days after receipt of notice at no additional cost to the Owner.
- D. Provide a qualified field serviceman, representing the manufacturer of each piece of major electrical equipment, to make proper and complete adjustments of all adjustable devices, load switches, etc. after final installation and completion of all field wiring. Verify and approve all connections prior to any initial or test operation of equipment. Submit confirmation in writing by the manufacturer's authorized representative of said services to the Engineer.

3.21 HAZARDOUS LOCATIONS

- A. Wiring and equipment in hazardous locations, as defined by the NEC, shall conform to the special requirements of the NEC, unless otherwise indicated or specified.

3.22 CLEANING AND PAINTING

- A. Collect and remove from the premises all debris, scraps and other waste material after completion of work.
- B. Tamp and level all trench work.

ELECTRICAL

- C. Remove excess dirt and debris, when and as directed by the Engineer.
- D. Thoroughly clean all electrical equipment, lighting fixtures, exposed conduit, enclosures and boxes of all foreign materials and paint in accordance with Section 09900 of these Specifications unless noted or directed otherwise.
- E. Clean any exposed threaded area of raceway of cutting oil and paint with a cold galvanizing compound prior to final finish painting.

3.23 ELECTRIC EQUIPMENT BY OTHERS

- A. The equipment manufacturer shall furnish all motors for equipment.
- B. Verify voltage, dimensions, extent, type, etc. of this and all other such electrical equipment.
- C. Furnish and install all electrical supply and control equipment and material required to put all the items in proper operative condition.
- D. Refer to other sections of these specifications for verification of other equipment and devices requiring electrical connections, wiring and devices not included in this section.
- E. Refer to other drawings for details not indicated on the electrical drawings.
- F. Prior to connecting any piece of such equipment, check the nameplate data against the information shown on the drawings and call to the immediate attention of the Engineer any discrepancies discovered.

3.24 PROJECT COMPLETION

- A. Test all 600-Volt service entrance and feeder wiring using an instrument, which applies a voltage of approximately 500 volts DC to provide a direct reading of resistance.
- B. Perform test on ground system utilizing Fall-Of-Potential method. Meg grounding systems to measure ground resistance, and provide not more than 5 ohms resistance, adding ground rods as necessary to achieve that level.
- C. Conduct all tests in presence of Engineer or his representative. Identify and properly record all readings. Submit readings to Engineer for acceptance.
- D. Measure voltages as directed by the Engineer and report to him these values.

ELECTRICAL

- E. Provide entire system free from all shorts and grounds.
- F. Fully comply with local and national codes for equipment bonding and grounding.
- G. Test system in the presence of the Engineer and operate to his complete satisfaction in accordance with true intent of plans and specifications. Defray cost of all adjustments necessary to bring system up to standards set forth by Contract Documents at no additional cost.
- H. Thoroughly indoctrinate the Owner's operation and maintenance personnel in the contents of the operations and maintenance manual.
- I. On the first day the facility is in operation, for at least eight (8) hours at a time directed by the Engineer, provide a qualified foreman and crew to perform such electrical work as may be required by the Engineer.

3.25 FIELD SETTINGS

- A. Perform field adjustments of the protective devices, as required, to place the equipment in final operating condition. The settings shall be in accordance with the approved short circuit study, protective device evaluation study, and protective device coordination study.
- B. Necessary field settings of devices and adjustments and minor modifications to equipment to accomplish conformance with the approved short circuit and protective device coordination study shall be carried out by the Contractor at no additional cost to the Owner.

END OF SECTION

**SECTION 16910
CONTROL PANEL CONSTRUCTION**

PART 1 - GENERAL

1.1 SCOPE

- A. The Supplier shall furnish, test, and startup all furnished electrical control panels and control system components related to their furnished equipment.
- B. Specifically included are the following control panels:
 - 1. All Process Equipment (Vendor Supplied) Control Panels

1.2 SUBMITTALS

- A. Product Data: For each type of product supplied. Include rated capacities, weights, operating characteristics, furnished specialties, and accessories.
- B. Shop Drawings: Dimensioned plans, elevations, sections, and details showing minimum clearances, conductor entry provisions, gutter space, installed features and devices, and material lists for each switch specified.
- C. Additional Shop Drawing Requirements:
 - 1. Point - to - Point Wiring Drawings.
 - 2. Process Loop Drawings
 - 3. Fabrication and nameplate legend drawings
 - 4. Internal wiring schematic and layout drawings
 - 5. Systems schematic drawings illustrating all components being supplied complete with electrical interconnections.
 - 6. Computer Input/Output lists and a written description of the control strategy

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR CONTROL PANELS

- A. All control panes shall be constructed in accordance with the following standards: National Electrical Manufacturers Association (NEMA), Institute of Electrical and Electronics Engineers (IEEE), Underwriter Laboratories (UL),

CONTROL PANEL CONSTRUCTION

Nation Fire Protection Association (NFPA), and Instrumentation Systems and Automation Society (ISA)

- B. All control panels shall be constructed in a UL approved production facility and bear all applicable UL labels for panel construction (i.e. UL508A, etc.).
- C. The completed panel shall be factory tested prior to shipment. Field installation by the Contractor shall consist only of setting the panel in place and making necessary pneumatic and/or electrical connections.
- D. All control panels shall be designed to operate at the service voltage as indicated in the project plans.

2.2 CONTROL PANEL ENCLOSURES

- A. Unless otherwise noted, all control panels shall be NEMA 4X construction with a 3-point steel latching mechanism and padlocking stainless steel handles. Latch rods to have rollers for easier door closing. Enclosures shall be manufactured by Hoffman or engineer approved equal.
- B. All control panels and associated hardware shall be constructed of 304, 14 gauge stainless-steel unless otherwise noted.
- C. All interior components shall be mounted with stainless steel hardware and shall be clearly identified with plastic identification nametags. The tags shall be white with black lettering.
- D. Door shall be provided with heavy gauge stainless steel hinges.
- E. Control panels shall also include a 10 gauge mild steel sub-panel mounted on collar studs for equipment mounting.
- F. All control panel seams shall be continuously welded and ground smooth.
- G. Data pockets shall be provided on all interior panel doors. The equipment supplier shall provide laminated schematics in each pocket for the associated control panel.
- H. All cabinets shall be sized to accommodate the equipment required plus 25% spare space.

2.3 CONTROL PANEL COOLING REQUIREMENTS

- A. NEMA 4X air conditioners and sun shields shall be supplied as required to keep the equipment mounted inside the control panels operating within the manufacturers operating temperature requirements. The air conditioner unit

CONTROL PANEL CONSTRUCTION

shall not exchange the air inside the control panel with the air outside the control panel. The unit shall be coated to provide environmental protection.

- B. The manufacturer of the control panels and cabinets shall provide all necessary cooling/heating equipment required to maintain temperature and humidity within the operating requirements of all equipment located within panels and cabinets. Coordination for electrical/mechanical connection is the responsibility of the Contractor. At the time of submittals, the Contractor shall submit calculations indicating that such requirements have been met.
- C. All exterior control panels designed for exterior mounting shall be provided with equipment rated for 60° Celsius or provided with air conditioners.

2.4 PLC EQUIPMENT (where required)

- A. Unless otherwise noted, all control panels that perform logic or control functions shall be provided with a Programmable Logic Controller (PLC). For vendor supplied process control panels the PLC shall be an Allen Bradley Micrologix 1400.
- B. All Programmable Logic Controllers shall be provided with removable memory modules or SD cards.
- C. Control panels shall be supplied with all communication equipment to facilitate interconnection and integration into the plant control system network.
- D. The PLC power supply shall be sized to provide 25% spare capacity.
- E. All PLC units shall be provided with battery backup. All exterior control panels shall be provided with a battery back-up system that consists of a power supply, DCUPS, and sealed re-chargeable batteries. The use of an off the shelf UPS shall not be considered acceptable.
- F. Each vendor supplied control panel shall be provided with a Human Machine Interface (HMI) that allows the operator to control and monitor the status of the devices connected/controlled by the associated control panel in the event that pushbutton operators (lights and switches) can't provide the necessary monitoring and control capabilities. The operator interface shall be mounted on the panel exterior and shall be provided with a NEMA 4X window kit to provide protection from the elements when not in use. The Human Machine Interface shall be provided with Touch functions and an Ethernet communication module. The Human Machine Interface shall be Allen-Bradley Panelview Component or Panelview Plus series or engineer approved equal. All HMI devices shall be configured to use screensavers with a 5-minute delay.
- G. Each control panel shall be supplied with a DIN rail mounted industrial Ethernet switch with fiber optic connections (if necessary) to allow connection of the

CONTROL PANEL CONSTRUCTION

control panel to the control system network (the connector styles shall be coordinated by the system integrator). The industrial Ethernet switches shall be manufactured by Allen Bradley, Ntron or engineered approved equal. All switches shall be provided with at least two spare RJ-45 Ethernet ports.

- H. All PLC systems shall be designed to include 25% additional I/O capacity of each type of signal.
- I. All PLC spare I/O shall be fully wired to terminals for future use.

2.5 PLC / HMI PROGRAMMING

- A. All PLC / HMI script/code shall be supplied to the Owner with fully descriptive instruction and comments.
- B. The control panel manufacture shall provide the Owner with a flow chart of all PLC code as well as a written algorithm of the codes functions.
- C. The Engineer will define the graphic standards to be used for all HMI equipment. The control panel manufactures shall assume that all control screens will be custom.
- D. The control panel manufacture shall provide the Owner with all tag addressing and I/O mapping of all process variables in the PLC.
- E. All PLC code shall be the property of the Owner.
- F. The Contractor shall provide three copies of all commented PLC, HMI, and Operator Interface code/script/screen layouts to the Owner in electronic format prior to acceptance by the Owner. Any documentation not containing symbol information or comments will not be considered acceptable.

2.6 CONTROL PANEL WIRING

- A. Wiring, where required, shall be general-purpose open type, neatly bundled and laced or installed in plastic wiring troughs. Wire shall be stranded No. 16 AWG minimum, with thermoplastic insulation rated for 600V and 90 degrees C.
- B. All equipment mounting backboards shall be provided with nonmetallic slotted ducts. All nonmetallic slotted ducts shall have spare space equal to 40% of the depth of the duct.
- C. Wiring colors shall be as follows:
 - 1. All ungrounded AC conductors operating at the supply voltage shall be "Black"

CONTROL PANEL CONSTRUCTION

2. All grounded AC current carrying conductors shall be "White"
 3. All ground conductors shall be "Green"
 4. All ungrounded AC control conductors operating at a voltage less than or equal to the supply shall be "Red"
 5. All 24V DC+ control conductors shall be "Purple"
 6. All 24v DC- control conductors shall be "Orange"
 7. All intrinsically safe circuits shall be "Blue"
 8. Panel foreign voltage shall be "Yellow"
 9. A wiring color code legend shall be mounted inside the control panel door.
- D. All wires entering and leaving all panels shall be terminated at barrier type terminal strips with integral surge protection. All terminals shall be identified and labeled per the Owner's standard naming conventions. It shall be the Supplier's responsibility to coordinate with the Owner for the accepted naming conventions. (All terminal strips shall be designed for #12 AWG, XHHW-2, 90 degree C field wiring for terminations.)
- E. No terminal strip may be located closer than 8" from any side or bottom of the control panel. This is designed to allow for adequate wire bending radius for field terminations.
- F. All wiring shall be clearly marked with an identification number consistent with the wiring schematic.
- G. Devices mounted on the enclosure door or interior dead front panel shall be run in spiral wrap to avoid pinch points when opening and closing the enclosure door(s) or interior panels

2.7 SURGE PROTECTION

- A. All power and digital I/O signals shall be protected from surges at the control panel with suitable surge suppression devices. Panel mounted surge protection shall be Plug in Style & DIN rail mounted to allow for easy replacement. The power and digital I/O signals shall be protected with solid state surge suppression devices manufactured by Phoenix Contact or Engineer approved equal. MOV only type surge suppression is not acceptable.

CONTROL PANEL CONSTRUCTION

- B. All analog I/O signals shall be protected by loop powered isolators manufactured by Phoenix Contact or Engineer approved equal.
- C. All incoming power to the control panel shall be protected by Phoenix Contacts "Trabtech" surge protectors or Engineered approved equal rated for the voltage being supplied. Protection shall be provided for all phase and neutral conductors.

2.8 PANEL MOUNTED DEVICES

- A. Indicating lights to be heavy duty, oil tight, industrial LED type. Lenses shall be colored as noted on drawings or as required by the equipment manufacturers if not specified on the drawings. Legend plates shall be factory engraved as required. Pilot lights shall be Allen-Bradley Bulletin 800T 30.5mm or approved equal.
- B. Momentary pushbuttons to be heavy duty, oil tight, industrial type with full guard and momentary contact rated at 10 Amps continuous at 120 VAC. Legend plates shall be factory engraved as required. Pushbutton shall be Allen-Bradley Bulletin 800T 30.5mm or approved equal.
- C. Selector switches, on/off and H.O.A. to be heavy duty, oil tight, industrial type with contact rated at 120 VAC, 10 amps continuous service. Legend plates shall be factory engraved as required. Switches shall be Allen-Bradley Bulletin 800T 30.5mm or approved equal.
- D. Current to voltage converters, 4-20mAdc to 1-5Vdc shall be as manufactured by Phoenix Contact or Engineer approved equal.
- E. D.C. power supplies shall be as manufactured by PLC Manufacturer, PULS, or approved equal and shall be sized for 1.5 times the application requirements. (No open power supplies will be allowed.)
- F. All relays shall be Potter Brumfield or engineer approved equal based on the application requirements for switching and ampacity. Units shall incorporate a lamp in parallel with relay coil.
- G. All circuit breakers shall be of the same AIC rating as the panel or MCC to which they are connected, and shall be required to selectively coordinate above 0.1 seconds.
- H. All motor starters shall be manufactured by the manufacturer of the MCC equipment. All starters shall be NEMA rated (no IEC devices). All motor speed controllers shall have the following capabilities: remote start/stop, status output, running output, and remote speed.

CONTROL PANEL CONSTRUCTION

- I. H-O-A selector switches are required for each motor starter contained within a control panel. All adjustable speed controllers shall be provided with manual speed adjustment devices (separate from any HMI or Operator Interface Panel), which may be located on the face of the enclosure. H-O-A selector switches and manual speed switches shall allow the operator to control all motors and valves manually in the event of a PLC failure.
- J. Runtimes for each motor starter located in the control panel shall be tracked in the PLC and displayed on the HMI.
- K. Power distribution blocks shall be block style distribution blocks manufactured by Mersen or Engineer approved equal. All distribution blocks shall be provided with polycarbonate safety covers to provide dead front protection. The safety cover shall have a test prod hole for testing purposes.
- L. Fuse blocks/holders shall be UL style fuse blocks manufactured by Mersen or Engineer approved equal.
- M. General purpose fuses shall be Mersen UL Power Fuse style or Engineer approved equal. Unless otherwise noted the fuse rating and type shall be determined based on the equipment (which the fuse is protecting) manufacturer's recommendations for overcurrent protection.
- N. Semiconductor fuses shall be Mersen Amp Trap series fuses or Engineer approved equal. Unless otherwise noted the fuse rating and type shall be determined based on the equipment (which the fuse is protecting) manufacturer's recommendations for overcurrent protection.
- O. All control transformers shall be sized to provide 25% spare capacity. The transformer connections shall be provided with protective covers to guard against accidental contact, and the transformer shall be provided with primary and secondary fusing per the manufacturer's recommendations.
- P. Each control panel shall be provided with a ground fault duplex service receptacle that is accessible from the interior dead-front panel. The service receptacle shall be capable of providing 15A at 125VAC
- Q. Each control panel shall be provided with a series connected suppression filter system to protect the programmable logic controller and instrumentation power from high-frequency noise and electrical transients. The suppression filter shall be a current technology LoadGuard or Engineer approved equal.
- R. All intrinsically safe barrier relays shall be UL listed and shall be manufactured by Phoenix Contact or Engineer approved equal.

CONTROL PANEL CONSTRUCTION

- S. All circuit breakers shall be manufactured by Square D, Allen Bradley, or Engineer approved equal. A main circuit breaker shall be provided for each control panel.
- T. Pilot lights shall be provided for each starter located inside the control panel. The lights shall be as follows: Red (Run), Green (Off), Amber (Fault).
- U. Control power transformers shall be provided in each control panel with a supply voltage other than 120V or 120/208V. Control power transformers shall be manufactured by Allen Bradley and provided with both primary and secondary fuses per the NEC.

2.9 MISCELLANEOUS

- A. Engraved laminated plastic nameplates shall be furnished for each front panel mounted instrument. The Contractor shall coordinate with the Owner for nameplate color and naming conventions. All instruments and components shall be tagged on rear with embossed plastic tape labels.
- B. No pneumatic tubing shall be installed inside the control panels.

PART 3 - EXECUTION

3.1 CONTRACTOR'S RESPONSIBILITY

- A. The Contractor shall coordinate the work of the service personnel during construction, testing, and acceptance of the work.
- B. The Contractor shall receive final approval on all panel, enclosure, and equipment layouts by the Engineer prior to fabrication or installation.

3.2 QUALITY ASSURANCE

- A. All control panels shall be factory tested and certified prior to releasing for shipment. The testing shall consist of but not limited to the following:
 - 1. Point to point testing of all wiring prior to application of power
 - 2. The intended supply voltage shall be applied to the control panel and all components shall be tested for proper operation and calibration.
 - 3. The programmable logic controller and operator interface code shall be loaded, and each shall be tested for functionality.
 - 4. All components shall be checked to confirm that each device has been installed per the plans and specifications as well as the Manufacturer's recommendations.

CONTROL PANEL CONSTRUCTION

5. The enclosure shall be inspected for defects and shall be repaired or replaced if necessary.
 6. All labeling and identification tags shall be verified and be clean and visible.
- B. An Electrical Engineer, registered in the state of South Carolina, shall be required to document the results of the control panel testing. The documentation shall contain the results of the tests listed above as well as any rework items and subsequent repairs that were required prior to shipment. In addition, he/she must certify this document prior to the release for shipment. Prior to shipment all one copy of the applicable documentation shall be placed in the drawing pocket of each enclosure, and three copies shall be sent to the Engineer.

3.3 INSTALLATION

- A. All equipment and devices for the work shall be installed in the locations shown on the drawings, in accordance with the manufacturer's recommendations, and in compliance with the requirements of these specifications.
- B. The Contractor shall be responsible for coordinating the installation of all equipment in the proposed locations with all other trades performing work on the project that may be affected.

3.4 FINAL INSPECTION

- A. Include all changes and/or alterations in the control panels prior to final inspection and acceptance by the owner.
- B. Any changes and/or alterations in the Control Panels shall be reflected/updated in all Control Panel Schematics prior to acceptance by the Owner. This includes all electronic copies delivered to the Owner.

END OF SECTION

