BIDDING, SPECIFICATIONS, AND CONTRACT DOCUMENTS

FOR

FLEMING ISLAND WASTEWATER TREATMENT FACILITY
BTU NO. 3 EXPANSION

CLAY COUNTY UTILITY AUTHORITY
CONSERVATION – COMMITMENT - COMMUNITY
MIDDLEBURG, FLORIDA

CCUA PROJECT NO. 2203-132
CCUA BID NO. 19/20-A9

Prepared For:
Clay County Utility Authority
3176 Old Jennings Road
Middleburg, Florida 32068
(904) 272-5999

Prepared By:
CDM Smith Inc.
4651 Salisbury Road, Suite 420
Jacksonville, FL 32256
License No. EB-0000020

September 2020

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LAY COUNTY UTILITY AUTHORITY

FLEMING ISLAND WASTEWATER TREATMENT FACILITY BTU NO. 3 IMPROVEMENTS

Issued for Bid

September 2020

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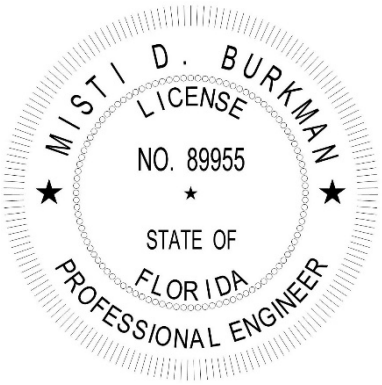
FL COA No. EB-0000020

Project No.: 259364-242828



Misti Don Burkman, P.E. Date
Florida Registered P.E. No. 89955
General, Civil and Process Mechanical
Specification Divisions: 00, 01, 02, 10, 11, 13
Specification Sections: 09901, 09910, 15042, 15062, 15065, 15075, 15108.

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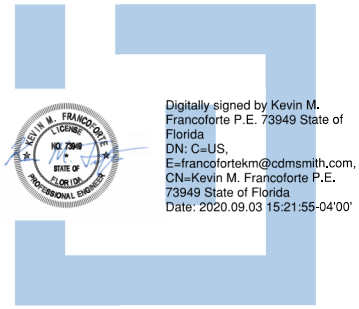

Kevin M. Francoforte, P.E. Date
Florida Registered P.E. No. 73949
Structural
Florida Building Code, 6th Edition - Chapters 16, 18 – 22
Specification Divisions: 03, 05.
Specification Sections: 09972

CLAY COUNTY UTILITY AUTHORITY

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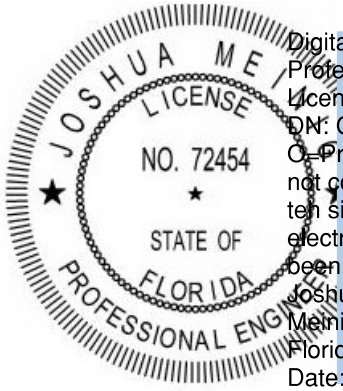

Digitally signed by Joshua Meinig, Professional Engineer, State of Florida, License No. 72454
DN: C=US, E=meinigjh@cdmsmith.com, O=Printed copies of this document are not considered signed and sealed and ten signature must be verified on any electronic copies., OU="This item has been digitally signed and sealed by Joshua Meinig, PE, ", CN="Joshua Meinig, Professional Engineer, State of Florida, License No. 72454"
Date: 2020.09.03 15:27:44-04'00'

Joshua Meinig, P.E. Date
Florida Registered P.E. No. 72454
HVAC and Plumbing
Florida Building Code, 6th Edition - Chapters 13, 28, & 29
Florida Mechanical Code, 6th Edition
Florida Plumbing Code, 6th Edition
Florida Energy Conservation Code, 6th Edition
Specification Sections: 15093, 15254, 15816, 15905.

CLAY COUNTY UTILITY AUTHORITY

FLEMING ISLAND WASTEWATER TREATMENT FACILITY BTU NO. 3 IMPROVEMENTS

Issued for Bid

September 2020

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904.731.7109
FL COA No. EB-0000020

Project No.: 259364-242828

Digitally signed by William David Lassetter
Date: 2020.09.03 '16:25:56 -04'00

William David Lassetter., P.E. Date
Florida Registered P.E. No. 37971
Electrical
Florida Building Code, 6th Edition - Chapters 13 & 27
Florida Energy Conservation Code, 6th Edition
Specification Divisions: 16.

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CLAY COUNTY UTILITY AUTHORITY

Fleming Island Wastewater Treatment Facility – BTU No. 3 Expansion

CCUA Project No. 2203-132 CCUA Bid No. 19/20-A9

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SECTION 00020

REQUEST FOR BIDS

NOTICE IS HEREBY GIVEN that the Clay County Utility Authority (AUTHORITY), Clay County, Florida, will be accepting sealed Bids in triplicate, which will be received until **2:00 p.m., local time, Wednesday, October 14, 2020**, at the Clay County Utility Authority, 3176 Old Jennings Road, Middleburg, Florida 32068-3907 for the following:

Fleming Island Wastewater Treatment Facility
BTU No. 3 Expansion Project
BID NO. 19/20-A9

The Selected Bidder shall furnish, unless otherwise noted, all necessary permits, labor, equipment and materials to complete the following:

- The Contractor is responsible for mobilization and demobilization from the site. Contractor shall be responsible for general conditions, performance and payment bonds, insurance and permits.

- The Contractor shall schedule and conduct his work such that it will not impede any part of the treatment process, create potential hazards to operating equipment and/or personnel, reduce the quality of the plant finished water or cause treatment process upsets.

- The Contractor is responsible for demolition of above and below grade utilities including, but not limited to, above grade concrete walls and foundations, miscellaneous equipment, buried piping, wire, and conduit. Removed items not to be salvaged shall be disposed off-site by the Contractor in accordance with local, state, and federal codes and requirements.

- The Contractor shall be responsible for temporary bypass pumping to complete the modifications to the Influent Structure and installation of the Automatic Transfer Switch. Bypass pumping will be set-up and ready to power the effluent pump station in the event that the standby generator fails during replacement of the electrical service and during modifications to the main breaker, and in the event normal power fails during replacement of the standby generator.

- The Contractor shall be responsible for settlement monitoring of existing structures during construction.

- The Contractor shall be responsible for site clearing and site grading to provide level ground for construction of Biological Treatment Unit (BTU) No. 3. A swale will be added between BTU No. 3 and existing BTU No. 2 to ensure site drainage.

- The Contractor shall be responsible for installing temporary silt fences and/or barriers as required to avoid silt or turbid water transport from the work areas.

- The Contractor shall construct, install and test yard piping improvements, including; influent biological treatment unit (BTU) No. 3 influent piping, BTU No. 3 effluent piping, BTU No. 3 drain piping and non-potable water piping.

- The Contractor shall construct, install and test modifications to the Influent Structure. Within the Influent Structure, the distribution box shall be extended to accommodate splitting flow to the new BTU No. 3 and a future BTU No. 4, including new weir gates. Contractor shall construct, install and submit the proposed system of protection of the Influent Structure and Odor Control Tank signed and sealed by a professional engineer.

- The Contractor shall relocate equipment associated with the odor control system at the Influent Structure and reroute the odor control piping and ductwork.

- The Contractor shall provide, install, test and commission the new BTU No. 3. BTU No. 3 shall be an elliptical carrousel process, 2-stage oxidation ditch with anoxic and aerobic zones, three aerators and two turbine mixers. The BTU tank shall be pre-stressed concrete.

- The Contractor shall construct, install and test the expansion of the existing Motor Control Center (MCC) to accommodate the new equipment associated with BTU No. 3. New variable frequency drives (VFDs) for BTU No. 3 aerators shall be installed and tested. The Contractor shall update the instrumentation and controls to accommodate the modifications to the Influent Structure and the new BTU No. 3 including integration of the upgrades into the plant supervisory control and data acquisition (SCADA) system.

- The Contractor will replace the effluent control gate in the existing BTU No. 1. A structural evaluation will be performed by the Engineer once BTU No. 1 is removed from service. The Contractor shall assist with preparation of BTU No 1 for the evaluation and shall remove and dispose settled grit/debris/solids and sludge from BTU No. 1. Recommendations for repair will be provided by the Engineer after completion of the evaluation. The intent is to incorporate repair recommendations, which will be added to the Scope of Work through a change order.

- The Contractor shall construct, install and test buried conduits from the existing Electrical Building to BTU No. 3. Contractor shall construct, install and test new fiber optic cable from the existing WWTF Office and Lab Building to the WWTF Electrical Building.

- The Contractor shall disconnect, remove and salvage the existing generator set and transport to a location on Site as directed by CCUA. The Contractor shall procure the services of the existing standby generator manufacturer to prepare the equipment for long-term outdoor storage in accordance with the equipment manufacturer's recommendations. The Contractor shall install and test a new standby generator, fuel

piping and extend the existing generator pad.

- The Contractor shall be responsible for putting Project in operational order, adjusting, and balancing equipment, initial operation (startup) of equipment, operating equipment, starting systems, operations of systems, testing of equipment and systems, and demonstration and verification of the completed Work.

- The Contractor shall be responsible for site restoration, final cleaning, and project record drawings.

All materials, methods of construction, and standards must be in accordance with the AUTHORITY's approved material manual, specifications, and details.

The AUTHORITY will evaluate the Bids and the award will be made to the lowest, responsive, and responsible Bidder selected by the AUTHORITY.

Certified minority business enterprises or minority persons are encouraged to timely submit their Bid for this project consistent with the terms of this Notice. Due consideration also will be given to Bidders, other than certified minority business enterprises or minority persons, whose Bid contains a written plan or summary outlining their intended efforts to use certified minority business enterprises or minority persons as subcontractors or material suppliers for this project, should Bidder be awarded a contract.

A pre-Bid meeting will be held on **Thursday, September 24, 2020 at 10:00 a.m., local time**, at Fleming Island Wastewater Treatment Facility, 1770 Radar Road, Fleming Island, Florida 32003. Representative of Owner and Engineer will be present to discuss the Project. Anyone interested in submitting a Bid is strongly encouraged to attend. The pre-bid meeting includes a site visit to allow the Bidders to acquaint and familiarize themselves with site conditions. To limit person-to-person contact, please limit attendance to prime contractors and major trades. All Bidders will be responsible for any information discussed at the pre-Bid meeting and familiarizing themselves with the site.

Questions should be directed in writing by email to Lisa Sterling P.E., CDM Smith Inc. at Sterlinglm@cdmsmith.com no later than ***Friday, October 2, 2020 at 2:00 p.m., local time.***

Bids are due at 2:00 p.m., local time, Wednesday, October 14, 2020, at the Clay County Utility Authority, 3176 Old Jennings Road, Middleburg, Florida 32068-3907, and will be opened as soon thereafter as possible in the presence of the Recording Secretary of the AUTHORITY and all other interested persons. The opened Bids will be read aloud, examined for conformance to the specifications, tabulated, and one copy preserved in the custody of the AUTHORITY'S Recording Secretary.

Bids <u>will not</u> be valid unless received in triplicate by the Bid deadline. Sealed packages should be mailed or delivered in person marked on the outside so that it is distinguishable from regular mail and package deliveries with the notation "BID ENCLOSED – CCUA Bid No. 19/20-A9, Fleming Island Wastewater Treatment Facility, BTU No. 3 Expansion to 00020-3

be opened at 2:00 p.m., local time, Wednesday, October 14, 2020" addressed to the Chief Engineer, Clay County Utility Authority, 3176 Old Jennings Road, Middleburg, Florida 32068-3907, so as to guard against opening prior to the date and time set therefore.

Bidding Documents, drawings and any ADDENDA may be obtained electronically from www.clayutility.org/projects/procurement.aspx. All Bidders shall be responsible for obtaining any information, documents and ADDENDA provided by the Issuing Office prior to the Bid. The AUTHORITY shall not be responsible for full or partial sets of documents including ADDENDA, if any, obtained from sources other than the issuing office.

Bids require a five percent (5%) Bid Security in the form of a certified check or bank money order or a Bid Bond and may not be withdrawn after the scheduled opening time for a period of sixty (60) days.

The AUTHORITY reserves the right to change the time and date of the pre-Bid meeting, to change the Bid due date and time, to waive formalities in any Bid, to reject any or all Bids with or without cause, and/or to accept the Bid or any portion thereof that, in the AUTHORITY'S sole and absolute judgment, will be in the best interest of the AUTHORITY.

END OF SECTION

INSTRUCTIONS TO BIDDERS FOR CONSTRUCTION CONTRACTS

Prepared by

ENGINEERS JOINT CONTRACT DOCUMENTS COMMITTEE

and

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ASCE American Society of Civil Engineers

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INSTRUCTIONS TO BIDDERS

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ARTICLE 1 – DEFINED TERMS

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

A. *Issuing Office* – The office from which the Bidding Documents and any addenda, if any, are to be issued and where the bidding procedures are to be administered.

ARTICLE 2 – COPIES OF BIDDING DOCUMENTS

2.01 Complete sets of the Bidding Documents in the number and for the deposit sum, if any, stated in the advertisement or invitation to bid may be obtained from the Issuing Office. The deposit will be refunded to each document holder of record who returns a complete set of Bidding Documents in good condition within 60 days after opening of Bids.

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 *Within ten (10) calendar days (240 hours) of bid opening date and time, the three (3) apparent lowest bidders shall provide the following minimum information to Owner to demonstrate Bidders' qualifications, responsibility, responsiveness, and resources to successfully perform and complete the work. If Bidder subsequently does not provide complete information as outlined in this section to the Owner within 10 days of the Bid Opening, the Owner may consider Bidder to be in default or non-responsive and reject the Bid, and the Owner may then award the Bid to the next lowest conforming, responsive Bidder.*

A. Bidder's License Information: *Include a Copy of Bidder's license(s).*

B. Bidder's Federal Employer Identification Number (FEIN).

C. Bidder's SunBiz Document Number.

D. Minimum Experience Requirements:

1. Proof that the Bidder has been in business, under the same name, for a minimum of five (5) years.

2. Proof that the Bidder is a licensed Florida General Contractor and has performed satisfactory work for a government entity in Florida within the last three (3) years. If the

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General Contractor wishes to sub-contract out the underground utility work, submit the name and the experience of the subcontractor performing the work as specified on the contract. The underground utility sub-contractor must have also performed satisfactory work for a government entity in Florida in the last three (3) years.

3. Proof of satisfactory completion on a minimum of three (3) reference projects of similar scope, size, and cost to this project, including performing satisfactory work for at least one project for a government entity in Florida for the General Contractor and any Utility Subcontractors. Each of these three (3) reference projects must be verifiable by reference and include the following minimum information:

   a. Project Name

   b. Project Location (city, state)

   c. Brief Description of Project Substantiating Similarity to this Project

   d. Date of Completion of Project

   e. Owner's Name

   f. Owner's Project Manager's Name, Phone Number, and Email Address: Contact

E. Provide the resumes of the Bidder's proposed project manager and project superintendent with verification that they have a minimum of five (5) years of verifiable experience matching the scope, type and complexity of the construction services performed on this project, that are currently employed with Bidder's company, and the verifiable projects that include contacts, dates, and project descriptive information to the Owners complete satisfaction.

F. Provide a list of all subcontractors proposed for the project who will perform work in the amount equal to, or greater than, $10,000. Include the following information for each proposed subcontractor:

   1. Name of Subcontractor

   2. Type of Work Subcontractor will Perform

   3. Subcontractor's License Number (if applicable)

   4. MBE/WBE Status

G. Provide the Bidder's documentation of good faith efforts to utilize MBE/WBEs on this project. In the event of a tie bid, the low bidder who proposes to utilize a higher percentage of MBE/WBEs on the project will receive preference for award.

H. Current workload (project) commitments: Provide the Bidder's project commitments that includes project start date or projected start date, current project stage, anticipated

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completion date, contract value, location, brief project description, contact name, current contact phone number, current contact email, project name, Bidder's project manager, and Bidder's superintendent.

I. Bidder's Bonding capacity verification: Provide the Bidder's bonding capacity verification using the form provided in Section 00440 "Bonding Capacity Certification" completed by the Bidder's bonding company stating that the Bidder has sufficient available bonding capacity for the project for the bonds required in the contract documents or a letter from the Bidder's bonding company with the equivalent information as the provided Bonding Capacity Certification form in Section 00440 "Bonding Capacity Certification". The Contractor shall acquire and execute any Bonds as required in the contract documents prior to award of any contract.

J. Bidder's Dun & Bradstreet (DUNS) number: Bidder to provide their Dun & Bradsteet (www.dnb.com) DUNS number. Owner may request most recent financial statements and verifications to demonstrate the bidder has the financial resources to perform this project. Financial statements, when requested, MUST BE SUBMITTED IN A SEPARATE ENVELOPE WITH "FINANCIAL INFORMATION WRITTEN ON THE OUTSIDE. Per Florida Statues, this information is exempt from public information requests."

K. Bidder's Insurability: The Bidder shall provide Certificates of Insurance (COI) for all coverages and amounts specified in the Contract Documents within 15 days of Notice of Intent to Award. If Bidder fails to furnish all required insurance verification(s) within 15 days after the Notice of Award, Owner may consider Bidder to be in default and annul the Notice of Award in accordance with Article 8.

L. Public Entity Crimes Statement (Section 00420,) completely filled out and executed.

M. W-9 Federal ID Number Form (Section 00425) completely filled out.

N. Bidder's Proposed Schedule in days from Notice to Proceed to Final Completion.

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

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

4.01 Subsurface and Physical Conditions

A. The Supplementary Conditions identify:

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

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

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B. Copies of reports and drawings referenced in Appendix A. Those reports and drawings are not part of the Contract Documents, but the "technical data" contained therein upon which Bidder is entitled to rely as provided in Paragraph 4.02 of the General Conditions has been identified and established in Paragraph 4.02 of the Supplementary Conditions. Bidder is responsible for any interpretation or conclusion Bidder draws from any "technical data" or any other data, interpretations, opinions, or information contained in such reports or shown or indicated in such drawings.

4.02 Underground Facilities

A. Information and data shown or indicated in the Bidding Documents with respect to existing Underground Facilities at or contiguous to the Site(s) is based upon information and data furnished to Owner and Engineer by owners of such Underground Facilities, including Owner, or others.

4.03 Hazardous Environmental Condition

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

B. Copies of reports and drawings referenced in Paragraph 4.03.A will be made available by Owner to any Bidder on request. Those reports and drawings are not part of the Contract Documents, but the "technical data" contained therein upon which Bidder is entitled to rely as provided in Paragraph 4.06 of the General Conditions has been identified and established in Paragraph 4.06 of the Supplementary Conditions. Bidder is responsible for any interpretation or conclusion Bidder draws from any "technical data" or any other data, interpretations, opinions, or information contained in such reports or shown or indicated in such drawings.

4.04 Provisions concerning responsibilities for the adequacy of data furnished to prospective Bidders with respect to subsurface conditions, other physical conditions, and Underground Facilities, and possible changes in the Bidding Documents due to differing or unanticipated subsurface or physical conditions appear in Paragraphs 4.02, 4.03, and 4.04 of the General Conditions. Provisions concerning responsibilities for the adequacy of data furnished to prospective Bidders with respect to a Hazardous Environmental Condition at the Site(s), if any, and possible changes in the Contract Documents due to any Hazardous Environmental Condition uncovered or revealed at the Site(s) which was not shown or indicated in the Drawings or Specifications or identified in the Contract Documents to be within the scope of the Work, appear in Paragraph 4.06 of the General Conditions.

4.05 On request, Owner will provide Bidder access to the Site(s) to conduct such examinations, investigations, explorations, tests, and studies as Bidder deems necessary for submission of a Bid. Bidder shall fill all holes and clean up and restore the Site(s) to its former condition upon completion of such explorations, investigations, tests, and studies. Bidder shall comply with all applicable Laws and Regulations relative to excavation and utility locates.

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4.06 A. Reference is made to Article 7 of the Supplementary Conditions for the identification of the general nature of other work that is to be performed at the Site(s) by Owner or others (such as utilities and other prime contractors) that relates to the Work contemplated by these Bidding Documents. On request, Owner will provide to each Bidder for examination access to or copies of contract documents (other than portions thereof related to price) for such other work.

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

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

A. examine and carefully study the Bidding Documents, and the other related data identified in the Bidding Documents;

B. visit the Site(s) and become familiar with and satisfy Bidder as to the general, local, and Site(s) conditions that may affect cost, progress, and performance of the Work;

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

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

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

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

G. become aware of the general nature of the work to be performed by Owner and others at the Site(s) that relates to the Work as indicated in the Bidding Documents;

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H. promptly give Engineer written notice of all conflicts, errors, ambiguities, or discrepancies that Bidder discovers in the Bidding Documents and confirm that the written resolution thereof by Engineer is acceptable to Bidder; and

I. determine that the Bidding Documents are generally sufficient to indicate and convey understanding of all terms and conditions for the performance of the Work.

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

ARTICLE 5 – PRE-BID CONFERENCE

5.01 A pre-bid meeting will be held on **Thursday, September 24, 2020 at 10:00 a.m., local time** at Clay County Utility Authority, Fleming Island Wastewater Treatment Facility, 1770 Radar Road, Fleming Island, Florida 32003. Anyone interested in submitting a bid is strongly encouraged to attend. The pre-bid meeting includes a site visit to allow the bidders to acquaint and familiarize themselves with site conditions. To limit person-to-person contact please limit attendance to prime and major trades. All bidders will be responsible for any information discussed at the pre-bid meeting and familiarizing themselves with the site.

ARTICLE 6 – SITE AND OTHER AREAS

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

ARTICLE 7 – INTERPRETATIONS AND ADDENDA

7.01 All questions about the meaning or intent of the Bidding Documents are to be submitted to Engineer in writing. Interpretations or clarifications considered necessary by Engineer in response to such questions will be issued by Addenda and will be made available on CCUA's website to review; www.clayutility.org/projects/procurement.aspx. Questions received after **Friday, October 2, 2020 at 2:00 p.m.** may not be answered. Only questions answered by Addenda will be binding. Oral and other interpretations or clarifications will be

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without legal effect. Respondents shall be responsible for checking CCUA's website for any Addenda prior to bid submittal.

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

7.03 Bidders shall have no contact related to this solicitation with CCUA's employees during this solicitation process outside of the pre-Bid meeting. This shall include from the time the solicitation is advertised until after the Bids are submitted. Unauthorized contact with CCUA's employees may result in rejection of the bid. All communications with CCUA shall be in writing to the office indicated in Section 00020 "Requests for Bids".

ARTICLE 8 – BID SECURITY

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

8.02 The Bid security of the Successful Bidder will be retained until such Bidder has executed the Contract Documents, furnished all required insurance verification, furnish an executed current version of IRS form W-9, furnished the required contract security and met the other conditions of the Notice of Award, whereupon the Bid security will be returned. If the Successful Bidder fails to execute and deliver the Contract Documents, furnish all required insurance verification(s), executed current version of IRS form W-9, 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. The Bid security of other Bidders whom Owner believes to have a reasonable chance of receiving the award may be retained by Owner until the earlier of seven days after the Effective Date of the Agreement or 61 days after the Bid opening, whereupon Bid security furnished by such Bidders will be returned.

8.03 Bid security of other Bidders whom Owner believes do not have a reasonable chance of receiving the award will be returned within seven 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 ready for final payment are set forth in the Standard Form of Agreement (Section 00500 – Article 4).*

ARTICLE 10 – LIQUIDATED DAMAGES

10.01 *Provisions for liquidated damages, if any, are set forth in the Standard Form of Agreement (Section 00500 – Article 4).*

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ARTICLE 11 – SUBSTITUTE AND "OR-EQUAL" ITEMS

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

ARTICLE 12 – SUBCONTRACTORS, SUPPLIERS AND OTHERS

12.01 If the Supplementary Conditions require the identity of certain Subcontractors, Suppliers, individuals, or entities to be submitted to Owner in advance of a specified date prior to the Effective Date of the Agreement, the apparent Successful Bidder, and any other Bidder so requested, shall within five days after Bid opening, submit to Owner a list of all such Subcontractors, Suppliers, individuals, or entities proposed for those portions of the Work for which such identification is required. Such list shall be accompanied by an experience statement with pertinent information regarding similar projects and other evidence of qualification for each such Subcontractor, Supplier, individual, or entity if requested by Owner. If Owner or Engineer, after due investigation, has reasonable objection to any proposed Subcontractor, Supplier, individual, or entity, Owner may, before the Notice of Award is given, request apparent Successful Bidder to submit a substitute, without an increase in the Bid.

12.02 If apparent Successful Bidder declines to make any such substitution, Owner may award the Contract to the next lowest Bidder that proposes to use acceptable Subcontractors, Suppliers, individuals, or entities. Declining to make requested substitutions will not constitute grounds for forfeiture of the Bid security of any Bidder. Any Subcontractor, Supplier, individual, or entity so listed and against which Owner or Engineer makes no written objection prior to the giving of the Notice of Award will be deemed acceptable to Owner and Engineer subject to revocation of such acceptance after the Effective Date of the Agreement as provided in Paragraph 6.06 of the General Conditions.

12.03 Contractor shall not be required to employ any Subcontractor, Supplier, individual, or entity against whom Contractor has reasonable objection.

ARTICLE 13 – PREPARATION OF BID

13.01 *The Bid Form is included with the Bidding Documents. Bidding Documents are available on CCUA's website;* www.clayutility.org/projects/procurement.aspx. The authority shall not be responsible for full or partial sets of documents including Addenda, if any, obtained from sources other than the issuing office.

13.02 *All blanks on the Bid Form shall be completed in ink and the Bid Form signed in ink. Erasures or alterations shall be initialed in ink by the person signing the Bid Form. A Bid price shall be indicated for each Bid item, alternate, and unit cost listed therein*. In the case

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of optional alternatives, the words "No Bid," "No Change," or "Not Applicable" may be entered.

13.03 A Bid by a corporation shall be executed in the corporate name by the president or a vice-president or other corporate officer accompanied by evidence of authority to sign. The corporate seal shall be affixed and attested by the secretary or an assistant secretary. The corporate address and state of incorporation shall be shown.

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

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

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

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

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

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

13.10 Postal and e-mail addresses and telephone number for communications regarding the Bid shall be shown.

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

ARTICLE 14 – BASIS OF BID; COMPARISON OF BIDS

14.01 Lump Sum

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

ARTICLE 15 – SUBMITTAL OF BID

15.01 *BID Documents, drawings, and ADDENA, if any, may be obtained electronically from;* www.clayutility.org/projects/procurement.aspx. *All Bidders shall be responsible for*

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obtaining Addenda, if any, issued prior to the bid. The authority shall not be responsible for full or partial sets of documents including Addenda, if any, obtained from sources other than the issuing office. The Bid Form is to be completed and submitted with the Bid Security and completed Public Entities Crimes Sworn Statement.

15.02 A Bid shall be submitted in triplicate 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" along with the bid number, project name, date and time of the bid opening so as to guard against opening prior to the date and time set therefore and identifiable from normal mail and deliveries. A mailed Bid shall be addressed to Chief Engineer, Clay County Utility Authority, 3176 Old Jennings Road, Middleburg, Florida 32068.

15.03 AUTHORITY's sole and absolute judgement will be in the best interest of the AUTHORITY.

15.04 All Bidders will be responsible for any information provided by the Issuing Office.

ARTICLE 16 – MODIFICATION AND WITHDRAWAL OF BID

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

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

ARTICLE 17 – OPENING OF BIDS

17.01 Bids will be opened at the time and place indicated in the Request for 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.

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ARTICLE 19 – EVALUATION OF BIDS AND AWARD OF CONTRACT

19.01 Owner reserves the right to reject any or all Bids, including without limitation, incomplete, irregular, not in conformance with the specifications, invitation or Instructions to Bidders, nonconforming, nonresponsive, unbalanced, or conditional Bids. Owner further reserves the right to reject the Bid of any Bidder whom it finds, after reasonable inquiry and evaluation, to not be responsible or the Bidder is behind by 10 percent or more on completing an approved progress schedule for the Owner at the time of advertising the work. A Bid may be found to be irregular or non-responsive by reasons that include, but are not limited to, failure to utilize or complete the prescribed forms, modifying the Bid specifications, submitting conditional Bids, incomplete Bids, submitting indefinite or ambiguous Bids, executing forms or the Bid sheet with improper and/or undated signatures, failure to provide all required information Bids containing any conditions, omissions, unexplained erasures, alterations of the provided bid documents or forms, or items not called for in the bid documents. Other conditions which may cause rejection of the Bids include, evidence of collusion among Bidders, obvious lack of experience or expertise, and failure to perform or meet financial obligations on previous agreements. Owner may also reject the Bid of any Bidder if Owner believes that it would not be in the best interest of the Project to make an award to that Bidder. Owner also reserves the right to waive all informalities not involving price, time, or changes in the Work and to negotiate contract terms with the Successful Bidder.

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

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

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

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

19.06 If the Contract is to be awarded, Owner will award the Contract to the Bidder whose Bid is in the best interests of the Project.

19.07 The Owner will evaluate the bids and the award will be made to the lowest responsive,

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responsible bidder. Certified minority business enterprises or minority persons as defined in F.S.s. 288.703 are encouraged to timely submit their bid for this project consistent with the terms of this Notice. Due consideration also will be given to bidders, other than certified minority business enterprises or minority persons, who agree to use certified minority business enterprises or minority persons as subcontractors or material suppliers for this project, should they be awarded this bid.

19.08 The lowest, responsive, responsible bidder may voluntary reduce its bid price or prices provided such reduction is not conditioned on, or does not result in, the modification or deletion of any specifications or conditions contained in the Bidding Documents that would alter the determination of which the bidder would be awarded or portion thereof when in the best interest of the Authority.

ARTICLE 20 – CONTRACT SECURITY AND INSURANCE

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

ARTICLE 21 – SIGNING OF AGREEMENT

21.01 When Owner issues a Notice of Award to the Successful Bidder, it shall be accompanied by the required number of unsigned counterparts of the Agreement along with the other Contract Documents which are identified in the Agreement as attached thereto. Within 15 days thereafter, Successful Bidder shall sign and deliver the required number of counterparts of the Agreement and furnish all required insurance verifications, furnish an executed current version of IRS form W-9, furnish the required contract security and met the other conditions of the Contract Documents to the Owner. The Owner shall deliver one fully signed counterpart to Successful Bidder with a complete set of the Drawings with appropriate identification.

ARTICLE 22 – SALES AND USE TAXES

22.01 State sales and use taxes on materials and equipment to be incorporated in the Work shall be included in the Bid. However, the Owner is exempt from sales and use taxes on materials and equipment and therefore, at the Owners option, the Contractor shall be required to provide the Owner with the details of his Purchase Order(s), including quote(s), vendor name, address, and quantity and type of materials and/or equipment being ordered. The Owner may choose to order the major materials and/or equipment direct. Should the Owner choose to do this, any payment that is made direct by the Owner (plus an amount equal to the sales tax that would have been paid by the Contractor) for the materials shall be a direct deduct from the Contractors contract as if the payment were made direct to the Contractor. The whole purpose of this provision is to save the amount of sales taxes that would be otherwise assessed to the Contractor for the major material purchases.

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ARTICLE 23 – RETAINAGE

23.01 Provisions concerning Contractor's rights to deposit securities in lieu of retainage are set forth in the Agreement.

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SECTION 00300

BID FORM

PROJECT NO. 2203-132 **BID NO.** 19/20-A9
Fleming Island Wastewater Treatment Facility
BTU No. 3 Expansion
CLAY COUNTY UTILITY AUTHORITY

SUBMITTED BY: _____ DATE:_____

Company: _____

Email: _____

City/State/Zip: _____

Telephone No.: _____

Email: _____

The undersigned, as Bidder, hereby declares that the only person or persons interested in the proposal as Principal(s) is (or are) named herein and that no other person who is herein mentioned has any interest in this proposal or in the contract to be entered into; that this proposal is made without connection with any other person, company, or parties making a bid or proposal; and that it is in all respects fair and in good faith, without collusion or fraud.

The Bidder further declares that the Bidder has examined the site of the work and is fully informed in regard to all conditions pertaining to the places where the work is to be performed; that the Bidder has examined the plans and specifications for the work and contract documents relative thereto, that the Bidder has read all special provisions furnished prior to the opening of bids, and that the Bidder is satisfied as to the work to be performed.

The Bidder further understands that the AUTHORITY reserves the right to waive formalities in any Bid, to reject any or all bids with or without cause, and/or to accept the Bid or any portion thereof that, in the AUTHORITY'S sole and absolute judgment, will be in the best interest of the AUTHORITY.

The Bidder proposes and agrees, if this proposal is accepted, to contract with the AUTHORITY in the form of contract specified, to furnish all necessary materials, equipment, machinery, tools, apparatus, means of transportation and labor necessary to complete the contract in full and complete it in accordance with the shown, noted, described and reasonable intended requirements of the plans and specifications and contract documents to the full satisfaction of the contract with the AUTHORITY with a definite understanding that no money will be allowed for extra work except as set forth in the attached General Conditions and contract documents, as follows:

BID SCHEDULE:

Total Lump Sum Bid Price is the sum of the amounts shown for all items listed below and includes all labor, materials, equipment, permits, and incidentals necessary to perform the work as indicated in the Contract Documents based upon the Bidder's own estimate of the quantities and costs for a functional and complete system. Work includes, but is not necessarily limited to, all the items described in the Contract Documents, and generally described as follows:

- The Contractor is responsible for mobilization and demobilization from the site. Contractor shall be responsible for general conditions, performance and payment bonds, insurance and permits.

- The Contractor shall schedule and conduct his work such that it will not impede any part of the treatment process, create potential hazards to operating equipment and/or personnel, reduce the quality of the plant finished water or cause treatment process upsets.

- The Contractor is responsible for demolition of above and below grade utilities including, but not limited to, above grade concrete walls and foundations, miscellaneous equipment, buried piping, wire, and conduit. Removed items not to be salvaged shall be disposed off-site by the Contractor in accordance with local, state, and federal codes and requirements.

- The Contractor shall be responsible for temporary bypass pumping to complete the modifications to the Influent Structure and installation of the Automatic Transfer Switch. Bypass pumping will be set-up and ready to power the effluent pump station in the event that the standby generator fails during replacement of the electrical service and during modifications to the main breaker, and in the event normal power fails during replacement of the standby generator.

- The Contractor shall be responsible for settlement monitoring of existing structures during construction.

- The Contractor shall be responsible for site clearing and site grading to provide level ground for construction of Biological Treatment Unit (BTU) No. 3. A swale will be added between BTU No. 3 and existing BTU No. 2 to ensure site drainage.

- The Contractor shall be responsible for installing temporary silt fences and/or barriers as required to avoid silt or turbid water transport from the work areas.

- The Contractor shall construct, install and test yard piping improvements, including; influent biological treatment unit (BTU) No. 3 influent piping, BTU No. 3 effluent piping, BTU No. 3 drain piping and non-potable water piping.

- The Contractor shall construct, install and test modifications to the Influent Structure. Within the Influent Structure, the distribution box shall be extended to accommodate splitting flow to the new BTU No. 3 and a future BTU No. 4, including new weir gates. Contractor shall construct, install and submit the proposed system of protection of the

Influent Structure and Odor Control Tank signed and sealed by a professional engineer.

- The Contractor shall relocate equipment associated with the odor control system at the Influent Structure and reroute the odor control piping and ductwork.

- The Contractor shall provide, install, test and commission the new BTU No. 3. BTU No. 3 shall be an elliptical carrousel process, 2-stage oxidation ditch with anoxic and aerobic zones, three aerators and two turbine mixers. The BTU tank shall be pre-stressed concrete.

- The Contractor shall construct, install and test the expansion of the existing Motor Control Center (MCC) to accommodate the new equipment associated with BTU No. 3. New variable frequency drives (VFDs) for BTU No. 3 aerators shall be installed and tested. The Contractor shall update the instrumentation and controls to accommodate the modifications to the Influent Structure and the new BTU No. 3 including integration of the upgrades into the plant supervisory control and data acquisition (SCADA) system.

- The Contractor will replace the effluent control gate in the existing BTU No. 1. A structural evaluation will be performed by the Engineer once BTU No. 1 is removed from service. The Contractor shall assist with preparation of BTU No 1 for the evaluation and shall remove and dispose settled grit/debris/solids and sludge from BTU No. 1. Recommendations for repair will be provided by the Engineer after completion of the evaluation. The intent is to incorporated repair recommendations will be added to the Scope of Work through a change order.

- The Contractor shall construct, install and test buried conduits from the existing Electrical Building to BTU No. 3. Contractor shall construct, install and test new fiber optic cable from the existing WWTF Office and Lab Building to the WWTF Electrical Building.

- The Contractor shall disconnect, remove and salvage the existing generator set and transport to a location on Site as directed by CCUA. The Contractor shall procure the services of the existing standby generator manufacturer to prepare the equipment for long-term outdoor storage in accordance with the equipment manufacturer's recommendations. The Contractor shall install and test a new standby generator, fuel piping and extend the existing generator pad.

- The Contractor shall be responsible for putting Project in operational order, adjusting, and balancing equipment, initial operation (startup) of equipment, operating equipment, starting systems, operations of systems, testing of equipment and systems, and demonstration and verification of the completed Work.

- The Contractor shall be responsible for site restoration, final cleaning, and project record drawings.

Total Lump Sum Bid: $_____
(Numerals)

Additive Alternate Unit Price Work

1. Overexcavation and fill with common fill for structures or utilities, includes excavation, backfill, installation and compaction

   1,500 cubic yards at $_____/cubic yard = $ _____

   Provide the total price for all Unit Price Work, an amount equal to the sum of the established unit price for each separately identified item in the Additive Alternate Unit Price Work times the estimated quantity of that item as indicated. Estimated quantities are not guaranteed, and determinations of actual quantities and classifications are to be made by Engineer as provided in the General Conditions.

Total Additive Alternate Unit Price Work $ _____
(Numerals)

ADDENDUM RECEIPT:
Bidders shall acknowledge below the receipt of all addenda, if any, to plans and specifications.

ADDENDUM NO. _____ DATED _____

ADDENDUM NO. _____ DATED _____

ADDENDUM NO. _____ DATED _____

BIDDER'S LICENSE INFORMATION:

Bidder's License Type: _____

Bidder's License Category (if any): _____

Bidder's License Special Qualification (if any): _____

Bidder's License No: _____

Bidder's License State: _____

License Name/Organization: _____

At the AUTHORITY's option, the Contractor shall be required to provide the AUTHORITY with the details of Contractor's Purchase Order, including vendor quote(s), vendor name, address, and quantity and type of materials being ordered. The AUTHORITY may choose to order the major materials and/or equipment direct. Should the AUTHORITY choose to do this, any payment that is made direct by the AUTHORITY (plus an amount equal to the sales tax that would have been paid by the Contractor) for the materials shall be a direct deduct from the Contractor's contract as if the payment were made direct to the Contractor. The whole purpose of this provision is to save the amount of sales taxes that would be otherwise assessed to the Contractor for the major material purchases.

It shall be the Contractor's responsibility to ensure conformance with contract requirements, coordinate ordering, deliveries, submit Shop Drawings, receive and verify accuracy of such shipments and, unload such shipments as if Contractor had purchased the materials direct. Any Shop Drawings received directly by the AUTHORITY from the suppliers will be forwarded by the AUTHORITY to the Contractor for the Contractor's review of accuracy and correctness of the Shop Drawings, and the Contractor shall provide an approval action on each product. Contractor then shall submit Shop Drawings to the Design Engineer for review and approval action. After the Contractor and Engineer have reviewed and approved the Shop Drawings, they then shall be submitted to the Clay County Utility Authority for review.

The Contractor shall include all risk of loss and bear the cost of insurance on all materials purchased tax exempt. Once the AUTHORITY's Purchase Order is prepared, then it will be returned to the Contractor for proofing and mailing to the vendor.

The Bidder further proposes and agrees to commence work under the Bidder's contract on a date to be specified in the Notice-to-Proceed and shall complete all work there under within the time schedule in the Agreement.

The Bidder has fully reviewed and informed themselves regarding the Bidding Documents. The Bidder, by submitting a Bid to the Authority, warrants that the Bidder conforms with all specified requirements including experience, present commitments, schedule, necessary facilities, MBE/WBE utilization, insurance verification, bonding capacity, local license(s), required Form(s), ability, and financial resources contained in the Bidding Documents. The Bidder shall provide any required proof of experience, license(s), form(s), coverages, requirements, and limits specified in the Bidding Documents within 10 days of the Bid Opening or the Owner may consider Bidder to be in default or non-responsive and reject the Bid and the Owner may then award the Bid to the next lowest conforming, responsive Bidder.

AN INDIVIDUAL:

By _____ (Seal)

(Signature)

_____

(Print Name)

Doing business as

Business Address: _____

Phone No: _____ Fax No: _____

A PARTNERSHIP:

_____ (Seal)

(Firm Name)

_____

(General Partner/Signature)

_____

(Print Name)

Business Address: _____

Phone No: _____ Fax No: _____

A CORPORATION:

_____(Seal)
(Corporation Name)

_____
(State of Incorporation)

By _____
(Signature of Person Authorized to Sign)

_____
(Print Name)

_____
(Title) (Corporate Seal)

Attest _____
(Secretary)

Business Address: _____
Phone No: _____ Fax No: _____

A JOINT VENTURE:

_____
(Business Name)

By: _____
(Signature)

_____
(Print Name)

_____
(Address)

By: _____
(Signature)

_____
(Print Name)

_____
(Address)

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

The full names; business addresses; business and emergency telephone numbers of persons and firms interested in the foregoing bid, as principals, are as follows:

(If Corporation, President, Secretary, and Treasurer Identification)

ITEMS REQUIRED TO BE SUBMITTED WITH BID:

1. Fully completed and executed Bid Form
2. Required Bid Security
3. Public Entities Crimes Sworn Statement

ITEMS REQUIRED TO BE SUBMITTED POST-BID:

Refer to Section 00200, Instructions to Bidders, for items required to be submitted post-Bid by the three apparent lowest bidders.

SECTION 00400

BID BOND

KNOW ALL MEN BY THESE PRESENTS: That we, the undersigned,_____ _____as Principal, and _____ _____as Surety, are hereby held and firmly bound unto Clay County Utility Authority as OWNER in the penal sum of _____ _____for payment of which, well and truly to be made, we hereby jointly and severally bind ourselves, successors and assigns.

Signed, this _____ day of _____,20__

The Condition of the above obligation is such that whereas the Principal has submitted to Clay County Utility Authority a certain BID, attached hereto and hereby made a part hereof to enter into a contract in writing for the Fleming Island Wastewater Treatment Facility, BTU No. 3 Expansion, Clay County Utility Authority Bid No. 19/20-A9.

NOW, THEREFORE,

(a) If said BID shall be rejected, or

(b) If said BID shall be accepted and the Principal shall execute and deliver a contract in the Form of Contract attached hereto (properly completed in accordance with said BID) and shall furnish a BOND for his faithful performance of said contract, and for the payment of all persons performing labor or furnishing materials in connection therewith, and shall in all other respects perform the agreement created by the acceptance of said BID, then this obligation shall be void, otherwise the same shall remain in force and effect; it being expressly understood and agreed that the liability of the Surety of all and all claims hereunder shall, in no event, exceed the penal amount of this obligation as herein stated.

The Surety, for value received, hereby stipulates and agrees that the obligations of said Surety and its BOND shall be in no way impaired or affected by any extension of time within which the OWNER may accept such BID; and said Surety does hereby waive notice of any such extension.

IN WITNESS WHEREOF, the Principal and the Surety have hereunto set their hands and seals, and such of them as are corporations have caused their corporate seals to be hereto affixed and these presents to be signed by their proper officers, the day and year first set forth above.

BY: _____
Principal

_____
Surety

_____
Attorney-in-Fact

END OF SECTION

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SWORN STATEMENT PURSUANT TO SECTION 287.133 (3) (A), FLORIDA STATUTES, ON PUBLIC ENTITY CRIMES

THIS FORM MUST BE SIGNED AND SWORN TO IN THE PRESENCE OF A NOTARY PUBLIC OR OTHER OFFICIAL, AUTHORIZED TO ADMINISTER OATHS.

1. This sworn statement is submitted to Clay County Utility Authority
(print name of public entity)

by _____
(print individual's name and title)

whose business address is _____
and (if applicable) its Federal Employer Identification Number (FEIN) is _____
(If the entity has no FEIN, include Social Security Number of the individual signing this sworn statement: _____

2. I understand that a "public entity crime" as defined in Paragraph 287.133 (1) (G), Florida Statutes means a violation of any state or federal law by a person with respect to and directly related to the transaction of business with any public entity or with an agency or political subdivision of any other state or of the United States, including, but not limited to, any bid or contract for goods or services to be provided to any public entity or an agency or political subdivision of any other state or of the United States and involving antitrust, fraud, theft, bribery, collusion, racketeering, conspiracy, or material misrepresentation.

3. I understand that "convicted" or "conviction" as defined in Section 287.133 (1) (b), Florida Statutes, means a finding of guilt or a conviction of a public entity crime, with or without adjudication of guilt, in any federal or state trial court of record, relating to charges brought by indictment or information after July 1, 1989, as a result of a jury verdict, non-jury trial, or entry of a plea of guilty or nolo contendere.

4. I understand that an "affiliate" as defined in Paragraph 287.133 (1) (A), Florida Statutes, means:

a. A predecessor or successor of a person convicted of a public entity crime; or
b. An entity under the control of any natural person who is active in the management of the entity and who has been convicted of a public entity crime. The term "affiliate" includes those officers, directors, executives, partners, shareholders, employees, members, and agents who are active in the management of an affiliate. The ownership by one person of shares constituting a controlling interest in another person, or a pooling of equipment or income among persons when not for fair market value under an arm's length agreement, shall be prima facie case that one person controls another person. A person who knowingly enters into a joint venture with a person who has been convicted of a public entity crime in Florida during the preceding 36 months shall be considered an affiliate.

5. I understand that a "person" as defined in Paragraph 287.133 (1) (E), Florida Statutes, means any natural person or entity organized under the laws of any state or of the United States with the legal power to enter into a binding contract and which aids or applies to bid on contracts for the provision of goods or services led by a public entity, or which otherwise transacts or applies to transact

business with a public entity. The term "person" includes those officers, directors, executives, partners, shareholders, employees, members, and agents who are active in management of an entity.

6. Based on information and belief, the statement which I have marked below is true in relation to the entity submitting this sworn statement. [Indicate which statement applies.]

☐ Neither the entity submitting this sworn statement nor any of its officers, directors, executives, partners, shareholders, employees, members, or agents who are active in the management of the entity, nor any affiliate of the entity has been charged with and convicted of a public entity crime subsequent to July 1, 1989.

☐ The entity submitting this sworn statement, or one or more of its officers, directors, executives, partners, shareholders, employees, members or agents who are active in the management of the entity, or an affiliate of the entity has been charged with and convicted of a public entity crime subsequent to July 1, 1989.

☐ The entity submitting this sworn statement, or one or more of its officers, directors, executives, partners, shareholders, employees, members, or agents who are active in the management of the entity, or an affiliate of the entity has been charged with and convicted of a public entity crime subsequent to July 1, 1989. However, there has been a subsequent proceeding before a Hearing Officer of the State of Florida Division of Administrative Hearings and the Final Order entered by the Hearing Officer determined that it was not in the public interest to place the entity submitting this sworn statement on the convicted vendor list. (Attach a copy of final order)

I UNDERSTAND THAT THE SUBMISSION OF THIS FORM TO THE CONTRACTING OFFICER FOR THE PUBLIC ENTITY IDENTIFIED IN PARAGRAPH 1 (ONE) ABOVE IS FOR THAT PUBLIC ENTITY ONLY AND, THAT THIS FORM IS VALID THROUGH DECEMBER 31 OF THE CALENDAR YEAR IN WHICH IT IS FILED. I ALSO UNDERSTAND THAT I AM REQUIRED TO INFORM THE PUBLIC ENTITY PRIOR TO ENTERING INTO A CONTRACT IN EXCESS OF THE THRESHOLD AMOUNT PROVIDED IN SECTION 287.017, FLORIDA STATUTES FOR CATEGORY TWO OF ANY CHANGE IN THE INFORMATION CONTAINED IN THIS FORM.

_____ _____

(Signature) (Date)

STATE OF_____

COUNTY OF_____

Sworn to (or affirmed) and subscribed before me by means of ☐ physical presence or ☐ online notarization, on this _____ day of_____, 20___, by _____ (name of individual signing), who is personally known to me or who produced_____as identification.

My commission expires:

_____

NOTARY PUBLIC

Print Name: _____

SECTION 00425

W-9 Form

(See next page for W-9 Form)

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Form **W-9**
(Rev. October 2018)
Department of the Treasury
Internal Revenue Service

Request for Taxpayer Identification Number and Certification

► **Go to *www.irs.gov/FormW9* for instructions and the latest information.**

Give Form to the requester. Do not send to the IRS.

Print or type. See **Specific Instructions** on page 3.

1 Name (as shown on your income tax return). Name is required on this line; do not leave this line blank.

2 Business name/disregarded entity name, if different from above

3 Check appropriate box for federal tax classification of the person whose name is entered on line 1. Check only **one** of the following seven boxes.

☐ Individual/sole proprietor or single-member LLC ☐ C Corporation ☐ S Corporation ☐ Partnership ☐ Trust/estate

☐ Limited liability company. Enter the tax classification (C=C corporation, S=S corporation, P=Partnership) ► _____

Note: Check the appropriate box in the line above for the tax classification of the single-member owner. Do not check LLC if the LLC is classified as a single-member LLC that is disregarded from the owner unless the owner of the LLC is another LLC that is **not** disregarded from the owner for U.S. federal tax purposes. Otherwise, a single-member LLC that is disregarded from the owner should check the appropriate box for the tax classification of its owner.

☐ Other (see instructions) ►

4 Exemptions (codes apply only to certain entities, not individuals; see instructions on page 3):

Exempt payee code (if any) _____

Exemption from FATCA reporting code (if any) _____

(Applies to accounts maintained outside the U.S.)

5 Address (number, street, and apt. or suite no.) See instructions.

Requester's name and address (optional)

6 City, state, and ZIP code

7 List account number(s) here (optional)

Part I Taxpayer Identification Number (TIN)

Enter your TIN in the appropriate box. The TIN provided must match the name given on line 1 to avoid backup withholding. For individuals, this is generally your social security number (SSN). However, for a resident alien, sole proprietor, or disregarded entity, see the instructions for Part I, later. For other entities, it is your employer identification number (EIN). If you do not have a number, see *How to get a TIN,* later.

Note: If the account is in more than one name, see the instructions for line 1. Also see *What Name and Number To Give the Requester* for guidelines on whose number to enter.

Social security number

			–			–				

or

Employer identification number

		–							

Part II Certification

Under penalties of perjury, I certify that:

1. The number shown on this form is my correct taxpayer identification number (or I am waiting for a number to be issued to me); and
2. I am not subject to backup withholding because: (a) I am exempt from backup withholding, or (b) I have not been notified by the Internal Revenue Service (IRS) that I am subject to backup withholding as a result of a failure to report all interest or dividends, or (c) the IRS has notified me that I am no longer subject to backup withholding; and
3. I am a U.S. citizen or other U.S. person (defined below); and
4. The FATCA code(s) entered on this form (if any) indicating that I am exempt from FATCA reporting is correct.

Certification instructions. You must cross out item 2 above if you have been notified by the IRS that you are currently subject to backup withholding because you have failed to report all interest and dividends on your tax return. For real estate transactions, item 2 does not apply. For mortgage interest paid, acquisition or abandonment of secured property, cancellation of debt, contributions to an individual retirement arrangement (IRA), and generally, payments other than interest and dividends, you are not required to sign the certification, but you must provide your correct TIN. See the instructions for Part II, later.

Sign Here **Signature of U.S. person** ► **Date** ►

General Instructions

Section references are to the Internal Revenue Code unless otherwise noted.

Future developments. For the latest information about developments related to Form W-9 and its instructions, such as legislation enacted after they were published, go to *www.irs.gov/FormW9.*

Purpose of Form

An individual or entity (Form W-9 requester) who is required to file an information return with the IRS must obtain your correct taxpayer identification number (TIN) which may be your social security number (SSN), individual taxpayer identification number (ITIN), adoption taxpayer identification number (ATIN), or employer identification number (EIN), to report on an information return the amount paid to you, or other amount reportable on an information return. Examples of information returns include, but are not limited to, the following.

- Form 1099-INT (interest earned or paid)
- Form 1099-DIV (dividends, including those from stocks or mutual funds)
- Form 1099-MISC (various types of income, prizes, awards, or gross proceeds)
- Form 1099-B (stock or mutual fund sales and certain other transactions by brokers)
- Form 1099-S (proceeds from real estate transactions)
- Form 1099-K (merchant card and third party network transactions)
- Form 1098 (home mortgage interest), 1098-E (student loan interest), 1098-T (tuition)
- Form 1099-C (canceled debt)
- Form 1099-A (acquisition or abandonment of secured property)

Use Form W-9 only if you are a U.S. person (including a resident alien), to provide your correct TIN.

If you do not return Form W-9 to the requester with a TIN, you might be subject to backup withholding. See What is backup withholding, *later.*

By signing the filled-out form, you:

1. Certify that the TIN you are giving is correct (or you are waiting for a number to be issued),

2. Certify that you are not subject to backup withholding, or

3. Claim exemption from backup withholding if you are a U.S. exempt payee. If applicable, you are also certifying that as a U.S. person, your allocable share of any partnership income from a U.S. trade or business is not subject to the withholding tax on foreign partners' share of effectively connected income, and

4. Certify that FATCA code(s) entered on this form (if any) indicating that you are exempt from the FATCA reporting, is correct. See *What is FATCA reporting,* later, for further information.

Note: If you are a U.S. person and a requester gives you a form other than Form W-9 to request your TIN, you must use the requester's form if it is substantially similar to this Form W-9.

Definition of a U.S. person. For federal tax purposes, you are considered a U.S. person if you are:

- An individual who is a U.S. citizen or U.S. resident alien;
- A partnership, corporation, company, or association created or organized in the United States or under the laws of the United States;
- An estate (other than a foreign estate); or
- A domestic trust (as defined in Regulations section 301.7701-7).

Special rules for partnerships. Partnerships that conduct a trade or business in the United States are generally required to pay a withholding tax under section 1446 on any foreign partners' share of effectively connected taxable income from such business. Further, in certain cases where a Form W-9 has not been received, the rules under section 1446 require a partnership to presume that a partner is a foreign person, and pay the section 1446 withholding tax. Therefore, if you are a U.S. person that is a partner in a partnership conducting a trade or business in the United States, provide Form W-9 to the partnership to establish your U.S. status and avoid section 1446 withholding on your share of partnership income.

In the cases below, the following person must give Form W-9 to the partnership for purposes of establishing its U.S. status and avoiding withholding on its allocable share of net income from the partnership conducting a trade or business in the United States.

- In the case of a disregarded entity with a U.S. owner, the U.S. owner of the disregarded entity and not the entity;
- In the case of a grantor trust with a U.S. grantor or other U.S. owner, generally, the U.S. grantor or other U.S. owner of the grantor trust and not the trust; and
- In the case of a U.S. trust (other than a grantor trust), the U.S. trust (other than a grantor trust) and not the beneficiaries of the trust.

Foreign person. If you are a foreign person or the U.S. branch of a foreign bank that has elected to be treated as a U.S. person, do not use Form W-9. Instead, use the appropriate Form W-8 or Form 8233 (see Pub. 515, Withholding of Tax on Nonresident Aliens and Foreign Entities).

Nonresident alien who becomes a resident alien. Generally, only a nonresident alien individual may use the terms of a tax treaty to reduce or eliminate U.S. tax on certain types of income. However, most tax treaties contain a provision known as a "saving clause." Exceptions specified in the saving clause may permit an exemption from tax to continue for certain types of income even after the payee has otherwise become a U.S. resident alien for tax purposes.

If you are a U.S. resident alien who is relying on an exception contained in the saving clause of a tax treaty to claim an exemption from U.S. tax on certain types of income, you must attach a statement to Form W-9 that specifies the following five items.

1. The treaty country. Generally, this must be the same treaty under which you claimed exemption from tax as a nonresident alien.

2. The treaty article addressing the income.

3. The article number (or location) in the tax treaty that contains the saving clause and its exceptions.

4. The type and amount of income that qualifies for the exemption from tax.

5. Sufficient facts to justify the exemption from tax under the terms of the treaty article.

Example. Article 20 of the U.S.-China income tax treaty allows an exemption from tax for scholarship income received by a Chinese student temporarily present in the United States. Under U.S. law, this student will become a resident alien for tax purposes if his or her stay in the United States exceeds 5 calendar years. However, paragraph 2 of the first Protocol to the U.S.-China treaty (dated April 30, 1984) allows the provisions of Article 20 to continue to apply even after the Chinese student becomes a resident alien of the United States. A Chinese student who qualifies for this exception (under paragraph 2 of the first protocol) and is relying on this exception to claim an exemption from tax on his or her scholarship or fellowship income would attach to Form W-9 a statement that includes the information described above to support that exemption.

If you are a nonresident alien or a foreign entity, give the requester the appropriate completed Form W-8 or Form 8233.

Backup Withholding

What is backup withholding? Persons making certain payments to you must under certain conditions withhold and pay to the IRS 24% of such payments. This is called "backup withholding." Payments that may be subject to backup withholding include interest, tax-exempt interest, dividends, broker and barter exchange transactions, rents, royalties, nonemployee pay, payments made in settlement of payment card and third party network transactions, and certain payments from fishing boat operators. Real estate transactions are not subject to backup withholding.

You will not be subject to backup withholding on payments you receive if you give the requester your correct TIN, make the proper certifications, and report all your taxable interest and dividends on your tax return.

Payments you receive will be subject to backup withholding if:

1. You do not furnish your TIN to the requester,

2. You do not certify your TIN when required (see the instructions for Part II for details),

3. The IRS tells the requester that you furnished an incorrect TIN,

4. The IRS tells you that you are subject to backup withholding because you did not report all your interest and dividends on your tax return (for reportable interest and dividends only), or

5. You do not certify to the requester that you are not subject to backup withholding under 4 above (for reportable interest and dividend accounts opened after 1983 only).

Certain payees and payments are exempt from backup withholding. See *Exempt payee code,* later, and the separate Instructions for the Requester of Form W-9 for more information.

Also see *Special rules for partnerships,* earlier.

What is FATCA Reporting?

The Foreign Account Tax Compliance Act (FATCA) requires a participating foreign financial institution to report all United States account holders that are specified United States persons. Certain payees are exempt from FATCA reporting. See *Exemption from FATCA reporting code,* later, and the Instructions for the Requester of Form W-9 for more information.

Updating Your Information

You must provide updated information to any person to whom you claimed to be an exempt payee if you are no longer an exempt payee and anticipate receiving reportable payments in the future from this person. For example, you may need to provide updated information if you are a C corporation that elects to be an S corporation, or if you no longer are tax exempt. In addition, you must furnish a new Form W-9 if the name or TIN changes for the account; for example, if the grantor of a grantor trust dies.

Penalties

Failure to furnish TIN. If you fail to furnish your correct TIN to a requester, you are subject to a penalty of $50 for each such failure unless your failure is due to reasonable cause and not to willful neglect.

Civil penalty for false information with respect to withholding. If you make a false statement with no reasonable basis that results in no backup withholding, you are subject to a $500 penalty.

Criminal penalty for falsifying information. Willfully falsifying certifications or affirmations may subject you to criminal penalties including fines and/or imprisonment.

Misuse of TINs. If the requester discloses or uses TINs in violation of federal law, the requester may be subject to civil and criminal penalties.

Specific Instructions

Line 1

You must enter one of the following on this line; **do not** leave this line blank. The name should match the name on your tax return.

If this Form W-9 is for a joint account (other than an account maintained by a foreign financial institution (FFI)), list first, and then circle, the name of the person or entity whose number you entered in Part I of Form W-9. If you are providing Form W-9 to an FFI to document a joint account, each holder of the account that is a U.S. person must provide a Form W-9.

a. **Individual.** Generally, enter the name shown on your tax return. If you have changed your last name without informing the Social Security Administration (SSA) of the name change, enter your first name, the last name as shown on your social security card, and your new last name.

Note: ITIN applicant: Enter your individual name as it was entered on your Form W-7 application, line 1a. This should also be the same as the name you entered on the Form 1040/1040A/1040EZ you filed with your application.

b. **Sole proprietor or single-member LLC.** Enter your individual name as shown on your 1040/1040A/1040EZ on line 1. You may enter your business, trade, or "doing business as" (DBA) name on line 2.

c. **Partnership, LLC that is not a single-member LLC, C corporation, or S corporation.** Enter the entity's name as shown on the entity's tax return on line 1 and any business, trade, or DBA name on line 2.

d. **Other entities.** Enter your name as shown on required U.S. federal tax documents on line 1. This name should match the name shown on the charter or other legal document creating the entity. You may enter any business, trade, or DBA name on line 2.

e. **Disregarded entity.** For U.S. federal tax purposes, an entity that is disregarded as an entity separate from its owner is treated as a "disregarded entity." See Regulations section 301.7701-2(c)(2)(iii). Enter the owner's name on line 1. The name of the entity entered on line 1 should never be a disregarded entity. The name on line 1 should be the name shown on the income tax return on which the income should be reported. For example, if a foreign LLC that is treated as a disregarded entity for U.S. federal tax purposes has a single owner that is a U.S. person, the U.S. owner's name is required to be provided on line 1. If the direct owner of the entity is also a disregarded entity, enter the first owner that is not disregarded for federal tax purposes. Enter the disregarded entity's name on line 2, "Business name/disregarded entity name." If the owner of the disregarded entity is a foreign person, the owner must complete an appropriate Form W-8 instead of a Form W-9. This is the case even if the foreign person has a U.S. TIN.

Line 2

If you have a business name, trade name, DBA name, or disregarded entity name, you may enter it on line 2.

Line 3

Check the appropriate box on line 3 for the U.S. federal tax classification of the person whose name is entered on line 1. Check only one box on line 3.

IF the entity/person on line 1 is a(n) . . .	THEN check the box for . . .
• Corporation	Corporation
• Individual • Sole proprietorship, or • Single-member limited liability company (LLC) owned by an individual and disregarded for U.S. federal tax purposes.	Individual/sole proprietor or single-member LLC
• LLC treated as a partnership for U.S. federal tax purposes, • LLC that has filed Form 8832 or 2553 to be taxed as a corporation, or • LLC that is disregarded as an entity separate from its owner but the owner is another LLC that is not disregarded for U.S. federal tax purposes.	Limited liability company and enter the appropriate tax classification. (P= Partnership; C= C corporation; or S= S corporation)
• Partnership	Partnership
• Trust/estate	Trust/estate

Line 4, Exemptions

If you are exempt from backup withholding and/or FATCA reporting, enter in the appropriate space on line 4 any code(s) that may apply to you.

Exempt payee code.

- Generally, individuals (including sole proprietors) are not exempt from backup withholding.
- Except as provided below, corporations are exempt from backup withholding for certain payments, including interest and dividends.
- Corporations are not exempt from backup withholding for payments made in settlement of payment card or third party network transactions.
- Corporations are not exempt from backup withholding with respect to attorneys' fees or gross proceeds paid to attorneys, and corporations that provide medical or health care services are not exempt with respect to payments reportable on Form 1099-MISC.

The following codes identify payees that are exempt from backup withholding. Enter the appropriate code in the space in line 4.

1—An organization exempt from tax under section 501(a), any IRA, or a custodial account under section 403(b)(7) if the account satisfies the requirements of section 401(f)(2)

2—The United States or any of its agencies or instrumentalities

3—A state, the District of Columbia, a U.S. commonwealth or possession, or any of their political subdivisions or instrumentalities

4—A foreign government or any of its political subdivisions, agencies, or instrumentalities

5—A corporation

6—A dealer in securities or commodities required to register in the United States, the District of Columbia, or a U.S. commonwealth or possession

7—A futures commission merchant registered with the Commodity Futures Trading Commission

8—A real estate investment trust

9—An entity registered at all times during the tax year under the Investment Company Act of 1940

10—A common trust fund operated by a bank under section 584(a)

11—A financial institution

12—A middleman known in the investment community as a nominee or custodian

13—A trust exempt from tax under section 664 or described in section 4947

The following chart shows types of payments that may be exempt from backup withholding. The chart applies to the exempt payees listed above, 1 through 13.

IF the payment is for . . .	THEN the payment is exempt for . . .
Interest and dividend payments	All exempt payees except for 7
Broker transactions	Exempt payees 1 through 4 and 6 through 11 and all C corporations. S corporations must not enter an exempt payee code because they are exempt only for sales of noncovered securities acquired prior to 2012.
Barter exchange transactions and patronage dividends	Exempt payees 1 through 4
Payments over $600 required to be reported and direct sales over $5,000[1]	Generally, exempt payees 1 through 5[2]
Payments made in settlement of payment card or third party network transactions	Exempt payees 1 through 4

[1] See Form 1099-MISC, Miscellaneous Income, and its instructions.

[2] However, the following payments made to a corporation and reportable on Form 1099-MISC are not exempt from backup withholding: medical and health care payments, attorneys' fees, gross proceeds paid to an attorney reportable under section 6045(f), and payments for services paid by a federal executive agency.

Exemption from FATCA reporting code. The following codes identify payees that are exempt from reporting under FATCA. These codes apply to persons submitting this form for accounts maintained outside of the United States by certain foreign financial institutions. Therefore, if you are only submitting this form for an account you hold in the United States, you may leave this field blank. Consult with the person requesting this form if you are uncertain if the financial institution is subject to these requirements. A requester may indicate that a code is not required by providing you with a Form W-9 with "Not Applicable" (or any similar indication) written or printed on the line for a FATCA exemption code.

A—An organization exempt from tax under section 501(a) or any individual retirement plan as defined in section 7701(a)(37)

B—The United States or any of its agencies or instrumentalities

C—A state, the District of Columbia, a U.S. commonwealth or possession, or any of their political subdivisions or instrumentalities

D—A corporation the stock of which is regularly traded on one or more established securities markets, as described in Regulations section 1.1472-1(c)(1)(i)

E—A corporation that is a member of the same expanded affiliated group as a corporation described in Regulations section 1.1472-1(c)(1)(i)

F—A dealer in securities, commodities, or derivative financial instruments (including notional principal contracts, futures, forwards, and options) that is registered as such under the laws of the United States or any state

G—A real estate investment trust

H—A regulated investment company as defined in section 851 or an entity registered at all times during the tax year under the Investment Company Act of 1940

I—A common trust fund as defined in section 584(a)

J—A bank as defined in section 581

K—A broker

L—A trust exempt from tax under section 664 or described in section 4947(a)(1)

M—A tax exempt trust under a section 403(b) plan or section 457(g) plan

Note: You may wish to consult with the financial institution requesting this form to determine whether the FATCA code and/or exempt payee code should be completed.

Line 5

Enter your address (number, street, and apartment or suite number). This is where the requester of this Form W-9 will mail your information returns. If this address differs from the one the requester already has on file, write NEW at the top. If a new address is provided, there is still a chance the old address will be used until the payor changes your address in their records.

Line 6

Enter your city, state, and ZIP code.

Part I. Taxpayer Identification Number (TIN)

Enter your TIN in the appropriate box. If you are a resident alien and you do not have and are not eligible to get an SSN, your TIN is your IRS individual taxpayer identification number (ITIN). Enter it in the social security number box. If you do not have an ITIN, see *How to get a TIN* below.

If you are a sole proprietor and you have an EIN, you may enter either your SSN or EIN.

If you are a single-member LLC that is disregarded as an entity separate from its owner, enter the owner's SSN (or EIN, if the owner has one). Do not enter the disregarded entity's EIN. If the LLC is classified as a corporation or partnership, enter the entity's EIN.

Note: See *What Name and Number To Give the Requester,* later, for further clarification of name and TIN combinations.

How to get a TIN. If you do not have a TIN, apply for one immediately. To apply for an SSN, get Form SS-5, Application for a Social Security Card, from your local SSA office or get this form online at *www.SSA.gov*. You may also get this form by calling 1-800-772-1213. Use Form W-7, Application for IRS Individual Taxpayer Identification Number, to apply for an ITIN, or Form SS-4, Application for Employer Identification Number, to apply for an EIN. You can apply for an EIN online by accessing the IRS website at *www.irs.gov/Businesses* and clicking on Employer Identification Number (EIN) under Starting a Business. Go to *www.irs.gov/Forms* to view, download, or print Form W-7 and/or Form SS-4. Or, you can go to *www.irs.gov/OrderForms* to place an order and have Form W-7 and/or SS-4 mailed to you within 10 business days.

If you are asked to complete Form W-9 but do not have a TIN, apply for a TIN and write "Applied For" in the space for the TIN, sign and date the form, and give it to the requester. For interest and dividend payments, and certain payments made with respect to readily tradable instruments, generally you will have 60 days to get a TIN and give it to the requester before you are subject to backup withholding on payments. The 60-day rule does not apply to other types of payments. You will be subject to backup withholding on all such payments until you provide your TIN to the requester.

Note: Entering "Applied For" means that you have already applied for a TIN or that you intend to apply for one soon.

Caution: A disregarded U.S. entity that has a foreign owner must use the appropriate Form W-8.

Part II. Certification

To establish to the withholding agent that you are a U.S. person, or resident alien, sign Form W-9. You may be requested to sign by the withholding agent even if item 1, 4, or 5 below indicates otherwise.

For a joint account, only the person whose TIN is shown in Part I should sign (when required). In the case of a disregarded entity, the person identified on line 1 must sign. Exempt payees, see *Exempt payee code,* earlier.

Signature requirements. Complete the certification as indicated in items 1 through 5 below.

1. Interest, dividend, and barter exchange accounts opened before 1984 and broker accounts considered active during 1983. You must give your correct TIN, but you do not have to sign the certification.

2. Interest, dividend, broker, and barter exchange accounts opened after 1983 and broker accounts considered inactive during 1983. You must sign the certification or backup withholding will apply. If you are subject to backup withholding and you are merely providing your correct TIN to the requester, you must cross out item 2 in the certification before signing the form.

3. Real estate transactions. You must sign the certification. You may cross out item 2 of the certification.

4. Other payments. You must give your correct TIN, but you do not have to sign the certification unless you have been notified that you have previously given an incorrect TIN. "Other payments" include payments made in the course of the requester's trade or business for rents, royalties, goods (other than bills for merchandise), medical and health care services (including payments to corporations), payments to a nonemployee for services, payments made in settlement of payment card and third party network transactions, payments to certain fishing boat crew members and fishermen, and gross proceeds paid to attorneys (including payments to corporations).

5. Mortgage interest paid by you, acquisition or abandonment of secured property, cancellation of debt, qualified tuition program payments (under section 529), ABLE accounts (under section 529A), IRA, Coverdell ESA, Archer MSA or HSA contributions or distributions, and pension distributions. You must give your correct TIN, but you do not have to sign the certification.

What Name and Number To Give the Requester

For this type of account:	Give name and SSN of:
1. Individual	The individual
2. Two or more individuals (joint account) other than an account maintained by an FFI	The actual owner of the account or, if combined funds, the first individual on the account[1]
3. Two or more U.S. persons (joint account maintained by an FFI)	Each holder of the account
4. Custodial account of a minor (Uniform Gift to Minors Act)	The minor[2]
5. a. The usual revocable savings trust (grantor is also trustee)	The grantor-trustee[1]
b. So-called trust account that is not a legal or valid trust under state law	The actual owner[1]
6. Sole proprietorship or disregarded entity owned by an individual	The owner[3]
7. Grantor trust filing under Optional Form 1099 Filing Method 1 (see Regulations section 1.671-4(b)(2)(i)(A))	The grantor*
For this type of account:	**Give name and EIN of:**
8. Disregarded entity not owned by an individual	The owner
9. A valid trust, estate, or pension trust	Legal entity[4]
10. Corporation or LLC electing corporate status on Form 8832 or Form 2553	The corporation
11. Association, club, religious, charitable, educational, or other tax-exempt organization	The organization
12. Partnership or multi-member LLC	The partnership
13. A broker or registered nominee	The broker or nominee
14. Account with the Department of Agriculture in the name of a public entity (such as a state or local government, school district, or prison) that receives agricultural program payments	The public entity
15. Grantor trust filing under the Form 1041 Filing Method or the Optional Form 1099 Filing Method 2 (see Regulations section 1.671-4(b)(2)(i)(B))	The trust

[1] List first and circle the name of the person whose number you furnish. If only one person on a joint account has an SSN, that person's number must be furnished.

[2] Circle the minor's name and furnish the minor's SSN.

[3] You must show your individual name and you may also enter your business or DBA name on the "Business name/disregarded entity" name line. You may use either your SSN or EIN (if you have one), but the IRS encourages you to use your SSN.

[4] List first and circle the name of the trust, estate, or pension trust. (Do not furnish the TIN of the personal representative or trustee unless the legal entity itself is not designated in the account title.) Also see *Special rules for partnerships,* earlier.

***Note:** The grantor also must provide a Form W-9 to trustee of trust.

Note: If no name is circled when more than one name is listed, the number will be considered to be that of the first name listed.

Secure Your Tax Records From Identity Theft

Identity theft occurs when someone uses your personal information such as your name, SSN, or other identifying information, without your permission, to commit fraud or other crimes. An identity thief may use your SSN to get a job or may file a tax return using your SSN to receive a refund.

To reduce your risk:

- Protect your SSN,
- Ensure your employer is protecting your SSN, and
- Be careful when choosing a tax preparer.

If your tax records are affected by identity theft and you receive a notice from the IRS, respond right away to the name and phone number printed on the IRS notice or letter.

If your tax records are not currently affected by identity theft but you think you are at risk due to a lost or stolen purse or wallet, questionable credit card activity or credit report, contact the IRS Identity Theft Hotline at 1-800-908-4490 or submit Form 14039.

For more information, see Pub. 5027, Identity Theft Information for Taxpayers.

Victims of identity theft who are experiencing economic harm or a systemic problem, or are seeking help in resolving tax problems that have not been resolved through normal channels, may be eligible for Taxpayer Advocate Service (TAS) assistance. You can reach TAS by calling the TAS toll-free case intake line at 1-877-777-4778 or TTY/TDD 1-800-829-4059.

Protect yourself from suspicious emails or phishing schemes. Phishing is the creation and use of email and websites designed to mimic legitimate business emails and websites. The most common act is sending an email to a user falsely claiming to be an established legitimate enterprise in an attempt to scam the user into surrendering private information that will be used for identity theft.

The IRS does not initiate contacts with taxpayers via emails. Also, the IRS does not request personal detailed information through email or ask taxpayers for the PIN numbers, passwords, or similar secret access information for their credit card, bank, or other financial accounts.

If you receive an unsolicited email claiming to be from the IRS, forward this message to *phishing@irs.gov.* You may also report misuse of the IRS name, logo, or other IRS property to the Treasury Inspector General for Tax Administration (TIGTA) at 1-800-366-4484. You can forward suspicious emails to the Federal Trade Commission at *spam@uce.gov* or report them at *www.ftc.gov/complaint.* You can contact the FTC at *www.ftc.gov/idtheft* or 877-IDTHEFT (877-438-4338). If you have been the victim of identity theft, see *www.IdentityTheft.gov* and Pub. 5027.

Visit *www.irs.gov/IdentityTheft* to learn more about identity theft and how to reduce your risk.

Privacy Act Notice

Section 6109 of the Internal Revenue Code requires you to provide your correct TIN to persons (including federal agencies) who are required to file information returns with the IRS to report interest, dividends, or certain other income paid to you; mortgage interest you paid; the acquisition or abandonment of secured property; the cancellation of debt; or contributions you made to an IRA, Archer MSA, or HSA. The person collecting this form uses the information on the form to file information returns with the IRS, reporting the above information. Routine uses of this information include giving it to the Department of Justice for civil and criminal litigation and to cities, states, the District of Columbia, and U.S. commonwealths and possessions for use in administering their laws. The information also may be disclosed to other countries under a treaty, to federal and state agencies to enforce civil and criminal laws, or to federal law enforcement and intelligence agencies to combat terrorism. You must provide your TIN whether or not you are required to file a tax return. Under section 3406, payers must generally withhold a percentage of taxable interest, dividend, and certain other payments to a payee who does not give a TIN to the payer. Certain penalties may also apply for providing false or fraudulent information.

SECTION 00430

TRENCH SAFETY AFFIDAVIT

Trench excavations on Projects authorized under this Contract are expected to be in excess of 5 feet deep. The Occupational Safety and Health Administration excavation safety standards, 29 CFR 1926.650 Subpart P trench safety standards will be in effect during the period of construction of the Project.

Bidder acknowledges that included in the Bid Price are costs for complying with the Florida Trench Safety Act (90-96, Laws of FL) effective October 1, 1990, and hereby gives assurance that, if awarded the Contract, the Contractor or Subcontractor performing trench excavation work on the Project will comply with the applicable trench safety standards. The Bidder further identifies the costs as follows:

Trench Safety Item (Description)	Unit Quantity	Units of Measure (LF, SY)	Unit Cost	Extended Cost
BASE BID ITEMS:				
A. _____	_____	_____	_____	_____
B. _____	_____	_____	_____	_____
C. _____	_____	_____	_____	_____
ALTERNATE NO. 1 ITEMS:				
_____	_____	_____	_____	_____
			TOTAL $	_____

FAILURE TO COMPLETE THE ABOVE SHALL RESULT IN THE BID BEING DECLARED NON-RESPONSIVE.

COMPANY NAME: _____

DATE: _____ BY: _____

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SECTION 00430

TRENCH SAFETY AFFIDAVIT

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Trench Safety Item (Description)	Unit Quantity	Units of Measure (LF,SY)	Unit Cost	Extended Cost
BASE BID ITEMS:				
A._____	_____	_____	_____	_____
B._____	_____	_____	_____	_____
C._____	_____	_____	_____	_____
ALTERNATE NO. 1 ITEMS:				
_____	_____	_____	_____	_____
			TOTAL $_____	

FAILURE TO COMPLETE THE ABOVE SHALL RESULT IN THE BID BEING DECLARED NON-RESPONSIVE.

COMPANY NAME:_____

DATE:_____ BY:_____

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SECTION 00440

BONDING CAPACITY CERTIFICATION LETTER

OWNER:
Clay County Utility Authority
3176 Old Jennings Road
Middleburg, FL 32068
904-213-2400

BIDDER:

Firm Name: _____

Address: _____

City, State, Zip: _____

Phone: _____

This letter serves as a certified statement that the Surety Company's authorized bonding Capacity for the referenced Bidder will not be exceeded by the inclusion of Bidder's Submitted Bid for_____ _____. The present limits on bonding for the referenced Contractor are as follows:

$_____ each occurrence

$ _____ aggregate

Percentage of bonding capacity expended with inclusion of this Bid _____%

Bidder's Bonding Rate _____%

Amount of ALL projects that the Bidder is currently preparing bid/proposals and/or have not yet been awarded:

$_____

(Amount indicated above must be representative of all projects inclusive of delivery methods such as the following but not limited to: Competitive Bids, Competitive Sealed Proposals, Design-Build, Construction Manager at Risk, Job Order Contracting etc.,) Issuance and approval of any bond shall be predicated on the most current financial and job information available to the underwriter on the date that the bond is issued. The Surety Company hereby certifies that they are duly authorized by certificate of authority issued by the State of Florida and that they are rated as follows:

A.M. Best Rating: _____

Financial Size Category: _____

Notes: This is the only acceptable format for the Surety's Bonding Capacity Certification Letter. This statement must be notarized (on an original document with an embossed stamp). Power of Attorney form must be attached.

SURETY COMPANY

Surety Company Name: _____

Address: _____

City, State, Zip Code: _____

Authorized Signature: _____

Date: _____

STATE OF_____ COUNTY OF_____

PERSONALLY APPEARED BEFORE ME, the undersigned authority_____who after first being sworn by me, affixed his/her (name of individual signing) signature in the space provided above on this_____day of_____, 20__.

My commission expires: _____

NOTARY PUBLIC

END OF SECTION

SECTION 00500

STANDARD FORM OF AGREEMENT

BETWEEN OWNER AND CONTRACTOR
ON THE BASIS OF A STIPULATED PRICE

THIS AGREEMENT is by and between CLAY COUNTY UTILITY AUTHORITY (owner)

and _____ (Contractor)

Owner and Contractor, in consideration of the mutual covenants set forth herein, agree as follows:

ARTICLE 1 - WORK

1.01 Contractor shall complete all Work as specified or indicated in the Contract Documents. The Fleming Island Wastewater Treatment Facility (WWTF) BTU No. 3 Expansion is generally described to include:

- The Contractor is responsible for mobilization and demobilization from the site. Contractor shall be responsible for general conditions, performance and payment bonds, insurance and permits.

- The Contractor shall schedule and conduct his work such that it will not impede any part of the treatment process, create potential hazards to operating equipment and/or personnel, reduce the quality of the plant finished water or cause treatment process upsets.

- The Contractor is responsible for demolition of above and below grade utilities including, but not limited to, above grade concrete walls and foundations, miscellaneous equipment, buried piping, wire, and conduit. Removed items not to be salvaged shall be disposed off-site by the Contractor in accordance with local, state, and federal codes and requirements.

- The Contractor shall be responsible for temporary bypass pumping to complete the modifications to the Influent Structure and installation of the Automatic Transfer Switch. Bypass pumping will be set-up and ready to power the effluent pump station in the event that the standby generator fails during replacement of the electrical service and during modifications to the main breaker, and in the event normal power fails during replacement of the standby generator.

- The Contractor shall be responsible for settlement monitoring of existing structures during construction.

- The Contractor shall be responsible for site clearing and site grading to provide level ground for construction of Biological Treatment Unit (BTU) No. 3. A swale will be added between BTU No. 3 and existing BTU No. 2 to ensure site drainage.

- The Contractor shall be responsible for installing temporary silt fences and/or barriers as required to avoid silt or turbid water transport from the work areas.

- The Contractor shall construct, install and test yard piping improvements, including; influent biological treatment unit (BTU) No. 3 influent piping, BTU No. 3 effluent piping, BTU No. 3 drain piping and non-potable water piping.

- The Contractor shall construct, install and test modifications to the Influent Structure. Within the Influent Structure, the distribution box shall be extended to accommodate splitting flow to the new BTU No. 3 and a future BTU No. 4, including new weir gates. Contractor shall construct, install and submit the proposed system of protection of the Influent Structure and Odor Control Tank signed and sealed by a professional engineer.

- The Contractor shall relocate equipment associated with the odor control system at the Influent Structure and reroute the odor control piping and ductwork.

- The Contractor shall provide, install, test and commission the new BTU No. 3. BTU No. 3 shall be an elliptical carrousel process, 2-stage oxidation ditch with anoxic and aerobic zones, three aerators and two turbine mixers. The BTU tank shall be pre-stressed concrete.

- The Contractor shall construct, install and test the expansion of the existing Motor Control Center (MCC) to accommodate the new equipment associated with BTU No. 3. New variable frequency drives (VFDs) for BTU No. 3 aerators shall be installed and tested. The Contractor shall update the instrumentation and controls to accommodate the modifications to the Influent Structure and the new BTU No. 3 including integration of the upgrades into the plant supervisory control and data acquisition (SCADA) system.

- The Contractor will replace the effluent control gate in the existing BTU No. 1. A structural evaluation will be performed by the Engineer once BTU No. 1 is removed from service. The Contractor shall assist with preparation of BTU No 1 for the evaluation and shall remove and dispose settled grit/debris/solids and sludge from BTU No. 1. Recommendations for repair will be provided by the Engineer after completion of the evaluation. The intent is to incorporated repair recommendations will be added to the Scope of Work through a change order.

- The Contractor shall construct, install and test buried conduits from the existing Electrical Building to BTU No. 3. Contractor shall construct, install and test new fiber optic cable from the existing WWTF Office and Lab Building to the WWTF Electrical Building.

- The Contractor shall disconnect, remove and salvage the existing generator set and transport to a location on Site as directed by CCUA. The Contractor shall procure the services of the existing standby generator manufacturer to prepare the equipment for long-term outdoor storage in accordance with the equipment manufacturer's recommendations. The Contractor shall install and test a new standby generator, fuel piping and extend the existing generator pad.

- The Contractor shall be responsible for putting Project in operational order, adjusting, and balancing equipment, initial operation (startup) of equipment, operating equipment, starting systems, operations of systems, testing of equipment and systems, and demonstration and verification of the completed Work.

- The Contractor shall be responsible for site restoration, final cleaning, and project record drawings.

  All materials, methods of construction, and standards must be in accordance with the AUTHORITY's approved materials manual, standards, and details.

ARTICLE 2 - THE PROJECT

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

Fleming Island Wastewater Treatment Facility – BTU No. 3 Expansion
Clay County Utility Authority Project No. 2203-132, Bid No. 19/20-A9
1770 Radar Rd., Fleming Island, FL, 32003

ARTICLE 3 - ENGINEER

3.01 The Project has been designed by

Misti Burkman, P.E.
CDM Smith Inc.
4651 Salisbury Road, Suite 420
Jacksonville, FL 32256

(Engineer), who is to act as Owner's representative, assume all duties and responsibilities, and have the rights and authority assigned to Engineer in the Contract Documents in connection with the completion of the Work in accordance with the Contract Documents.

ARTICLE 4 - CONTRACT TIMES

4.01 Time of the Essence

A. All time limits for Milestones, if any, Substantial Completion, and completion and readiness for final payment as stated in the Contract Documents are of the essence of the Contract.

4.02 Days to Achieve Substantial Completion and Final Payment

A. The Work will be substantially completed within 510 days after the date when the Contract Times commence to run as provided in Paragraph 2.03 of the General Conditions and completed and ready for final payment in accordance with Paragraph 14.07 of the General Conditions within 540 days after the date when the Contract Times commence to run.

4.03 Liquidated Damages

A. Contractor and Owner recognize that time is of the essence of this Agreement and that Owner will suffer financial loss if the Work is not completed within the times specified in Paragraph 4.02 above, plus any extensions thereof allowed in accordance with Article 12 of the General Conditions. The parties also recognize the delays, expense, and difficulties involved in proving in a legal or arbitration proceeding the actual loss suffered by Owner if the Work is not completed on time. Accordingly, instead of requiring any such proof, Owner and Contractor agree that as liquidated damages for delay (but not as a penalty), Contractor shall pay Owner $*500 min* for each day that expires after the time specified in Paragraph 4.02 for Substantial Completion until the Work is substantially complete. After Substantial Completion, if Contractor shall neglect, refuse, or fail to complete the remaining Work within the Contract Time or any proper extension thereof granted by Owner, Contractor shall pay Owner $*250 min* for each day that expires after the time specified in Paragraph 4.02 for completion and readiness for final payment until the Work is completed and ready for final payment.

ARTICLE 5 - CONTRACT PRICE

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

A. For all Work other than Unit Price Work, a Lump Sum of: $_____
(Numerals)

_____
(Written)

All specific cash allowances are included in the above price and have been computed in accordance with paragraph 11.02 of the General Conditions.

B. For all Additive Alternate Unit Price Work, an amount equal to the sum of the established unit price for each separately identified item of Unit Price Work times the estimated quantity of that item as indicated in this Paragraph 5.01.B:

As provided in Paragraph 11.03 of the General Conditions, estimated quantities are not guaranteed, and determinations of actual quantities and classifications are to be made by Engineer as provided in Paragraph 9.07 of the General Conditions. Unit prices have been computed as provided in Paragraph 11.03 of the General Conditions.

UNIT PRICE WORK

Item No.	Description	Unit	Estimated Quantity	Unit Price	Estimated
1	Overexcavation and fill for structures or utilities, includes excavation, backfill, installation and compaction.	CY	1,500	_____	_____

TOTAL OF ALL ESTIMATED PRICES $_____
(Numerals)

_____
(Written)

CB.For all Work, at the prices stated in Contractor's Bid, attached hereto as an exhibit.

ARTICLE 6 - PAYMENT PROCEDURES

6.01 Submittal and Processing of Payments

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

6.02 Progress Payments; Retainage

A. Owner shall make one progress payment per month on account of the Contract Price on the basis of Contractor's Applications for Payment on or about the 1st or 3rd Wednesday of each month during performance of the Work as provided in Paragraphs 6.02.A.1 and 6.02.A.2 below. All such payments will be measured by the schedule of values established as provided in Paragraph 2.07.A of the General Conditions (and in the case of Unit Price Work based on the number of units completed) or, in the event there is no schedule of values, as provided in the General Requirements:

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

   a. Ninety percent (90%) of the Work completed including the cost of materials and equipment stored and secured on the Site, but not incorporated in the Work (with the balance being retainage). If the Work has been fifty percent (50%) completed as determined by Engineer, the retainage shall be reduced to five percent (5%) on all subsequent payment requests. After fifty percent (50%) completion, if the character and progress of the Work have been satisfactory to Owner and Engineer, Contractor may request payment of up to one-half of the retainage held by the Owner on the entire amount of the Work completed, including the cost of materials and equipment stored and secured on the Site, but not incorporated in the Work.

2. Upon Substantial Completion, Owner shall pay an amount sufficient to increase total payments to Contractor to ninety-five percent (95%) of the Work completed, less such amounts as Engineer shall determine in accordance with Paragraph 14.02.B.5 of the General Conditions and less one hundred percent (100%) of Engineer's estimate of the value of the Work to be completed or corrected as shown on the tentative list of items to be completed or corrected attached to the certificate of Substantial Completion.

6.03 Project Closeout

A. Owner shall develop a list of items required to render complete, satisfactory, and acceptable the Work purchased by Owner. The process for the development of the list, including responsibilities of Owner and Contractor in developing and reviewing the list and a reasonable time for developing the list, are as follows:

1. For construction projects having an estimated cost of less than $10 million, within 30 calendar days after reaching substantial completion of the Work; or

2. For construction projects having an estimated cost of $10 million or more, within 30 calendar days, unless otherwise extended by contract not to exceed 60 calendar days, after reaching substantial completion of the Work.

B. If this Agreement between Owner and Contractor relates to Work covering more than one building or structure, or involves a multi-phased Project, the list shall contain items required to render complete, satisfactory, and acceptable all of the Work for each building, structure, or phase of the Project within the time limitations provided in subsection 1, above.

C. The failure to include any corrective work or pending items not yet competed on the list developed pursuant to subsection 1 or subsection 2, above, does not alter the responsibility of the Contractor to complete all of the Work.

D. Upon completion of all items on the list, Contractor may submit a payment request for all remaining retainage withheld by Owner pursuant to Section 255.078, Florida Statutes (2007) or any successor statue thereto. If a good faith dispute exists as to whether one or more items identified on the list have been completed pursuant to this Agreement, Owner may continue to withhold an amount not to exceed one-hundred fifty percent (150%) of the total costs to complete such items.

E. All items of the Work that require correction under this Agreement and that are identified after the preparation and delivery of the list remain the obligation of Contractor as defined by this Agreement.

F. Warranty items may not affect the final payment of retainage as provided in this section or as provided in this Agreement between Contractor and its subcontractors and suppliers.

G. Retainage may not be held by Owner or Contractor to secure payment of insurance premiums under a consolidated insurance program or series of insurance policies issued to Owner or Contractor for the Project or a group of projects, and the final payment of retainage as provided in the section may not be delayed pending a final audit by Owner's or Contractor's insurance provider.

H. If Owner fails to comply with its responsibilities to develop the list required under subsection 1 or subsection 2, above, as defined in this Agreement, within the time limitations provided in subsection 1, above, Contractor may submit a payment request for all remaining retainage withheld by Owner pursuant to Section 255.078, Florida Statutes (2007) or any successor statue thereto. Owner need not pay or process any payment request for retainage if Contractor has, in whole or in part, failed to cooperate with Owner in the development of the list of failed to perform its contractual responsibilities, if any, with regard to the development of the list or if Section 255.078 (6), Florida Statutes (2007) or any successor statue thereto applies.

6.04 Final Payment

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

ARTICLE 7 - INTEREST

7.01 All payments due for the Work as provided in Article 14 of the General Conditions and not made within the applicable time limits shall bear interest at the rate specified in Section 255.073 (4), Florida Statutes (2007) or any successor statue thereto.

ARTICLE 8 – CONTRACTOR'S REPRESENTATIONS

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

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

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

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

D. Contractor has carefully studied all: (1) reports of explorations and tests of subsurface conditions at or contiguous to the Site and all drawings of physical conditions in or relating to existing surface or subsurface structures at or contiguous to the Site (except Underground Facilities) which have been identified in the Supplementary Conditions as provided in Paragraph 4.02 of the General Conditions and (2) reports and drawings of a Hazardous Environmental Condition, if any, at the Site which has been identified in the Supplementary Conditions as provided in Paragraph 4.06 of the General Conditions. See Appendix for Geotechnical Report.

E. Contractor has obtained and carefully studied (or assumes responsibility for doing so) all additional or supplementary examinations, investigations, explorations, tests, studies, and data concerning conditions (surface, subsurface, and Underground Facilities) at or contiguous to the Site which may affect cost, progress, or performance of the Work or which relate to any aspect of the means, methods, techniques, sequences, and procedures of construction to be employed by Contractor, including any specific means, methods, techniques, sequences, and procedures of construction expressly required by the Bidding Documents, and safety precautions and programs incident thereto.

F. Contractor does not consider that any further examinations, investigations, explorations, tests, studies, or data are necessary for the performance of the Work at the Contract Price, within the Contract Times, and in accordance with the other terms and conditions of the Contract Documents.

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 correlated the information known to Contractor, information and observations obtained from visits to the Site, reports and drawings identified in the Contract Documents, and all additional examinations, investigations, explorations, tests, studies, and data with the Contract Documents.

I. 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.

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

ARTICLE 9 - CONTRACT DOCUMENTS

9.01 Contents

A. The Contract Documents consist of the following:

1. This Agreement (pages 00500-1 to 00500-12, inclusive).

2. Performance bond (pages 00600-1 to 00600-2, inclusive).

3. Payment bond (pages 00600-1 to 00600-2, inclusive).

4. Other bonds (None)

5. General Conditions (C-700 pages 1 to 61, inclusive).

6. Supplementary Conditions (pages 00800-1 to 00800-12, inclusive).

7. Specifications as listed in the table of contents of the Project Manual.

8. Drawings consisting of 57 sheets with each sheet bearing the following general title: Fleming Island Wastewater Treatment Facility – BTU No. 3 Expansion.

9. Addenda (numbers _____ to _____, inclusive).

10. Exhibits to this Agreement (enumerated as follows):

    a. Contractor's Bid (pages _____ to _____, inclusive).

    b. Documentation submitted by Contractor prior to Notice of Award (pages _____ to _____, inclusive).

11. The following which may be delivered or issued on or after the Effective Date of the Agreement and are not attached hereto:

    a. Notice to Proceed (pages _____ to _____, inclusive).

    b. Work Change Directives.

    c. Change Order(s).

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

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

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

ARTICLE 10 - MISCELLANEOUS

10.01 Terms

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

10.02 Assignment of Contract

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

10.03 Successors and Assigns

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

10.04 Severability

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

10.05 Other Provisions

A. WAIVER: The failure of either party to exercise any of its rights is not a waiver of those rights. A party waives only those rights specified in writing and signed by the party waiving its rights. Oral modification or rescission of this Agreement by an employee or agent of either party, shall not release either party of its obligations under this Agreement, shall not be deemed a waiver of any rights of either party to insist upon strict performance hereof, or of either party's rights or remedies under this Agreement or by law, and shall not operate as a waiver of any of the provisions hereof.

B. Remote Access: The Owner may grant remote access, if required, to complete the Contractor's contractual obligations. The Contractor by accepting remote access, agrees to comply with the following provisions:

1. The Contractor will make a formal request for remote access if needed. The request will contain the following:
   (a) The names of any employees that will use the remote connection.
   (b) The scope of access needed (e.g. single machine, server, or service e.g. phone system).

(c) The duration that access is needed. This date should not exceed the length of the contract.

(d) List of applications that will be employed over the remote connection.

2. The Contractor shall maintain current industry standard anti-virus and anti-malware tools on the Contractor's IT systems. The Contractor shall maintain up-to-date security patches, hotfixes, security patches and other similar software and firmware changes on the system(s) used to access the remote connection.

3. The Contractor shall take reasonable precautions to prevent the transmission of a computer virus, malware, or other malicious code.

4. The Contractor shall take reasonable precautions to prevent an open connection or port that would allow an unauthorized connection to the Owner's computer, server or system.

5. If the Contractor has suffered a computer virus, intrusion, ransomware, or other cyber-attack that might put Owner's data at risk, the consultant or contractor will notify the Owner, within two (2) hours after discovery.

6. The Contractor shall only use the remote connection for the purposes of fulfilling the Contractor's contractual obligations with the Owner.

7. The Owner reserves the right to change the remote connection application, encryption, or methodology, without prior notice, in order to maintain its secure network.

8. The Contractor shall not share the remote connection. If a subcontractor or vendor requires remote access, the subcontractor or vendor shall contact Owner and make a formal request for a separate remote connection that contains the same information as the Contractor.

9. The Owner reserves the right to sever the remote connection at any time in order to maintain its secure network. It is the Contractor's responsibility to seek an alternate means to share data.

10. At no time will the contractor attempt to copy, transmit, or store confidential, or Personally Identifiable Information contained in the Owner's computer, server or system.

11. At the conclusion of the contract the Contractor agrees to purge any of the Owner's data that was obtained over the remote connection, and provide a written statement attesting to the data destruction. If the Contractor wishes to retain this data, a formal request must be submitted to the Owner prior to the completion of the contract.

12. The Contractor shall require all its employees, subconsultant(s), vendor(s) and subcontractor(s) to comply with provisions of this paragraph.

IN WITNESS WHEREOF, Owner and Contractor have signed this Agreement in duplicate. One counterpart each has been delivered to Owner and Contractor. All portions of the Contract Documents have been signed or identified by Owner and Contractor or on their behalf.

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

OWNER:

CLAY COUNTY UTILITY AUTHORITY

By:_____
Jeremy D. Johnston, P.E., MBA
Executive Director

Attest:_____

Address for giving notices:

3176 Old Jennings Road
Middleburg, Florida 32068

Designated Representative:

Name: Warrick Sams, MBA, CPPO
Title: Program Manager
Address: 3176 Old Jennings Road
Middleburg, Florida 32068
Phone: (904) 213-2403
Facsimile: (904) 213-2469

CONTRACTOR:

_____

By:_____

[CORPORATE SEAL]

Attest:_____

Address for giving notices:

_____
_____

License No._____
(Where applicable)
Agent for service of process:

_____
_____
_____

(If CONTRACTOR is a corporation or a Partnership, attach evidence of authority to sign.)

Designated Representative:

Name:_____
Title:_____
Address:_____
_____
Phone:_____
Facsimile:_____

SECTION 00600

PUBLIC CONSTRUCTION PERFORMANCE AND PAYMENT BOND

BY THIS BOND, We _____ , as principal and _____ , a Corporation, as Surety, are bound to Clay County Utility Authority, an independent special district existing under Chapter 94-491, Laws of Florida, Special Acts of 1994, herein called Owner, in the sum of $_____, for performance, and the separate and additional sum of $_____ , for payment, for the payment of each of which we bind ourselves, our heirs, personal representatives, successors and assigns, jointly and severally.

THE CONDITION OF THIS BOND is that if Principal:

1. Performs the contract dated _____, 20__, between Principal and Owner for construction of_____ _____, the contract being made a part of this Bond by reference, at the times and in the manner prescribed in the contract; and

2. Promptly makes payment to all claimants, as defined in Section 255.05 (1), Florida Statutes, supplying Principal with labor, materials or supplies, used directly or indirectly by Principal in the prosecution of the work provided for in the contract; and

3. Pays Owner all losses, damages, expenses, costs, and attorney's fees, including appellate proceedings, that Owner sustains because of a default by Principal under the contract; and

4. Performs the guarantee of all work and materials furnished under the contract for the time specified in the contract, then this Bond is void, otherwise it remains in full force.

This Bond is to be deemed a Statutory Bond under Section 255.05, Florida Statutes, the provisions of which are hereby incorporated by reference and made a part hereof.

All interested parties are specifically directed to the following provisions regarding time and notice limitations as set out in Section 255.05(2), Florida Statutes:

A claimant, except a laborer, who is not in privity with the Contractor and who has not received payment for his labor, materials, or supplies, shall within 45 days after beginning to furnish labor, materials, or supplies for the prosecution of work, furnish the Contractor with a notice that he intends to look to the Bond for protection. A claimant who is not in privity with the Contractor and who has not received payment for his labor, materials or supplies shall, within 90 days after

performance of the labor or after complete delivery of the materials or supplies or, with respect to rental equipment, within 90 days after the date that the rental equipment was last on the job site available for use, deliver to the Contractor and to the Surety written notice of the performance of the labor or delivery of the materials or supplies and of the nonpayment. No action for labor, materials, or supplies may be instituted against the Contractor or the Surety unless both notices have been given. No action shall be instituted against the Contractor or the Surety on the Payment Bond or the payment provisions of a combined Payment and Performance Bond after one (1) year from the performance of the labor or completion of delivery of the materials or supplies.

Any changes in or under the Contract Documents and compliance or noncompliance with any formalities connected with the Contract or the changes does not affect Surety's obligation under this Bond.

Dated On:_____

Principal's Address:

_____

_____

_____

Surety's Address:

_____

_____

_____

Project Description and Location:

Fleming Island Wastewater Treatment Facility
BTU No. 3 Expansion
Clay County Utility Authority
CCUA Project No. 2203-132
CCUA Bid. No. 19/20-A9

_____
(Principal)

By: _____

_____
(Surety)

By: _____
(Attorney-in-Fact)

END OF SECTION

CLAY COUNTY UTILITY AUTHORITY
APPLICATION AND CERTIFICATION FOR PAYMENT

TO OWNER: CLAY COUNTY UTILITY AUTHORITY
3176 OLD JENNINGS ROAD
MIDDLEBURG, FL 32068

APPLICATION NO.:
PERIOD TO:
PROJECT NO.: 2203-132

Distribution to:
__ Owner
__ Engineer
__ Contractor

FROM CONTRACTOR:

CONTRACT FOR: FLEMING ISLAND WASTEWATER TREATMENT FACILITY - BTU NO. 3 EXPANSION (Bid No. 19/20-A9)

CONTRACTORS APPLICATION FOR PAYMENT

Application is made for payment, as shown below, in connection with the Contract.

1. ORIGINAL CONTRACT SUM $_____
2. Net change by Change Orders $_____
3. CONTRACT SUM TO DATE (LINE 1 + 2) $_____
4. TOTAL COMPLETED & STORED TO DATE $_____
5. RETAINAGE:
   a. _____% of Completed Work $_____
   b. _____% of Stored Material $_____
   Total Retainage (Line 5a + 5b) $_____
6. TOTAL EARNED LESS RETAINAGE $_____
   (Line 4 less Line 5 Total)
7. LESS PREVIOUS CERTIFICATES FOR PAYMENT
   (Line 6 from prior Certificate) $_____
8. CURRENT PAYMENT DUE $_____
9. BALANCE TO FINISH, INCLUDING RETAINAGE
   (Line 3 less Line 6) $_____

CHANGE ORDER SUMMARY	ADDITIONS	DEDUCTIONS
Total changes approved in previous months by Owner		
Total approved this Month		
TOTALS		
NET CHANGES by Change Order		

Attach a Schedule of Values which includes a description of work completed along with any supporting documentation.

The undersigned Contractor certifies that to the best of the Contractors knowledge, information and belief, the Work covered by this Application for Payment has been completed in accordance with the Contract Documents, that all amounts have been paid by the Contractor for Work for which previous Certificates for Payment were issued and payments received from the Owner, and that current payment shown herein is now due.

CONTRACTOR:
By: _____ Date:_____
State of:_____ County of:_____

Subscribed and sworn to before me this _____day of _____, 20__

Notary Public:_____

My Commission expires:

ENGINEER'S CERTIFICATE FOR PAYMENT

In accordance with the Contract Documents, based on on-site observations and the data comprising this application, the Engineer certifies to the Owner that to the best of the Engineers Knowledge, information and belief, the Work has progressed as indicated, the quality of the Work is in accordance with the Contract Documents, and the Contractor is entitled to payment of the AMOUNT CERTIFIED.

AMOUNT CERTIFIED $_____
(Attach explanation if amount certified differs from the amount applied for. Initial all figures on this Application and on the Continuation Sheet that are changed to conform to the amount certified.)

ENGINEER:
By:_____ Date:_____
This Certificate is not negotiable. The AMOUNT CERTIFIED is payable only to the Contractor named herein. Issuance, payment and acceptance of payment are without prejudice to any rights of the Owner or Contractor under this Contract.

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Section 00650

Request for Information (RFI)

Project: Fleming Island Wastewater Treatment Facility
BTU No. 3 Expansion

RFI No.: _____

Date: _____

Owner: CCUA Project No.: 2203-132 Project Manager: _____
Engineer: CDM Smith Inc. Project No.: 259364-242828 Project Manager: _____
Contractor: _____ Project No.: _____ Project Manager: _____

To: _____
From: _____

Contract document reference(s): _____

Description of RFI: □ Information □ Clarification □ Interpretation

Request for the items [*Described Below] / [in the Attached]:*

Requested By: _____ Date: _____
Signature

To: _____
From: _____

Response to RFI: □ Information □ Clarification □ Interpretation

Response to your request [*Described Below] / [in the Attached*]:

Response By: _____ Date: _____
Signature

CC: _____

Section 00650

Request for Information (RFI)

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SECTION 00660

Change Order Request Form

Project: Fleming Island Wastewater Treatment Facility
BTU No. 3 Expansion

Project No.: 2203-132
Change Order No.: _____

Change in Contract Times		**(Days)**		**(Days)**
Original Contract time:	Substantial Completion:	_____	Ready for Final Payment:	_____
Increased from previous C.O.:	Substantial Completion:	_____	Ready for Final Payment:	_____
Decreased from previous C.O.:	Substantial Completion:	_____	Ready for Final Payment:	_____
Contract time prior to this C.O.:	Substantial Completion:	_____	Ready for Final Payment:	_____
Increase in time on this C.O.:	Substantial Completion:	_____	Ready for Final Payment:	_____
Decrease in time on this C.O.:	Substantial Completion:	_____	Ready for Final Payment:	_____
Contract time with all approved C.O.s:	Substantial Completion:	_____	Ready for Final Payment:	_____

Change in Contract Price

Original Contract Price:	_____
Increased from previously approved C.O.:	_____
Decreased from previously approved C.O.:	_____
Increase in Contract price this C.O.:	_____
Decrease in Contract price this C.O.:	_____
Contract price with all approved C.O.s:	_____

The undersigned Contractor certifies to the best of my knowledge and belief: (1) all items and amounts shown above are correct; (2) all Work performed and Reimbursable Expenses fully comply with the terms and conditions of the Contract Documents; (3) all previous progress payments received from Clay County Utility Authority (CCUA), on account of Work done under the Contract referred to above have been applied to discharge in full all obligations of Contractor incurred in connection with Work covered by prior Applications for Payment; (4) title to all materials and deliverables incorporated in said Work or otherwise listed in or covered by this Application for Payment will pass to the CCUA at the time of payment clear of all liens, claims, security interests and encumbrances; (5) payment is due and has not been previously requested for these amounts; (6) no markup has been applied to reimbursable expenses.

_____
Contractor Name and Title

SECTION 00660

Change Order Request Form

Cost Break Down Form: (instructions: use a separate form for each individual work item)

Description	Unit	Quantity	Unit Cost	Extended Cost
Labor				$
Materials				$
Equipment				$
Maintenance of Traffic				$
Bonding				$
General Conditions				$
Overhead and Profit				$
				$
				$
Total firm fixed cost not to exceed amount:				$

Note: attached supporting documentation

RFI No. initiating the change: _____

Description: _____

_____

_____

Justification for the request: _____

_____

_____

_____

_____

State the firm fixed cost not to exceed amount in words:

Contractor Signature: _____ Date: _____

Printed Name: _____ Title: _____

SECTION 00700

GENERAL CONDITIONS

1.01 GENERAL

A. The GENERAL CONDITIONS for this contract are the Standard General Conditions of the Construction Contract. Document C-700, 2007 Edition, prepared by Engineers Joint Contract Documents Committee (EJCDC) and issued and published jointly by National Society of Professional Engineers (NSPE), ACEC, ASCE and CSI (EJCDC).

B. All provisions of the GENERAL CONDITIONS of EJCDC Document C-700 not amended or supplemental herein, or in the SUPPLEMENTARY CONDITIONS, shall remain in full force and effect.

1.02 SUPPLEMENTARY CONDITIONS

A. The provisions of the GENERAL CONDITIONS and the Modifications herein, may be further modified in the SUPPLEMENTARY CONDITIONS and in Division 1, GENERAL REQUIREMENTS.

END OF SECTION

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STANDARD GENERAL CONDITIONS OF THE CONSTRUCTION CONTRACT

Prepared by

ENGINEERS JOINT CONTRACT DOCUMENTS COMMITTEE

and

Issued and Published Jointly by

ACEC
American Council of Engineering Companies

The Associated General Contractors of America
Skill Responsibility Integrity

ASCE American Society of Civil Engineers

National Society of Professional Engineers
Professional Engineers in Private Practice

AMERICAN COUNCIL OF ENGINEERING COMPANIES

_____

ASSOCIATED GENERAL CONTRACTORS OF AMERICA

_____

AMERICAN SOCIETY OF CIVIL ENGINEERS

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PROFESSIONAL ENGINEERS IN PRIVATE PRACTICE
A Practice Division of the
NATIONAL SOCIETY OF PROFESSIONAL ENGINEERS

Endorsed by

CSI

CONSTRUCTION SPECIFICATIONS INSTITUTE

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STANDARD GENERAL CONDITIONS OF THE CONSTRUCTION CONTRACT

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ARTICLE 1 – DEFINITIONS AND TERMINOLOGY

1.01 *Defined Terms*

A. Wherever used in the Bidding Requirements or Contract Documents and printed with initial capital letters, the terms listed below will have the meanings indicated which are applicable to both the singular and plural thereof. In addition to terms specifically defined, terms with initial capital letters in the Contract Documents include references to identified articles and paragraphs, and the titles of other documents or forms.

1. *Addenda*—Written or graphic instruments issued prior to the opening of Bids which clarify, correct, or change the Bidding Requirements or the proposed Contract Documents.

2. *Agreement*—The written instrument which is evidence of the agreement between Owner and Contractor covering the Work.

3. *Application for Payment*—The form acceptable to Engineer which is to be used by Contractor during the course of the Work in requesting progress or final payments and which is to be accompanied by such supporting documentation as is required by the Contract Documents.

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

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

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

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

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

9. *Change Order*—A document recommended by Engineer which is signed by Contractor and Owner and authorizes an addition, deletion, or revision in the Work or an adjustment in the Contract Price or the Contract Times, issued on or after the Effective Date of the Agreement.

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

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

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

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

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

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

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

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

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

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

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

21. *General Requirements*—Sections of Division 1 of the Specifications.

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

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

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

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

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

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

28. *Notice to Proceed*—A written notice given by Owner to Contractor fixing the date on which the Contract Times will commence to run and on which Contractor shall start to perform the Work under the Contract Documents.

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

30. *PCBs*—Polychlorinated biphenyls.

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

32. *Progress Schedule*—A schedule, prepared and maintained by Contractor, describing the sequence and duration of the activities comprising the Contractor's plan to accomplish the Work within the Contract Times.

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

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

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

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

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

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

39. *Schedule of Values*—A schedule, prepared and maintained by Contractor, allocating portions of the Contract Price to various portions of the Work and used as the basis for reviewing Contractor's Applications for Payment.

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

41. *Site*—Lands or areas indicated in the Contract Documents as being furnished by Owner upon which the Work is to be performed, including rights-of-way and easements for access thereto, and such other lands furnished by Owner which are designated for the use of Contractor.

42. *Specifications*—That part of the Contract Documents consisting of written requirements for materials, equipment, systems, standards and workmanship as applied to the Work, and certain administrative requirements and procedural matters applicable thereto.

43. *Subcontractor*—An individual or entity having a direct contract with Contractor or with any other Subcontractor for the performance of a part of the Work at the Site.

44. *Substantial Completion*—The time at which the Work (or a specified part thereof) has progressed to the point where, in the opinion of Engineer, the Work (or a specified part thereof) is sufficiently complete, in accordance with the Contract Documents, so that the Work (or a specified part thereof) can be utilized for the purposes for which it is intended. The terms "substantially complete" and "substantially completed" as applied to all or part of the Work refer to Substantial Completion thereof.

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

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

47. *Supplier*—A manufacturer, fabricator, supplier, distributor, materialman, or vendor having a direct contract with Contractor or with any Subcontractor to furnish materials or equipment to be incorporated in the Work by Contractor or Subcontractor.

48. *Underground Facilities*—All underground pipelines, conduits, ducts, cables, wires, manholes, vaults, tanks, tunnels, or other such facilities or attachments, and any encasements containing such facilities, including those that convey electricity, gases, steam, liquid petroleum products, telephone or other communications, cable television, water, wastewater, storm water, other liquids or chemicals, or traffic or other control systems.

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

50. *Work*—The entire construction or the various separately identifiable parts thereof required to be provided under the Contract Documents. Work includes and is the result of performing or providing all labor, services, and documentation necessary to produce such construction, and furnishing, installing, and incorporating all materials and equipment into such construction, all as required by the Contract Documents.

51. *Work Change Directive*—A written statement to Contractor issued on or after the Effective Date of the Agreement and signed by Owner and recommended by Engineer ordering an

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addition, deletion, or revision in the Work, or responding to differing or unforeseen subsurface or physical conditions under which the Work is to be performed or to emergencies. A Work Change Directive will not change the Contract Price or the Contract Times but is evidence that the parties expect that the change ordered or documented by a Work Change Directive will be incorporated in a subsequently issued Change Order following negotiations by the parties as to its effect, if any, on the Contract Price or Contract Times.

1.02 *Terminology*

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

B. *Intent of Certain Terms or Adjectives:*

1. The Contract Documents include the terms "as allowed," "as approved," "as ordered," "as directed" or terms of like effect or import to authorize an exercise of professional judgment by Engineer. In addition, the adjectives "reasonable," "suitable," "acceptable," "proper," "satisfactory," or adjectives of like effect or import are used to describe an action or determination of Engineer as to the Work. It is intended that such exercise of professional judgment, action, or determination will be solely to evaluate, in general, the Work for compliance with the information in the Contract Documents and with the design concept of the Project as a functioning whole as shown or indicated in the Contract Documents (unless there is a specific statement indicating otherwise). The use of any such term or adjective is not intended to and shall not be effective to assign to Engineer any duty or authority to supervise or direct the performance of the Work, or any duty or authority to undertake responsibility contrary to the provisions of Paragraph 9.09 or any other provision of the Contract Documents.

C. *Day:*

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

D. *Defective:*

1. The word "defective," when modifying the word "Work," refers to Work that is unsatisfactory, faulty, or deficient in that it:

a. does not conform to the Contract Documents; or

b. does not meet the requirements of any applicable inspection, reference standard, test, or approval referred to in the Contract Documents; or

c. has been damaged prior to Engineer's recommendation of final payment (unless responsibility for the protection thereof has been assumed by Owner at Substantial Completion in accordance with Paragraph 14.04 or 14.05).

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

1. The word "furnish," when used in connection with services, materials, or equipment, shall mean to supply and deliver said services, materials, or equipment to the Site (or some other specified location) ready for use or installation and in usable or operable condition.

2. The word "install," when used in connection with services, materials, or equipment, shall mean to put into use or place in final position said services, materials, or equipment complete and ready for intended use.

3. The words "perform" or "provide," when used in connection with services, materials, or equipment, shall mean to furnish and install said services, materials, or equipment complete and ready for intended use.

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

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

ARTICLE 2 – PRELIMINARY MATTERS

2.01 *Delivery of Bonds and Evidence of Insurance*

A. When Contractor delivers the executed counterparts of the Agreement to Owner, Contractor shall also deliver to Owner such bonds as Contractor may be required to furnish.

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

2.02 *Copies of Documents*

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

2.03 *Commencement of Contract Times; Notice to Proceed*

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

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2.04 *Starting the Work*

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

2.05 *Before Starting Construction*

A. *Preliminary Schedules:* Within 10 days after the Effective Date of the Agreement (unless otherwise specified in the General Requirements), Contractor shall submit to Engineer for timely review:

1. a preliminary Progress Schedule indicating the times (numbers of days or dates) for starting and completing the various stages of the Work, including any Milestones specified in the Contract Documents;

2. a preliminary Schedule of Submittals; and

3. a preliminary Schedule of Values for all of the Work which includes quantities and prices of items which when added together equal the Contract Price and subdivides the Work into component parts in sufficient detail to serve as the basis for progress payments during performance of the Work. Such prices will include an appropriate amount of overhead and profit applicable to each item of Work.

2.06 *Preconstruction Conference; Designation of Authorized Representatives*

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

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

2.07 *Initial Acceptance of Schedules*

A. At least 10 days before submission of the first Application for Payment a conference attended by Contractor, Engineer, and others as appropriate will be held to review for acceptability to Engineer as provided below the schedules submitted in accordance with Paragraph 2.05.A. Contractor shall have an additional 10 days to make corrections and adjustments and to complete and resubmit the schedules. No progress payment shall be made to Contractor until acceptable schedules are submitted to Engineer.

1. The Progress Schedule will be acceptable to Engineer if it provides an orderly progression of the Work to completion within the Contract Times. Such acceptance will not impose on Engineer responsibility for the Progress Schedule, for sequencing, scheduling, or progress of

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the Work, nor interfere with or relieve Contractor from Contractor's full responsibility therefor.

2. Contractor's Schedule of Submittals will be acceptable to Engineer if it provides a workable arrangement for reviewing and processing the required submittals.

3. Contractor's Schedule of Values will be acceptable to Engineer as to form and substance if it provides a reasonable allocation of the Contract Price to component parts of the Work.

ARTICLE 3 – CONTRACT DOCUMENTS: INTENT, AMENDING, REUSE

3.01 *Intent*

A. The Contract Documents are complementary; what is required by one is as binding as if required by all.

B. It is the intent of the Contract Documents to describe a functionally complete project (or part thereof) to be constructed in accordance with the Contract Documents. Any labor, documentation, services, materials, or equipment that reasonably may be inferred from the Contract Documents or from prevailing custom or trade usage as being required to produce the indicated result will be provided whether or not specifically called for, at no additional cost to Owner.

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

3.02 *Reference Standards*

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

1. Reference to standards, specifications, manuals, or codes of any technical society, organization, or association, or to Laws or Regulations, whether such reference be specific or by implication, shall mean the standard, specification, manual, code, or Laws or Regulations in effect at the time of opening of Bids (or on the Effective Date of the Agreement if there were no Bids), except as may be otherwise specifically stated in the Contract Documents.

2. No provision of any such standard, specification, manual, or code, or any instruction of a Supplier, shall be effective to change the duties or responsibilities of Owner, Contractor, or Engineer, or any of their subcontractors, consultants, agents, or employees, from those set forth in the Contract Documents. No such provision or instruction shall be effective to assign to Owner, Engineer, or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors, any duty or authority to supervise or direct the performance of the Work or any duty or authority to undertake responsibility inconsistent with the provisions of the Contract Documents.

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3.03 *Reporting and Resolving Discrepancies*

A. *Reporting Discrepancies:*

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

2. *Contractor's Review of Contract Documents During Performance of Work*: If, during the performance of the Work, Contractor discovers any conflict, error, ambiguity, or discrepancy within the Contract Documents, or between the Contract Documents and (a) any applicable Law or Regulation , (b) any standard, specification, manual, or code, or (c) any instruction of any Supplier, then Contractor shall promptly report it to Engineer in writing. Contractor shall not proceed with the Work affected thereby (except in an emergency as required by Paragraph 6.16.A) until an amendment or supplement to the Contract Documents has been issued by one of the methods indicated in Paragraph 3.04.

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

B. *Resolving Discrepancies:*

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

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

b. the provisions of any Laws or Regulations applicable to the performance of the Work (unless such an interpretation of the provisions of the Contract Documents would result in violation of such Law or Regulation).

3.04 *Amending and Supplementing Contract Documents*

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

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

1. A Field Order;

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

3. Engineer's written interpretation or clarification.

3.05 *Reuse of Documents*

A. Contractor and any Subcontractor or Supplier shall not:

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

2. reuse any such Drawings, Specifications, other documents, or copies thereof on extensions of the Project or any other project without written consent of Owner and Engineer and specific written verification or adaptation by Engineer.

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

3.06 *Electronic Data*

A. Unless otherwise stated in the Supplementary Conditions, the data furnished by Owner or Engineer to Contractor, or by Contractor to Owner or Engineer, that may be relied upon are limited to the printed copies (also known as hard copies). Files in electronic media format of text, data, graphics, or other types are furnished only for the convenience of the receiving party. Any conclusion or information obtained or derived from such electronic files will be at the user's sole risk. If there is a discrepancy between the electronic files and the hard copies, the hard copies govern.

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

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

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

4.01 *Availability of Lands*

A. Owner shall furnish the Site. Owner shall notify Contractor of any encumbrances or restrictions not of general application but specifically related to use of the Site with which Contractor must

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

B. Upon reasonable written request, Owner shall furnish Contractor with a current statement of record legal title and legal description of the lands upon which the Work is to be performed and Owner's interest therein as necessary for giving notice of or filing a mechanic's or construction lien against such lands in accordance with applicable Laws and Regulations.

C. Contractor shall provide for all additional lands and access thereto that may be required for temporary construction facilities or storage of materials and equipment.

4.02 *Subsurface and Physical Conditions*

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

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

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

B. *Limited Reliance by Contractor on Technical Data Authorized:* Contractor may rely upon the accuracy of the "technical data" contained in such reports and drawings, but such reports and drawings are not Contract Documents. Such "technical data" is identified in the Supplementary Conditions. Except for such reliance on such "technical data," Contractor may not rely upon or make any claim against Owner or Engineer, or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors with respect to:

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

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

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

4.03 *Differing Subsurface or Physical Conditions*

A. *Notice:* If Contractor believes that any subsurface or physical condition that is uncovered or revealed either:

1. is of such a nature as to establish that any "technical data" on which Contractor is entitled to rely as provided in Paragraph 4.02 is materially inaccurate; or

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2. is of such a nature as to require a change in the Contract Documents; or

3. differs materially from that shown or indicated in the Contract Documents; or

4. is of an unusual nature, and differs materially from conditions ordinarily encountered and generally recognized as inherent in work of the character provided for in the Contract Documents;

then Contractor shall, promptly after becoming aware thereof and before further disturbing the subsurface or physical conditions or performing any Work in connection therewith (except in an emergency as required by Paragraph 6.16.A), notify Owner and Engineer in writing about such condition. Contractor shall not further disturb such condition or perform any Work in connection therewith (except as aforesaid) until receipt of written order to do so.

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

C. *Possible Price and Times Adjustments:*

1. The Contract Price or the Contract Times, or both, will be equitably adjusted to the extent that the existence of such differing subsurface or physical condition causes an increase or decrease in Contractor's cost of, or time required for, performance of the Work; subject, however, to the following:

   a. such condition must meet any one or more of the categories described in Paragraph 4.03.A; and

   b. with respect to Work that is paid for on a unit price basis, any adjustment in Contract Price will be subject to the provisions of Paragraphs 9.07 and 11.03.

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

   a. Contractor knew of the existence of such conditions at the time Contractor made a final commitment to Owner with respect to Contract Price and Contract Times by the submission of a Bid or becoming bound under a negotiated contract; or

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

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

3. If Owner and Contractor are unable to agree on entitlement to or on the amount or extent, if any, of any adjustment in the Contract Price or Contract Times, or both, a Claim may be made therefor as provided in Paragraph 10.05. However, neither Owner or Engineer, or any of their officers, directors, members, partners, employees, agents, consultants, or

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subcontractors shall be liable to Contractor for any claims, costs, losses, or damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) sustained by Contractor on or in connection with any other project or anticipated project.

4.04 *Underground Facilities*

A. *Shown or Indicated:* The information and data shown or indicated in the Contract Documents with respect to existing Underground Facilities at or contiguous to the Site is based on information and data furnished to Owner or Engineer by the owners of such Underground Facilities, including Owner, or by others. Unless it is otherwise expressly provided in the Supplementary Conditions:

1. Owner and Engineer shall not be responsible for the accuracy or completeness of any such information or data provided by others; and

2. the cost of all of the following will be included in the Contract Price, and Contractor shall have full responsibility for:

a. reviewing and checking all such information and data;

b. locating all Underground Facilities shown or indicated in the Contract Documents;

c. coordination of the Work with the owners of such Underground Facilities, including Owner, during construction; and

d. the safety and protection of all such Underground Facilities and repairing any damage thereto resulting from the Work.

B. *Not Shown or Indicated:*

1. If an Underground Facility is uncovered or revealed at or contiguous to the Site which was not shown or indicated, or not shown or indicated with reasonable accuracy in the Contract Documents, Contractor shall, promptly after becoming aware thereof and before further disturbing conditions affected thereby or performing any Work in connection therewith (except in an emergency as required by Paragraph 6.16.A), identify the owner of such Underground Facility and give written notice to that owner and to Owner and Engineer. Engineer will promptly review the Underground Facility and determine the extent, if any, to which a change is required in the Contract Documents to reflect and document the consequences of the existence or location of the Underground Facility. During such time, Contractor shall be responsible for the safety and protection of such Underground Facility.

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

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agree on entitlement to or on the amount or extent, if any, of any such adjustment in Contract Price or Contract Times, Owner or Contractor may make a Claim therefor as provided in Paragraph 10.05.

4.05 *Reference Points*

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

4.06 *Hazardous Environmental Condition at Site*

A. *Reports and Drawings:* The Supplementary Conditions identify those reports and drawings known to Owner relating to Hazardous Environmental Conditions that have been identified at the Site.

B. *Limited Reliance by Contractor on Technical Data Authorized:* Contractor may rely upon the accuracy of the "technical data" contained in such reports and drawings, but such reports and drawings are not Contract Documents. Such "technical data" is identified in the Supplementary Conditions. Except for such reliance on such "technical data," Contractor may not rely upon or make any claim against Owner or Engineer, or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors with respect to:

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

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

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

C. Contractor shall not be responsible for any Hazardous Environmental Condition uncovered or revealed at the Site which was not shown or indicated in Drawings or Specifications or identified in the Contract Documents to be within the scope of the Work. Contractor shall be responsible for a Hazardous Environmental Condition created with any materials brought to the Site by Contractor, Subcontractors, Suppliers, or anyone else for whom Contractor is responsible.

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

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Paragraph 6.16.A); and (iii) notify Owner and Engineer (and promptly thereafter confirm such notice in writing). Owner shall promptly consult with Engineer concerning the necessity for Owner to retain a qualified expert to evaluate such condition or take corrective action, if any. Promptly after consulting with Engineer, Owner shall take such actions as are necessary to permit Owner to timely obtain required permits and provide Contractor the written notice required by Paragraph 4.06.E.

E. Contractor shall not be required to resume Work in connection with such condition or in any affected area until after Owner has obtained any required permits related thereto and delivered written notice to Contractor: (i) specifying that such condition and any affected area is or has been rendered safe for the resumption of Work; or (ii) specifying any special conditions under which such Work may be resumed safely. If Owner and Contractor cannot agree as to entitlement to or on the amount or extent, if any, of any adjustment in Contract Price or Contract Times, or both, as a result of such Work stoppage or such special conditions under which Work is agreed to be resumed by Contractor, either party may make a Claim therefor as provided in Paragraph 10.05.

F. If after receipt of such written notice Contractor does not agree to resume such Work based on a reasonable belief it is unsafe or does not agree to resume such Work under such special conditions, then Owner may order the portion of the Work that is in the area affected by such condition to be deleted from the Work. If Owner and Contractor cannot agree as to entitlement to or on the amount or extent, if any, of an adjustment in Contract Price or Contract Times as a result of deleting such portion of the Work, then either party may make a Claim therefor as provided in Paragraph 10.05. Owner may have such deleted portion of the Work performed by Owner's own forces or others in accordance with Article 7.

G. To the fullest extent permitted by Laws and Regulations, Owner shall indemnify and hold harmless Contractor, Subcontractors, and Engineer, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to a Hazardous Environmental Condition, provided that such Hazardous Environmental Condition: (i) was not shown or indicated in the Drawings or Specifications or identified in the Contract Documents to be included within the scope of the Work, and (ii) was not created by Contractor or by anyone for whom Contractor is responsible. Nothing in this Paragraph 4.06.G shall obligate Owner to indemnify any individual or entity from and against the consequences of that individual's or entity's own negligence.

H. To the fullest extent permitted by Laws and Regulations, Contractor shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to a Hazardous Environmental Condition created by Contractor or by anyone for whom Contractor is responsible. Nothing in this Paragraph 4.06.H shall obligate Contractor to indemnify any individual or entity from and against the consequences of that individual's or entity's own negligence.

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

ARTICLE 5 – BONDS AND INSURANCE

5.01 *Performance, Payment, and Other Bonds*

A. Contractor shall furnish performance and payment bonds, each in an amount at least equal to the Contract Price as security for the faithful performance and payment of all of Contractor's obligations under the Contract Documents. These bonds shall remain in effect until one year after the date when final payment becomes due or until completion of the correction period specified in Paragraph 13.07, whichever is later, except as provided otherwise by Laws or Regulations or by the Contract Documents. Contractor shall also furnish such other bonds as are required by the Contract Documents.

B. All bonds shall be in the form prescribed by the Contract Documents except as provided otherwise by Laws or Regulations, and shall be executed by such sureties as are named in the list of "Companies Holding Certificates of Authority as Acceptable Sureties on Federal Bonds and as Acceptable Reinsuring Companies" as published in Circular 570 (amended) by the Financial Management Service, Surety Bond Branch, U.S. Department of the Treasury. All bonds signed by an agent or attorney-in-fact must be accompanied by a certified copy of that individual's authority to bind the surety. The evidence of authority shall show that it is effective on the date the agent or attorney-in-fact signed each bond.

C. If the surety on any bond furnished by Contractor is declared bankrupt or becomes insolvent or its right to do business is terminated in any state where any part of the Project is located or it ceases to meet the requirements of Paragraph 5.01.B, Contractor shall promptly notify Owner and Engineer and shall, within 20 days after the event giving rise to such notification, provide another bond and surety, both of which shall comply with the requirements of Paragraphs 5.01.B and 5.02.

5.02 *Licensed Sureties and Insurers*

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

5.03 *Certificates of Insurance*

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

B. Owner shall deliver to Contractor, with copies to each additional insured and loss payee identified in the Supplementary Conditions, certificates of insurance (and other evidence of

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insurance requested by Contractor or any other additional insured) which Owner is required to purchase and maintain.

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

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

E. The insurance and insurance limits required herein shall not be deemed as a limitation on Contractor's liability under the indemnities granted to Owner in the Contract Documents.

5.04 *Contractor's Insurance*

A. Contractor shall purchase and maintain such insurance as is appropriate for the Work being performed and as will provide protection from claims set forth below which may arise out of or result from Contractor's performance of the Work and Contractor's other obligations under the Contract Documents, whether it is to be performed by Contractor, any Subcontractor or Supplier, or by anyone directly or indirectly employed by any of them to perform any of the Work, or by anyone for whose acts any of them may be liable:

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

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

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

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

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

   b. by any other person for any other reason;

5. claims for damages, other than to the Work itself, because of injury to or destruction of tangible property wherever located, including loss of use resulting therefrom; and

6. claims for damages because of bodily injury or death of any person or property damage arising out of the ownership, maintenance or use of any motor vehicle.

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

1. with respect to insurance required by Paragraphs 5.04.A.3 through 5.04.A.6 inclusive, be written on an occurrence basis, include as additional insureds (subject to any customary

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exclusion regarding professional liability) Owner and Engineer, and any other individuals or entities identified in the Supplementary Conditions, all of whom shall be listed as additional insureds, and include coverage for the respective officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of all such additional insureds, and the insurance afforded to these additional insureds shall provide primary coverage for all claims covered thereby;

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

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

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

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

6. include completed operations coverage:

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

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

5.05 *Owner's Liability Insurance*

A. In addition to the insurance required to be provided by Contractor under Paragraph 5.04, Owner, at Owner's option, may purchase and maintain at Owner's expense Owner's own liability insurance as will protect Owner against claims which may arise from operations under the Contract Documents.

5.06 *Property Insurance*

A. Unless otherwise provided in the Supplementary Conditions, Owner shall purchase and maintain property insurance upon the Work at the Site in the amount of the full replacement cost thereof (subject to such deductible amounts as may be provided in the Supplementary Conditions or required by Laws and Regulations). This insurance shall:

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1. include the interests of Owner, Contractor, Subcontractors, and Engineer, and any other individuals or entities identified in the Supplementary Conditions, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, each of whom is deemed to have an insurable interest and shall be listed as a loss payee;

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

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

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

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

6. include testing and startup; and

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

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

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

D. Owner shall not be responsible for purchasing and maintaining any property insurance specified in this Paragraph 5.06 to protect the interests of Contractor, Subcontractors, or others in the Work to the extent of any deductible amounts that are identified in the Supplementary Conditions. The risk of loss within such identified deductible amount will be borne by Contractor, Subcontractors, or others suffering any such loss, and if any of them wishes property

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insurance coverage within the limits of such amounts, each may purchase and maintain it at the purchaser's own expense.

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

5.07 *Waiver of Rights*

A. Owner and Contractor intend that all policies purchased in accordance with Paragraph 5.06 will protect Owner, Contractor, Subcontractors, and Engineer, and all other individuals or entities identified in the Supplementary Conditions as loss payees (and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them) in such policies and will provide primary coverage for all losses and damages caused by the perils or causes of loss covered thereby. All such policies shall contain provisions to the effect that in the event of payment of any loss or damage the insurers will have no rights of recovery against any of the insureds or loss payees thereunder. Owner and Contractor waive all rights against each other and their respective officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them for all losses and damages caused by, arising out of or resulting from any of the perils or causes of loss covered by such policies and any other property insurance applicable to the Work; and, in addition, waive all such rights against Subcontractors and Engineer, and all other individuals or entities identified in the Supplementary Conditions as loss payees (and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them) under such policies for losses and damages so caused. None of the above waivers shall extend to the rights that any party making such waiver may have to the proceeds of insurance held by Owner as trustee or otherwise payable under any policy so issued.

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

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

2. loss or damage to the completed Project or part thereof caused by, arising out of, or resulting from fire or other insured peril or cause of loss covered by any property insurance maintained on the completed Project or part thereof by Owner during partial utilization pursuant to Paragraph 14.05, after Substantial Completion pursuant to Paragraph 14.04, or after final payment pursuant to Paragraph 14.07.

C. Any insurance policy maintained by Owner covering any loss, damage or consequential loss referred to in Paragraph 5.07.B shall contain provisions to the effect that in the event of payment of any such loss, damage, or consequential loss, the insurers will have no rights of recovery against Contractor, Subcontractors, or Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them.

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5.08 *Receipt and Application of Insurance Proceeds*

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

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

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

A. If either Owner or Contractor has any objection to the coverage afforded by or other provisions of the bonds or insurance required to be purchased and maintained by the other party in accordance with Article 5 on the basis of non-conformance with the Contract Documents, the objecting party shall so notify the other party in writing within 10 days after receipt of the certificates (or other evidence requested) required by Paragraph 2.01.B. Owner and Contractor shall each provide to the other such additional information in respect of insurance provided as the other may reasonably request. If either party does not purchase or maintain all of the bonds and insurance required of such party by the Contract Documents, such party shall notify the other party in writing of such failure to purchase prior to the start of the Work, or of such failure to maintain prior to any change in the required coverage. Without prejudice to any other right or remedy, the other party may elect to obtain equivalent bonds or insurance to protect such other party's interests at the expense of the party who was required to provide such coverage, and a Change Order shall be issued to adjust the Contract Price accordingly.

5.10 *Partial Utilization, Acknowledgment of Property Insurer*

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

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ARTICLE 6 – CONTRACTOR'S RESPONSIBILITIES

6.01 *Supervision and Superintendence*

A. Contractor shall supervise, inspect, and direct the Work competently and efficiently, devoting such attention thereto and applying such skills and expertise as may be necessary to perform the Work in accordance with the Contract Documents. Contractor shall be solely responsible for the means, methods, techniques, sequences, and procedures of construction. Contractor shall not be responsible for the negligence of Owner or Engineer in the design or specification of a specific means, method, technique, sequence, or procedure of construction which is shown or indicated in and expressly required by the Contract Documents.

B. At all times during the progress of the Work, Contractor shall assign a competent resident superintendent who shall not be replaced without written notice to Owner and Engineer except under extraordinary circumstances.

6.02 *Labor; Working Hours*

A. Contractor shall provide competent, suitably qualified personnel to survey and lay out the Work and perform construction as required by the Contract Documents. Contractor shall at all times maintain good discipline and order at the Site.

B. Except as otherwise required for the safety or protection of persons or the Work or property at the Site or adjacent thereto, and except as otherwise stated in the Contract Documents, all Work at the Site shall be performed during regular working hours. Contractor will not permit the performance of Work on a Saturday, Sunday, or any legal holiday without Owner's written consent (which will not be unreasonably withheld) given after prior written notice to Engineer.

6.03 *Services, Materials, and Equipment*

A. Unless otherwise specified in the Contract Documents, Contractor shall provide and assume full responsibility for all services, materials, equipment, labor, transportation, construction equipment and machinery, tools, appliances, fuel, power, light, heat, telephone, water, sanitary facilities, temporary facilities, and all other facilities and incidentals necessary for the performance, testing, start-up, and completion of the Work.

B. All materials and equipment incorporated into the Work shall be as specified or, if not specified, shall be of good quality and new, except as otherwise provided in the Contract Documents. All special warranties and guarantees required by the Specifications shall expressly run to the benefit of Owner. If required by Engineer, Contractor shall furnish satisfactory evidence (including reports of required tests) as to the source, kind, and quality of materials and equipment.

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

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6.04 *Progress Schedule*

A. Contractor shall adhere to the Progress Schedule established in accordance with Paragraph 2.07 as it may be adjusted from time to time as provided below.

1. Contractor shall submit to Engineer for acceptance (to the extent indicated in Paragraph 2.07) proposed adjustments in the Progress Schedule that will not result in changing the Contract Times. Such adjustments will comply with any provisions of the General Requirements applicable thereto.

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

6.05 *Substitutes and "Or-Equals"*

A. Whenever an item of material or equipment is specified or described in the Contract Documents by using the name of a proprietary item or the name of a particular Supplier, the specification or description is intended to establish the type, function, appearance, and quality required. Unless the specification or description contains or is followed by words reading that no like, equivalent, or "or-equal" item or no substitution is permitted, other items of material or equipment or material or equipment of other Suppliers may be submitted to Engineer for review under the circumstances described below.

1. *"Or-Equal" Items:* If in Engineer's sole discretion an item of material or equipment proposed by Contractor is functionally equal to that named and sufficiently similar so that no change in related Work will be required, it may be considered by Engineer as an "or-equal" item, in which case review and approval of the proposed item may, in Engineer's sole discretion, be accomplished without compliance with some or all of the requirements for approval of proposed substitute items. For the purposes of this Paragraph 6.05.A.1, a proposed item of material or equipment will be considered functionally equal to an item so named if:

a. in the exercise of reasonable judgment Engineer determines that:

1) it is at least equal in materials of construction, quality, durability, appearance, strength, and design characteristics;

2) it will reliably perform at least equally well the function and achieve the results imposed by the design concept of the completed Project as a functioning whole; and

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

b. Contractor certifies that, if approved and incorporated into the Work:

1) there will be no increase in cost to the Owner or increase in Contract Times; and

2) it will conform substantially to the detailed requirements of the item named in the Contract Documents.

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2. *Substitute Items:*

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

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

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

   d. Contractor shall make written application to Engineer for review of a proposed substitute item of material or equipment that Contractor seeks to furnish or use. The application:

      1) shall certify that the proposed substitute item will:

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

         b) be similar in substance to that specified, and

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

      2) will state:

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

         b) whether use of the proposed substitute item in the Work will require a change in any of the Contract Documents (or in the provisions of any other direct contract with Owner for other work on the Project) to adapt the design to the proposed substitute item, and

         c) whether incorporation or use of the proposed substitute item in connection with the Work is subject to payment of any license fee or royalty;

      3) will identify:

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

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

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

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

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

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

E. *Engineer's Cost Reimbursement*: Engineer will record Engineer's costs in evaluating a substitute proposed or submitted by Contractor pursuant to Paragraphs 6.05.A.2 and 6.05.B. Whether or not Engineer approves a substitute so proposed or submitted by Contractor, Contractor shall reimburse Owner for the reasonable charges of Engineer for evaluating each such proposed substitute. Contractor shall also reimburse Owner for the reasonable charges of Engineer for making changes in the Contract Documents (or in the provisions of any other direct contract with Owner) resulting from the acceptance of each proposed substitute.

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

6.06 *Concerning Subcontractors, Suppliers, and Others*

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

B. If the Supplementary Conditions require the identity of certain Subcontractors, Suppliers, or other individuals or entities to be submitted to Owner in advance for acceptance by Owner by a specified date prior to the Effective Date of the Agreement, and if Contractor has submitted a list thereof in accordance with the Supplementary Conditions, Owner's acceptance (either in writing or by failing to make written objection thereto by the date indicated for acceptance or objection in the Bidding Documents or the Contract Documents) of any such Subcontractor, Supplier, or other individual or entity so identified may be revoked on the basis of reasonable objection after due investigation. Contractor shall submit an acceptable replacement for the rejected Subcontractor, Supplier, or other individual or entity, and the Contract Price will be adjusted by the difference in the cost occasioned by such replacement, and an appropriate Change Order will be issued. No acceptance by Owner of any such Subcontractor, Supplier, or other individual or

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entity, whether initially or as a replacement, shall constitute a waiver of any right of Owner or Engineer to reject defective Work.

C. Contractor shall be fully responsible to Owner and Engineer for all acts and omissions of the Subcontractors, Suppliers, and other individuals or entities performing or furnishing any of the Work just as Contractor is responsible for Contractor's own acts and omissions. Nothing in the Contract Documents:

1. shall create for the benefit of any such Subcontractor, Supplier, or other individual or entity any contractual relationship between Owner or Engineer and any such Subcontractor, Supplier or other individual or entity; nor

2. shall create any obligation on the part of Owner or Engineer to pay or to see to the payment of any moneys due any such Subcontractor, Supplier, or other individual or entity except as may otherwise be required by Laws and Regulations.

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

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

F. The divisions and sections of the Specifications and the identifications of any Drawings shall not control Contractor in dividing the Work among Subcontractors or Suppliers or delineating the Work to be performed by any specific trade.

G. All Work performed for Contractor by a Subcontractor or Supplier will be pursuant to an appropriate agreement between Contractor and the Subcontractor or Supplier which specifically binds the Subcontractor or Supplier to the applicable terms and conditions of the Contract Documents for the benefit of Owner and Engineer. Whenever any such agreement is with a Subcontractor or Supplier who is listed as a loss payee on the property insurance provided in Paragraph 5.06, the agreement between the Contractor and the Subcontractor or Supplier will contain provisions whereby the Subcontractor or Supplier waives all rights against Owner, Contractor, Engineer, and all other individuals or entities identified in the Supplementary Conditions to be listed as insureds or loss payees (and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them) for all losses and damages caused by, arising out of, relating to, or resulting from any of the perils or causes of loss covered by such policies and any other property insurance applicable to the Work. If the insurers on any such policies require separate waiver forms to be signed by any Subcontractor or Supplier, Contractor will obtain the same.

6.07 *Patent Fees and Royalties*

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

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use is subject to patent rights or copyrights calling for the payment of any license fee or royalty to others, the existence of such rights shall be disclosed by Owner in the Contract Documents.

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

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

6.08 *Permits*

A. Unless otherwise provided in the Supplementary Conditions, Contractor shall obtain and pay for all construction permits and licenses. Owner shall assist Contractor, when necessary, in obtaining such permits and licenses. Contractor shall pay all governmental charges and inspection fees necessary for the prosecution of the Work which are applicable at the time of opening of Bids, or, if there are no Bids, on the Effective Date of the Agreement. Owner shall pay all charges of utility owners for connections for providing permanent service to the Work.

6.09 *Laws and Regulations*

A. Contractor shall give all notices required by and shall comply with all Laws and Regulations applicable to the performance of the Work. Except where otherwise expressly required by applicable Laws and Regulations, neither Owner nor Engineer shall be responsible for monitoring Contractor's compliance with any Laws or Regulations.

B. If Contractor performs any Work knowing or having reason to know that it is contrary to Laws or Regulations, Contractor shall bear all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such Work. However, it shall not be Contractor's responsibility to make certain that the Specifications and Drawings are in accordance with Laws and Regulations, but this shall not relieve Contractor of Contractor's obligations under Paragraph 3.03.

C. Changes in Laws or Regulations not known at the time of opening of Bids (or, on the Effective Date of the Agreement if there were no Bids) having an effect on the cost or time of performance of the Work shall be the subject of an adjustment in Contract Price or Contract Times. If Owner

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and Contractor are unable to agree on entitlement to or on the amount or extent, if any, of any such adjustment, a Claim may be made therefor as provided in Paragraph 10.05.

6.10 *Taxes*

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

6.11 *Use of Site and Other Areas*

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

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

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

3. To the fullest extent permitted by Laws and Regulations, Contractor shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to any claim or action, legal or equitable, brought by any such owner or occupant against Owner, Engineer, or any other party indemnified hereunder to the extent caused by or based upon Contractor's performance of the Work.

B. *Removal of Debris During Performance of the Work:* During the progress of the Work Contractor shall keep the Site and other areas free from accumulations of waste materials, rubbish, and other debris. Removal and disposal of such waste materials, rubbish, and other debris shall conform to applicable Laws and Regulations.

C. *Cleaning:* Prior to Substantial Completion of the Work Contractor shall clean the Site and the Work and make it ready for utilization by Owner. At the completion of the Work Contractor shall remove from the Site all tools, appliances, construction equipment and machinery, and surplus materials and shall restore to original condition all property not designated for alteration by the Contract Documents.

D. *Loading Structures:* Contractor shall not load nor permit any part of any structure to be loaded in any manner that will endanger the structure, nor shall Contractor subject any part of the Work or adjacent property to stresses or pressures that will endanger it.

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6.12 *Record Documents*

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

6.13 *Safety and Protection*

A. Contractor shall be solely responsible for initiating, maintaining and supervising all safety precautions and programs in connection with the Work. Such responsibility does not relieve Subcontractors of their responsibility for the safety of persons or property in the performance of their work, nor for compliance with applicable safety Laws and Regulations. Contractor shall take all necessary precautions for the safety of, and shall provide the necessary protection to prevent damage, injury or loss to:

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

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

3. other property at the Site or adjacent thereto, including trees, shrubs, lawns, walks, pavements, roadways, structures, utilities, and Underground Facilities not designated for removal, relocation, or replacement in the course of construction.

B. Contractor shall comply with all applicable Laws and Regulations relating to the safety of persons or property, or to the protection of persons or property from damage, injury, or loss; and shall erect and maintain all necessary safeguards for such safety and protection. Contractor shall notify owners of adjacent property and of Underground Facilities and other utility owners when prosecution of the Work may affect them, and shall cooperate with them in the protection, removal, relocation, and replacement of their property.

C. Contractor shall comply with the applicable requirements of Owner's safety programs, if any. The Supplementary Conditions identify any Owner's safety programs that are applicable to the Work.

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

E. All damage, injury, or loss to any property referred to in Paragraph 6.13.A.2 or 6.13.A.3 caused, directly or indirectly, in whole or in part, by Contractor, any Subcontractor, Supplier, or any other individual or entity directly or indirectly employed by any of them to perform any of the Work, or anyone for whose acts any of them may be liable, shall be remedied by Contractor (except damage or loss attributable to the fault of Drawings or Specifications or to the acts or omissions of Owner or Engineer or anyone employed by any of them, or anyone for whose acts

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any of them may be liable, and not attributable, directly or indirectly, in whole or in part, to the fault or negligence of Contractor or any Subcontractor, Supplier, or other individual or entity directly or indirectly employed by any of them).

F. Contractor's duties and responsibilities for safety and for protection of the Work shall continue until such time as all the Work is completed and Engineer has issued a notice to Owner and Contractor in accordance with Paragraph 14.07.B that the Work is acceptable (except as otherwise expressly provided in connection with Substantial Completion).

6.14 *Safety Representative*

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

6.15 *Hazard Communication Programs*

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

6.16 *Emergencies*

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

6.17 *Shop Drawings and Samples*

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

1. *Shop Drawings:*

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

b. Data shown on the Shop Drawings will be complete with respect to quantities, dimensions, specified performance and design criteria, materials, and similar data to show Engineer the services, materials, and equipment Contractor proposes to provide and to enable Engineer to review the information for the limited purposes required by Paragraph 6.17.D.

2. *Samples:*

a. Submit number of Samples specified in the Specifications.

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b. Clearly identify each Sample as to material, Supplier, pertinent data such as catalog numbers, the use for which intended and other data as Engineer may require to enable Engineer to review the submittal for the limited purposes required by Paragraph 6.17.D.

B. Where a Shop Drawing or Sample is required by the Contract Documents or the Schedule of Submittals, any related Work performed prior to Engineer's review and approval of the pertinent submittal will be at the sole expense and responsibility of Contractor.

C. *Submittal Procedures:*

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

a. reviewed and coordinated each Shop Drawing or Sample with other Shop Drawings and Samples and with the requirements of the Work and the Contract Documents;

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

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

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

2. Each submittal shall bear a stamp or specific written certification that Contractor has satisfied Contractor's obligations under the Contract Documents with respect to Contractor's review and approval of that submittal.

3. With each submittal, Contractor shall give Engineer specific written notice of any variations that the Shop Drawing or Sample may have from the requirements of the Contract Documents. This notice shall be both a written communication separate from the Shop Drawings or Sample submittal; and, in addition, by a specific notation made on each Shop Drawing or Sample submitted to Engineer for review and approval of each such variation.

D. *Engineer's Review:*

1. Engineer will provide timely review of Shop Drawings and Samples in accordance with the Schedule of Submittals acceptable to Engineer. Engineer's review and approval will be only to determine if the items covered by the submittals will, after installation or incorporation in the Work, conform to the information given in the Contract Documents and be compatible with the design concept of the completed Project as a functioning whole as indicated by the Contract Documents.

2. Engineer's review and approval will not extend to means, methods, techniques, sequences, or procedures of construction (except where a particular means, method, technique, sequence, or procedure of construction is specifically and expressly called for by the

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Contract Documents) or to safety precautions or programs incident thereto. The review and approval of a separate item as such will not indicate approval of the assembly in which the item functions.

3. Engineer's review and approval shall not relieve Contractor from responsibility for any variation from the requirements of the Contract Documents unless Contractor has complied with the requirements of Paragraph 6.17.C.3 and Engineer has given written approval of each such variation by specific written notation thereof incorporated in or accompanying the Shop Drawing or Sample. Engineer's review and approval shall not relieve Contractor from responsibility for complying with the requirements of Paragraph 6.17.C.1.

E. *Resubmittal Procedures:*

1. Contractor shall make corrections required by Engineer and shall return the required number of corrected copies of Shop Drawings and submit, as required, new Samples for review and approval. Contractor shall direct specific attention in writing to revisions other than the corrections called for by Engineer on previous submittals.

6.18 *Continuing the Work*

A. Contractor shall carry on the Work and adhere to the Progress Schedule during all disputes or disagreements with Owner. No Work shall be delayed or postponed pending resolution of any disputes or disagreements, except as permitted by Paragraph 15.04 or as Owner and Contractor may otherwise agree in writing.

6.19 *Contractor's General Warranty and Guarantee*

A. Contractor warrants and guarantees to Owner that all Work will be in accordance with the Contract Documents and will not be defective. Engineer and its officers, directors, members, partners, employees, agents, consultants, and subcontractors shall be entitled to rely on representation of Contractor's warranty and guarantee.

B. Contractor's warranty and guarantee hereunder excludes defects or damage caused by:

1. abuse, modification, or improper maintenance or operation by persons other than Contractor, Subcontractors, Suppliers, or any other individual or entity for whom Contractor is responsible; or

2. normal wear and tear under normal usage.

C. Contractor's obligation to perform and complete the Work in accordance with the Contract Documents shall be absolute. None of the following will constitute an acceptance of Work that is not in accordance with the Contract Documents or a release of Contractor's obligation to perform the Work in accordance with the Contract Documents:

1. observations by Engineer;

2. recommendation by Engineer or payment by Owner of any progress or final payment;

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3. the issuance of a certificate of Substantial Completion by Engineer or any payment related thereto by Owner;

4. use or occupancy of the Work or any part thereof by Owner;

5. any review and approval of a Shop Drawing or Sample submittal or the issuance of a notice of acceptability by Engineer;

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

7. any correction of defective Work by Owner.

6.20 *Indemnification*

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

B. In any and all claims against Owner or Engineer or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors by any employee (or the survivor or personal representative of such employee) of Contractor, any Subcontractor, any Supplier, or any individual or entity directly or indirectly employed by any of them to perform any of the Work, or anyone for whose acts any of them may be liable, the indemnification obligation under Paragraph 6.20.A shall not be limited in any way by any limitation on the amount or type of damages, compensation, or benefits payable by or for Contractor or any such Subcontractor, Supplier, or other individual or entity under workers' compensation acts, disability benefit acts, or other employee benefit acts.

C. The indemnification obligations of Contractor under Paragraph 6.20.A shall not extend to the liability of Engineer and Engineer's officers, directors, members, partners, employees, agents, consultants and subcontractors arising out of:

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

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

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6.21 *Delegation of Professional Design Services*

A. Contractor will not be required to provide professional design services unless such services are specifically required by the Contract Documents for a portion of the Work or unless such services are required to carry out Contractor's responsibilities for construction means, methods, techniques, sequences and procedures. Contractor shall not be required to provide professional services in violation of applicable law.

B. If professional design services or certifications by a design professional related to systems, materials or equipment are specifically required of Contractor by the Contract Documents, Owner and Engineer will specify all performance and design criteria that such services must satisfy. Contractor shall cause such services or certifications to be provided by a properly licensed professional, whose signature and seal shall appear on all drawings, calculations, specifications, certifications, Shop Drawings and other submittals prepared by such professional. Shop Drawings and other submittals related to the Work designed or certified by such professional, if prepared by others, shall bear such professional's written approval when submitted to Engineer.

C. Owner and Engineer shall be entitled to rely upon the adequacy, accuracy and completeness of the services, certifications or approvals performed by such design professionals, provided Owner and Engineer have specified to Contractor all performance and design criteria that such services must satisfy.

D. Pursuant to this Paragraph 6.21, Engineer's review and approval of design calculations and design drawings will be only for the limited purpose of checking for conformance with performance and design criteria given and the design concept expressed in the Contract Documents. Engineer's review and approval of Shop Drawings and other submittals (except design calculations and design drawings) will be only for the purpose stated in Paragraph 6.17.D.1.

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

ARTICLE 7 – OTHER WORK AT THE SITE

7.01 *Related Work at Site*

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

1. written notice thereof will be given to Contractor prior to starting any such other work; and

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

B. Contractor shall afford each other contractor who is a party to such a direct contract, each utility owner, and Owner, if Owner is performing other work with Owner's employees, proper and safe

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access to the Site, provide a reasonable opportunity for the introduction and storage of materials and equipment and the execution of such other work, and properly coordinate the Work with theirs. Contractor shall do all cutting, fitting, and patching of the Work that may be required to properly connect or otherwise make its several parts come together and properly integrate with such other work. Contractor shall not endanger any work of others by cutting, excavating, or otherwise altering such work; provided, however, that Contractor may cut or alter others' work with the written consent of Engineer and the others whose work will be affected. The duties and responsibilities of Contractor under this Paragraph are for the benefit of such utility owners and other contractors to the extent that there are comparable provisions for the benefit of Contractor in said direct contracts between Owner and such utility owners and other contractors.

C. If the proper execution or results of any part of Contractor's Work depends upon work performed by others under this Article 7, Contractor shall inspect such other work and promptly report to Engineer in writing any delays, defects, or deficiencies in such other work that render it unavailable or unsuitable for the proper execution and results of Contractor's Work. Contractor's failure to so report will constitute an acceptance of such other work as fit and proper for integration with Contractor's Work except for latent defects and deficiencies in such other work.

7.02 *Coordination*

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

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

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

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

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

7.03 *Legal Relationships*

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

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

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

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ARTICLE 8 – OWNER'S RESPONSIBILITIES

8.01 *Communications to Contractor*

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

8.02 *Replacement of Engineer*

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

8.03 *Furnish Data*

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

8.04 *Pay When Due*

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

8.05 *Lands and Easements; Reports and Tests*

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

8.06 *Insurance*

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

8.07 *Change Orders*

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

8.08 *Inspections, Tests, and Approvals*

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

8.09 *Limitations on Owner's Responsibilities*

A. The Owner shall not supervise, direct, or have control or authority over, nor be responsible for, Contractor's means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of Contractor to comply with Laws

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and Regulations applicable to the performance of the Work. Owner will not be responsible for Contractor's failure to perform the Work in accordance with the Contract Documents.

8.10 *Undisclosed Hazardous Environmental Condition*

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

8.11 *Evidence of Financial Arrangements*

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

8.12 *Compliance with Safety Program*

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

ARTICLE 9 – ENGINEER'S STATUS DURING CONSTRUCTION

9.01 *Owner's Representative*

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

9.02 *Visits to Site*

A. Engineer will make visits to the Site at intervals appropriate to the various stages of construction as Engineer deems necessary in order to observe as an experienced and qualified design professional the progress that has been made and the quality of the various aspects of Contractor's executed Work. Based on information obtained during such visits and observations, Engineer, for the benefit of Owner, will determine, in general, if the Work is proceeding in accordance with the Contract Documents. Engineer will not be required to make exhaustive or continuous inspections on the Site to check the quality or quantity of the Work. Engineer's efforts will be directed toward providing for Owner a greater degree of confidence that the completed Work will conform generally to the Contract Documents. On the basis of such visits and observations, Engineer will keep Owner informed of the progress of the Work and will endeavor to guard Owner against defective Work.

B. Engineer's visits and observations are subject to all the limitations on Engineer's authority and responsibility set forth in Paragraph 9.09. Particularly, but without limitation, during or as a result of Engineer's visits or observations of Contractor's Work, Engineer will not supervise, direct, control, or have authority over or be responsible for Contractor's means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of Contractor to comply with Laws and Regulations applicable to the performance of the Work.

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9.03 *Project Representative*

A. If Owner and Engineer agree, Engineer will furnish a Resident Project Representative to assist Engineer in providing more extensive observation of the Work. The authority and responsibilities of any such Resident Project Representative and assistants will be as provided in the Supplementary Conditions, and limitations on the responsibilities thereof will be as provided in Paragraph 9.09. If Owner designates another representative or agent to represent Owner at the Site who is not Engineer's consultant, agent or employee, the responsibilities and authority and limitations thereon of such other individual or entity will be as provided in the Supplementary Conditions.

9.04 *Authorized Variations in Work*

A. Engineer may authorize minor variations in the Work from the requirements of the Contract Documents which do not involve an adjustment in the Contract Price or the Contract Times and are compatible with the design concept of the completed Project as a functioning whole as indicated by the Contract Documents. These may be accomplished by a Field Order and will be binding on Owner and also on Contractor, who shall perform the Work involved promptly. If Owner or Contractor believes that a Field Order justifies an adjustment in the Contract Price or Contract Times, or both, and the parties are unable to agree on entitlement to or on the amount or extent, if any, of any such adjustment, a Claim may be made therefor as provided in Paragraph 10.05.

9.05 *Rejecting Defective Work*

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

9.06 *Shop Drawings, Change Orders and Payments*

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

B. In connection with Engineer's authority, and limitations thereof, as to design calculations and design drawings submitted in response to a delegation of professional design services, if any, see Paragraph 6.21.

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

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

9.07 *Determinations for Unit Price Work*

A. Engineer will determine the actual quantities and classifications of Unit Price Work performed by Contractor. Engineer will review with Contractor the Engineer's preliminary determinations

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on such matters before rendering a written decision thereon (by recommendation of an Application for Payment or otherwise). Engineer's written decision thereon will be final and binding (except as modified by Engineer to reflect changed factual conditions or more accurate data) upon Owner and Contractor, subject to the provisions of Paragraph 10.05.

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

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

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

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

D. When functioning as interpreter and judge under this Paragraph 9.08, Engineer will not show partiality to Owner or Contractor and will not be liable in connection with any interpretation or decision rendered in good faith in such capacity.

9.09 *Limitations on Engineer's Authority and Responsibilities*

A. Neither Engineer's authority or responsibility under this Article 9 or under any other provision of the Contract Documents nor any decision made by Engineer in good faith either to exercise or not exercise such authority or responsibility or the undertaking, exercise, or performance of any authority or responsibility by Engineer shall create, impose, or give rise to any duty in contract, tort, or otherwise owed by Engineer to Contractor, any Subcontractor, any Supplier, any other individual or entity, or to any surety for or employee or agent of any of them.

B. Engineer will not supervise, direct, control, or have authority over or be responsible for Contractor's means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of Contractor to comply with Laws and Regulations applicable to the performance of the Work. Engineer will not be responsible for Contractor's failure to perform the Work in accordance with the Contract Documents.

C. Engineer will not be responsible for the acts or omissions of Contractor or of any Subcontractor, any Supplier, or of any other individual or entity performing any of the Work.

D. Engineer's review of the final Application for Payment and accompanying documentation and all maintenance and operating instructions, schedules, guarantees, bonds, certificates of inspection, tests and approvals, and other documentation required to be delivered by Paragraph 14.07.A will only be to determine generally that their content complies with the requirements of,

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and in the case of certificates of inspections, tests, and approvals that the results certified indicate compliance with, the Contract Documents.

E. The limitations upon authority and responsibility set forth in this Paragraph 9.09 shall also apply to the Resident Project Representative, if any, and assistants, if any.

9.10 *Compliance with Safety Program*

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

ARTICLE 10 – CHANGES IN THE WORK; CLAIMS

10.01 *Authorized Changes in the Work*

A. Without invalidating the Contract and without notice to any surety, Owner may, at any time or from time to time, order additions, deletions, or revisions in the Work by a Change Order, or a Work Change Directive. Upon receipt of any such document, Contractor shall promptly proceed with the Work involved which will be performed under the applicable conditions of the Contract Documents (except as otherwise specifically provided).

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

10.02 *Unauthorized Changes in the Work*

A. Contractor shall not be entitled to an increase in the Contract Price or an extension of the Contract Times with respect to any work performed that is not required by the Contract Documents as amended, modified, or supplemented as provided in Paragraph 3.04, except in the case of an emergency as provided in Paragraph 6.16 or in the case of uncovering Work as provided in Paragraph 13.04.D.

10.03 *Execution of Change Orders*

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

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

2. changes in the Contract Price or Contract Times which are agreed to by the parties, including any undisputed sum or amount of time for Work actually performed in accordance with a Work Change Directive; and

3. changes in the Contract Price or Contract Times which embody the substance of any written decision rendered by Engineer pursuant to Paragraph 10.05; provided that, in lieu of

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executing any such Change Order, an appeal may be taken from any such decision in accordance with the provisions of the Contract Documents and applicable Laws and Regulations, but during any such appeal, Contractor shall carry on the Work and adhere to the Progress Schedule as provided in Paragraph 6.18.A.

10.04 *Notification to Surety*

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

10.05 *Claims*

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

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

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

1. deny the Claim in whole or in part;

2. approve the Claim; or

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

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

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

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

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

11.01 *Cost of the Work*

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

1. Payroll costs for employees in the direct employ of Contractor in the performance of the Work under schedules of job classifications agreed upon by Owner and Contractor. Such employees shall include, without limitation, superintendents, foremen, and other personnel employed full time on the Work. Payroll costs for employees not employed full time on the Work shall be apportioned on the basis of their time spent on the Work. Payroll costs shall include, but not be limited to, salaries and wages plus the cost of fringe benefits, which shall include social security contributions, unemployment, excise, and payroll taxes, workers' compensation, health and retirement benefits, bonuses, sick leave, vacation and holiday pay applicable thereto. The expenses of performing Work outside of regular working hours, on Saturday, Sunday, or legal holidays, shall be included in the above to the extent authorized by Owner.

2. Cost of all materials and equipment furnished and incorporated in the Work, including costs of transportation and storage thereof, and Suppliers' field services required in connection therewith. All cash discounts shall accrue to Contractor unless Owner deposits funds with Contractor with which to make payments, in which case the cash discounts shall accrue to Owner. All trade discounts, rebates and refunds and returns from sale of surplus materials and equipment shall accrue to Owner, and Contractor shall make provisions so that they may be obtained.

3. Payments made by Contractor to Subcontractors for Work performed by Subcontractors. If required by Owner, Contractor shall obtain competitive bids from subcontractors acceptable to Owner and Contractor and shall deliver such bids to Owner, who will then determine, with the advice of Engineer, which bids, if any, will be acceptable. If any subcontract provides that the Subcontractor is to be paid on the basis of Cost of the Work plus a fee, the Subcontractor's Cost of the Work and fee shall be determined in the same manner as Contractor's Cost of the Work and fee as provided in this Paragraph 11.01.

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4. Costs of special consultants (including but not limited to engineers, architects, testing laboratories, surveyors, attorneys, and accountants) employed for services specifically related to the Work.

5. Supplemental costs including the following:

    a. The proportion of necessary transportation, travel, and subsistence expenses of Contractor's employees incurred in discharge of duties connected with the Work.

    b. Cost, including transportation and maintenance, of all materials, supplies, equipment, machinery, appliances, office, and temporary facilities at the Site, and hand tools not owned by the workers, which are consumed in the performance of the Work, and cost, less market value, of such items used but not consumed which remain the property of Contractor.

    c. Rentals of all construction equipment and machinery, and the parts thereof whether rented from Contractor or others in accordance with rental agreements approved by Owner with the advice of Engineer, and the costs of transportation, loading, unloading, assembly, dismantling, and removal thereof. All such costs shall be in accordance with the terms of said rental agreements. The rental of any such equipment, machinery, or parts shall cease when the use thereof is no longer necessary for the Work.

    d. Sales, consumer, use, and other similar taxes related to the Work, and for which Contractor is liable, as imposed by Laws and Regulations.

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

    f. Losses and damages (and related expenses) caused by damage to the Work, not compensated by insurance or otherwise, sustained by Contractor in connection with the performance of the Work (except losses and damages within the deductible amounts of property insurance established in accordance with Paragraph 5.06.D), provided such losses and damages have resulted from causes other than the negligence of Contractor, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable. Such losses shall include settlements made with the written consent and approval of Owner. No such losses, damages, and expenses shall be included in the Cost of the Work for the purpose of determining Contractor's fee.

    g. The cost of utilities, fuel, and sanitary facilities at the Site.

    h. Minor expenses such as telegrams, long distance telephone calls, telephone service at the Site, express and courier services, and similar petty cash items in connection with the Work.

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

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

1. Payroll costs and other compensation of Contractor's officers, executives, principals (of partnerships and sole proprietorships), general managers, safety managers, engineers, architects, estimators, attorneys, auditors, accountants, purchasing and contracting agents, expediters, timekeepers, clerks, and other personnel employed by Contractor, whether at the Site or in Contractor's principal or branch office for general administration of the Work and not specifically included in the agreed upon schedule of job classifications referred to in Paragraph 11.01.A.1 or specifically covered by Paragraph 11.01.A.4, all of which are to be considered administrative costs covered by the Contractor's fee.

2. Expenses of Contractor's principal and branch offices other than Contractor's office at the Site.

3. Any part of Contractor's capital expenses, including interest on Contractor's capital employed for the Work and charges against Contractor for delinquent payments.

4. Costs due to the negligence of Contractor, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable, including but not limited to, the correction of defective Work, disposal of materials or equipment wrongly supplied, and making good any damage to property.

5. Other overhead or general expense costs of any kind and the costs of any item not specifically and expressly included in Paragraphs 11.01.A.

C. *Contractor's Fee:* When all the Work is performed on the basis of cost-plus, Contractor's fee shall be determined as set forth in the Agreement. When the value of any Work covered by a Change Order or when a Claim for an adjustment in Contract Price is determined on the basis of Cost of the Work, Contractor's fee shall be determined as set forth in Paragraph 12.01.C.

D. *Documentation:* Whenever the Cost of the Work for any purpose is to be determined pursuant to Paragraphs 11.01.A and 11.01.B, Contractor will establish and maintain records thereof in accordance with generally accepted accounting practices and submit in a form acceptable to Engineer an itemized cost breakdown together with supporting data.

11.02 *Allowances*

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

B. *Cash Allowances:*

1. Contractor agrees that:

a. the cash allowances include the cost to Contractor (less any applicable trade discounts) of materials and equipment required by the allowances to be delivered at the Site, and all applicable taxes; and

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b. Contractor's costs for unloading and handling on the Site, labor, installation, overhead, profit, and other expenses contemplated for the cash allowances have been included in the Contract Price and not in the allowances, and no demand for additional payment on account of any of the foregoing will be valid.

C. *Contingency Allowance:*

1. Contractor agrees that a contingency allowance, if any, is for the sole use of Owner to cover unanticipated costs.

D. Prior to final payment, an appropriate Change Order will be issued as recommended by Engineer to reflect actual amounts due Contractor on account of Work covered by allowances, and the Contract Price shall be correspondingly adjusted.

11.03 *Unit Price Work*

A. Where the Contract Documents provide that all or part of the Work is to be Unit Price Work, initially the Contract Price will be deemed to include for all Unit Price Work an amount equal to the sum of the unit price for each separately identified item of Unit Price Work times the estimated quantity of each item as indicated in the Agreement.

B. The estimated quantities of items of Unit Price Work are not guaranteed and are solely for the purpose of comparison of Bids and determining an initial Contract Price. Determinations of the actual quantities and classifications of Unit Price Work performed by Contractor will be made by Engineer subject to the provisions of Paragraph 9.07.

C. Each unit price will be deemed to include an amount considered by Contractor to be adequate to cover Contractor's overhead and profit for each separately identified item.

D. Owner or Contractor may make a Claim for an adjustment in the Contract Price in accordance with Paragraph 10.05 if:

1. the quantity of any item of Unit Price Work performed by Contractor differs materially and significantly from the estimated quantity of such item indicated in the Agreement; and

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

3. Contractor believes that Contractor is entitled to an increase in Contract Price as a result of having incurred additional expense or Owner believes that Owner is entitled to a decrease in Contract Price and the parties are unable to agree as to the amount of any such increase or decrease.

ARTICLE 12 – CHANGE OF CONTRACT PRICE; CHANGE OF CONTRACT TIMES

12.01 *Change of Contract Price*

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

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B. The value of any Work covered by a Change Order or of any Claim for an adjustment in the Contract Price will be determined as follows:

1. where the Work involved is covered by unit prices contained in the Contract Documents, by application of such unit prices to the quantities of the items involved (subject to the provisions of Paragraph 11.03); or

2. where the Work involved is not covered by unit prices contained in the Contract Documents, by a mutually agreed lump sum (which may include an allowance for overhead and profit not necessarily in accordance with Paragraph 12.01.C.2); or

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

C. *Contractor's Fee:* The Contractor's fee for overhead and profit shall be determined as follows:

1. a mutually acceptable fixed fee; or

2. if a fixed fee is not agreed upon, then a fee based on the following percentages of the various portions of the Cost of the Work:

   a. for costs incurred under Paragraphs 11.01.A.1 and 11.01.A.2, the Contractor's fee shall be 15 percent;

   b. for costs incurred under Paragraph 11.01.A.3, the Contractor's fee shall be five percent;

   c. where one or more tiers of subcontracts are on the basis of Cost of the Work plus a fee and no fixed fee is agreed upon, the intent of Paragraphs 12.01.C.2.a and 12.01.C.2.b is that the Subcontractor who actually performs the Work, at whatever tier, will be paid a fee of 15 percent of the costs incurred by such Subcontractor under Paragraphs 11.01.A.1 and 11.01.A.2 and that any higher tier Subcontractor and Contractor will each be paid a fee of five percent of the amount paid to the next lower tier Subcontractor;

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

   e. the amount of credit to be allowed by Contractor to Owner for any change which results in a net decrease in cost will be the amount of the actual net decrease in cost plus a deduction in Contractor's fee by an amount equal to five percent of such net decrease; and

   f. when both additions and credits are involved in any one change, the adjustment in Contractor's fee shall be computed on the basis of the net change in accordance with Paragraphs 12.01.C.2.a through 12.01.C.2.e, inclusive.

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12.02 *Change of Contract Times*

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

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

12.03 *Delays*

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

B. If Owner, Engineer, or other contractors or utility owners performing other work for Owner as contemplated by Article 7, or anyone for whom Owner is responsible, delays, disrupts, or interferes with the performance or progress of the Work, then Contractor shall be entitled to an equitable adjustment in the Contract Price or the Contract Times, or both. Contractor's entitlement to an adjustment of the Contract Times is conditioned on such adjustment being essential to Contractor's ability to complete the Work within the Contract Times.

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

D. Owner, Engineer, and their officers, directors, members, partners, employees, agents, consultants, or subcontractors shall not be liable to Contractor for any claims, costs, losses, or damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) sustained by Contractor on or in connection with any other project or anticipated project.

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

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

13.01 *Notice of Defects*

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

13.02 *Access to Work*

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

13.03 *Tests and Inspections*

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

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

1. for inspections, tests, or approvals covered by Paragraphs 13.03.C and 13.03.D below;

2. that costs incurred in connection with tests or inspections conducted pursuant to Paragraph 13.04.B shall be paid as provided in Paragraph 13.04.C; and

3. as otherwise specifically provided in the Contract Documents.

C. If Laws or Regulations of any public body having jurisdiction require any Work (or part thereof) specifically to be inspected, tested, or approved by an employee or other representative of such public body, Contractor shall assume full responsibility for arranging and obtaining such inspections, tests, or approvals, pay all costs in connection therewith, and furnish Engineer the required certificates of inspection or approval.

D. Contractor shall be responsible for arranging and obtaining and shall pay all costs in connection with any inspections, tests, or approvals required for Owner's and Engineer's acceptance of materials or equipment to be incorporated in the Work; or acceptance of materials, mix designs, or equipment submitted for approval prior to Contractor's purchase thereof for incorporation in the Work. Such inspections, tests, or approvals shall be performed by organizations acceptable to Owner and Engineer.

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E. If any Work (or the work of others) that is to be inspected, tested, or approved is covered by Contractor without written concurrence of Engineer, Contractor shall, if requested by Engineer, uncover such Work for observation.

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

13.04 *Uncovering Work*

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

B. If Engineer considers it necessary or advisable that covered Work be observed by Engineer or inspected or tested by others, Contractor, at Engineer's request, shall uncover, expose, or otherwise make available for observation, inspection, or testing as Engineer may require, that portion of the Work in question, furnishing all necessary labor, material, and equipment.

C. If it is found that the uncovered Work is defective, Contractor shall pay all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such uncovering, exposure, observation, inspection, and testing, and of satisfactory replacement or reconstruction (including but not limited to all costs of repair or replacement of work of others); and Owner shall be entitled to an appropriate decrease in the Contract Price. If the parties are unable to agree as to the amount thereof, Owner may make a Claim therefor as provided in Paragraph 10.05.

D. If the uncovered Work is not found to be defective, Contractor shall be allowed an increase in the Contract Price or an extension of the Contract Times, or both, directly attributable to such uncovering, exposure, observation, inspection, testing, replacement, and reconstruction. If the parties are unable to agree as to the amount or extent thereof, Contractor may make a Claim therefor as provided in Paragraph 10.05.

13.05 *Owner May Stop the Work*

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

13.06 *Correction or Removal of Defective Work*

A. Promptly after receipt of written notice, Contractor shall correct all defective Work, whether or not fabricated, installed, or completed, or, if the Work has been rejected by Engineer, remove it from the Project and replace it with Work that is not defective. Contractor shall pay all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers,

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architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such correction or removal (including but not limited to all costs of repair or replacement of work of others).

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

13.07 *Correction Period*

A. If within one year after the date of Substantial Completion (or such longer period of time as may be prescribed by the terms of any applicable special guarantee required by the Contract Documents) or by any specific provision of the Contract Documents, any Work is found to be defective, or if the repair of any damages to the land or areas made available for Contractor's use by Owner or permitted by Laws and Regulations as contemplated in Paragraph 6.11.A is found to be defective, Contractor shall promptly, without cost to Owner and in accordance with Owner's written instructions:

1. repair such defective land or areas; or

2. correct such defective Work; or

3. if the defective Work has been rejected by Owner, remove it from the Project and replace it with Work that is not defective, and

4. satisfactorily correct or repair or remove and replace any damage to other Work, to the work of others or other land or areas resulting therefrom.

B. If Contractor does not promptly comply with the terms of Owner's written instructions, or in an emergency where delay would cause serious risk of loss or damage, Owner may have the defective Work corrected or repaired or may have the rejected Work removed and replaced. All claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such correction or repair or such removal and replacement (including but not limited to all costs of repair or replacement of work of others) will be paid by Contractor.

C. In special circumstances where a particular item of equipment is placed in continuous service before Substantial Completion of all the Work, the correction period for that item may start to run from an earlier date if so provided in the Specifications.

D. Where defective Work (and damage to other Work resulting therefrom) has been corrected or removed and replaced under this Paragraph 13.07, the correction period hereunder with respect to such Work will be extended for an additional period of one year after such correction or removal and replacement has been satisfactorily completed.

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

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13.08 *Acceptance of Defective Work*

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

13.09 *Owner May Correct Defective Work*

A. If Contractor fails within a reasonable time after written notice from Engineer to correct defective Work, or to remove and replace rejected Work as required by Engineer in accordance with Paragraph 13.06.A, or if Contractor fails to perform the Work in accordance with the Contract Documents, or if Contractor fails to comply with any other provision of the Contract Documents, Owner may, after seven days written notice to Contractor, correct, or remedy any such deficiency.

B. In exercising the rights and remedies under this Paragraph 13.09, Owner shall proceed expeditiously. In connection with such corrective or remedial action, Owner may exclude Contractor from all or part of the Site, take possession of all or part of the Work and suspend Contractor's services related thereto, take possession of Contractor's tools, appliances, construction equipment and machinery at the Site, and incorporate in the Work all materials and equipment stored at the Site or for which Owner has paid Contractor but which are stored elsewhere. Contractor shall allow Owner, Owner's representatives, agents and employees, Owner's other contractors, and Engineer and Engineer's consultants access to the Site to enable Owner to exercise the rights and remedies under this Paragraph.

C. All claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) incurred or sustained by Owner in exercising the rights and remedies under this Paragraph 13.09 will be charged against Contractor, and a Change Order will be issued incorporating the necessary revisions in the Contract Documents with respect to the Work; and Owner shall be entitled to an appropriate decrease in the Contract Price. If the parties are unable to agree as to the amount of the adjustment, Owner may make a Claim therefor as provided in Paragraph 10.05. Such claims, costs, losses and damages will include but not be limited to all costs of repair, or replacement of work of others destroyed or damaged by correction, removal, or replacement of Contractor's defective Work.

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D. Contractor shall not be allowed an extension of the Contract Times because of any delay in the performance of the Work attributable to the exercise by Owner of Owner's rights and remedies under this Paragraph 13.09.

ARTICLE 14 – PAYMENTS TO CONTRACTOR AND COMPLETION

14.01 *Schedule of Values*

A. The Schedule of Values established as provided in Paragraph 2.07.A will serve as the basis for progress payments and will be incorporated into a form of Application for Payment acceptable to Engineer. Progress payments on account of Unit Price Work will be based on the number of units completed.

14.02 *Progress Payments*

A. *Applications for Payments:*

1. At least 20 days before the date established in the Agreement for each progress payment (but not more often than once a month), Contractor shall submit to Engineer for review an Application for Payment filled out and signed by Contractor covering the Work completed as of the date of the Application and accompanied by such supporting documentation as is required by the Contract Documents. If payment is requested on the basis of materials and equipment not incorporated in the Work but delivered and suitably stored at the Site or at another location agreed to in writing, the Application for Payment shall also be accompanied by a bill of sale, invoice, or other documentation warranting that Owner has received the materials and equipment free and clear of all Liens and evidence that the materials and equipment are covered by appropriate property insurance or other arrangements to protect Owner's interest therein, all of which must be satisfactory to Owner.

2. Beginning with the second Application for Payment, each Application shall include an affidavit of Contractor stating that all previous progress payments received on account of the Work have been applied on account to discharge Contractor's legitimate obligations associated with prior Applications for Payment.

3. The amount of retainage with respect to progress payments will be as stipulated in the Agreement.

B. *Review of Applications:*

1. Engineer will, within 10 days after receipt of each Application for Payment, either indicate in writing a recommendation of payment and present the Application to Owner or return the Application to Contractor indicating in writing Engineer's reasons for refusing to recommend payment. In the latter case, Contractor may make the necessary corrections and resubmit the Application.

2. Engineer's recommendation of any payment requested in an Application for Payment will constitute a representation by Engineer to Owner, based on Engineer's observations of the executed Work as an experienced and qualified design professional, and on Engineer's

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review of the Application for Payment and the accompanying data and schedules, that to the best of Engineer's knowledge, information and belief:

a. the Work has progressed to the point indicated;

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

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

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

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

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

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

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

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

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

d. to make any examination to ascertain how or for what purposes Contractor has used the moneys paid on account of the Contract Price, or

e. to determine that title to any of the Work, materials, or equipment has passed to Owner free and clear of any Liens.

5. Engineer may refuse to recommend the whole or any part of any payment if, in Engineer's opinion, it would be incorrect to make the representations to Owner stated in Paragraph 14.02.B.2. Engineer may also refuse to recommend any such payment or, because of subsequently discovered evidence or the results of subsequent inspections or tests, revise or revoke any such payment recommendation previously made, to such extent as may be necessary in Engineer's opinion to protect Owner from loss because:

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a. the Work is defective, or completed Work has been damaged, requiring correction or replacement;

b. the Contract Price has been reduced by Change Orders;

c. Owner has been required to correct defective Work or complete Work in accordance with Paragraph 13.09; or

d. Engineer has actual knowledge of the occurrence of any of the events enumerated in Paragraph 15.02.A.

C. *Payment Becomes Due:*

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

D. *Reduction in Payment:*

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

a. claims have been made against Owner on account of Contractor's performance or furnishing of the Work;

b. Liens have been filed in connection with the Work, except where Contractor has delivered a specific bond satisfactory to Owner to secure the satisfaction and discharge of such Liens;

c. there are other items entitling Owner to a set-off against the amount recommended; or

d. Owner has actual knowledge of the occurrence of any of the events enumerated in Paragraphs 14.02.B.5.a through 14.02.B.5.c or Paragraph 15.02.A.

2. If Owner refuses to make payment of the full amount recommended by Engineer, Owner will give Contractor immediate written notice (with a copy to Engineer) stating the reasons for such action and promptly pay Contractor any amount remaining after deduction of the amount so withheld. Owner shall promptly pay Contractor the amount so withheld, or any adjustment thereto agreed to by Owner and Contractor, when Contractor remedies the reasons for such action.

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

14.03 *Contractor's Warranty of Title*

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

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14.04 *Substantial Completion*

A. When Contractor considers the entire Work ready for its intended use Contractor shall notify Owner and Engineer in writing that the entire Work is substantially complete (except for items specifically listed by Contractor as incomplete) and request that Engineer issue a certificate of Substantial Completion.

B. Promptly after Contractor's notification, Owner, Contractor, and Engineer shall make an inspection of the Work to determine the status of completion. If Engineer does not consider the Work substantially complete, Engineer will notify Contractor in writing giving the reasons therefor.

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

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

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

14.05 *Partial Utilization*

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

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1. Owner at any time may request Contractor in writing to permit Owner to use or occupy any such part of the Work which Owner believes to be ready for its intended use and substantially complete. If and when Contractor agrees that such part of the Work is substantially complete, Contractor, Owner, and Engineer will follow the procedures of Paragraph 14.04.A through D for that part of the Work.

2. Contractor at any time may notify Owner and Engineer in writing that Contractor considers any such part of the Work ready for its intended use and substantially complete and request Engineer to issue a certificate of Substantial Completion for that part of the Work.

3. Within a reasonable time after either such request, Owner, Contractor, and Engineer shall make an inspection of that part of the Work to determine its status of completion. If Engineer does not consider that part of the Work to be substantially complete, Engineer will notify Owner and Contractor in writing giving the reasons therefor. If Engineer considers that part of the Work to be substantially complete, the provisions of Paragraph 14.04 will apply with respect to certification of Substantial Completion of that part of the Work and the division of responsibility in respect thereof and access thereto.

4. No use or occupancy or separate operation of part of the Work may occur prior to compliance with the requirements of Paragraph 5.10 regarding property insurance.

14.06 *Final Inspection*

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

14.07 *Final Payment*

A. *Application for Payment:*

1. After Contractor has, in the opinion of Engineer, satisfactorily completed all corrections identified during the final inspection and has delivered, in accordance with the Contract Documents, all maintenance and operating instructions, schedules, guarantees, bonds, certificates or other evidence of insurance, certificates of inspection, marked-up record documents (as provided in Paragraph 6.12), and other documents, Contractor may make application for final payment following the procedure for progress payments.

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

   a. all documentation called for in the Contract Documents, including but not limited to the evidence of insurance required by Paragraph 5.04.B.6;

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

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

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

3. In lieu of the releases or waivers of Liens specified in Paragraph 14.07.A.2 and as approved by Owner, Contractor may furnish receipts or releases in full and an affidavit of Contractor that: (i) the releases and receipts include all labor, services, material, and equipment for which a Lien could be filed; and (ii) all payrolls, material and equipment bills, and other indebtedness connected with the Work for which Owner might in any way be responsible, or which might in any way result in liens or other burdens on Owner's property, have been paid or otherwise satisfied. If any Subcontractor or Supplier fails to furnish such a release or receipt in full, Contractor may furnish a bond or other collateral satisfactory to Owner to indemnify Owner against any Lien.

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

1. If, on the basis of Engineer's observation of the Work during construction and final inspection, and Engineer's review of the final Application for Payment and accompanying documentation as required by the Contract Documents, Engineer is satisfied that the Work has been completed and Contractor's other obligations under the Contract Documents have been fulfilled, Engineer will, within ten days after receipt of the final Application for Payment, indicate in writing Engineer's recommendation of payment and present the Application for Payment to Owner for payment. At the same time Engineer will also give written notice to Owner and Contractor that the Work is acceptable subject to the provisions of Paragraph 14.09. Otherwise, Engineer will return the Application for Payment to Contractor, indicating in writing the reasons for refusing to recommend final payment, in which case Contractor shall make the necessary corrections and resubmit the Application for Payment.

C. *Payment Becomes Due:*

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

14.08 *Final Completion Delayed*

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

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14.09 *Waiver of Claims*

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

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

2. a waiver of all Claims by Contractor against Owner other than those previously made in accordance with the requirements herein and expressly acknowledged by Owner in writing as still unsettled.

ARTICLE 15 – SUSPENSION OF WORK AND TERMINATION

15.01 *Owner May Suspend Work*

A. At any time and without cause, Owner may suspend the Work or any portion thereof for a period of not more than 90 consecutive days by notice in writing to Contractor and Engineer which will fix the date on which Work will be resumed. Contractor shall resume the Work on the date so fixed. Contractor shall be granted an adjustment in the Contract Price or an extension of the Contract Times, or both, directly attributable to any such suspension if Contractor makes a Claim therefor as provided in Paragraph 10.05.

15.02 *Owner May Terminate for Cause*

A. The occurrence of any one or more of the following events will justify termination for cause:

1. Contractor's persistent failure to perform the Work in accordance with the Contract Documents (including, but not limited to, failure to supply sufficient skilled workers or suitable materials or equipment or failure to adhere to the Progress Schedule established under Paragraph 2.07 as adjusted from time to time pursuant to Paragraph 6.04);

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

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

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

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

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

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2. incorporate in the Work all materials and equipment stored at the Site or for which Owner has paid Contractor but which are stored elsewhere; and

3. complete the Work as Owner may deem expedient.

C. If Owner proceeds as provided in Paragraph 15.02.B, Contractor shall not be entitled to receive any further payment until the Work is completed. If the unpaid balance of the Contract Price exceeds all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) sustained by Owner arising out of or relating to completing the Work, such excess will be paid to Contractor. If such claims, costs, losses, and damages exceed such unpaid balance, Contractor shall pay the difference to Owner. Such claims, costs, losses, and damages incurred by Owner will be reviewed by Engineer as to their reasonableness and, when so approved by Engineer, incorporated in a Change Order. When exercising any rights or remedies under this Paragraph, Owner shall not be required to obtain the lowest price for the Work performed.

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

E. Where Contractor's services have been so terminated by Owner, the termination will not affect any rights or remedies of Owner against Contractor then existing or which may thereafter accrue. Any retention or payment of moneys due Contractor by Owner will not release Contractor from liability.

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

15.03 *Owner May Terminate For Convenience*

A. Upon seven days written notice to Contractor and Engineer, Owner may, without cause and without prejudice to any other right or remedy of Owner, terminate the Contract. In such case, Contractor shall be paid for (without duplication of any items):

1. completed and acceptable Work executed in accordance with the Contract Documents prior to the effective date of termination, including fair and reasonable sums for overhead and profit on such Work;

2. expenses sustained prior to the effective date of termination in performing services and furnishing labor, materials, or equipment as required by the Contract Documents in connection with uncompleted Work, plus fair and reasonable sums for overhead and profit on such expenses;

3. all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other

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dispute resolution costs) incurred in settlement of terminated contracts with Subcontractors, Suppliers, and others; and

4. reasonable expenses directly attributable to termination.

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

15.04 *Contractor May Stop Work or Terminate*

A. If, through no act or fault of Contractor, (i) the Work is suspended for more than 90 consecutive days by Owner or under an order of court or other public authority, or (ii) Engineer fails to act on any Application for Payment within 30 days after it is submitted, or (iii) Owner fails for 30 days to pay Contractor any sum finally determined to be due, then Contractor may, upon seven days written notice to Owner and Engineer, and provided Owner or Engineer do not remedy such suspension or failure within that time, terminate the Contract and recover from Owner payment on the same terms as provided in Paragraph 15.03.

B. In lieu of terminating the Contract and without prejudice to any other right or remedy, if Engineer has failed to act on an Application for Payment within 30 days after it is submitted, or Owner has failed for 30 days to pay Contractor any sum finally determined to be due, Contractor may, seven days after written notice to Owner and Engineer, stop the Work until payment is made of all such amounts due Contractor, including interest thereon. The provisions of this Paragraph 15.04 are not intended to preclude Contractor from making a Claim under Paragraph 10.05 for an adjustment in Contract Price or Contract Times or otherwise for expenses or damage directly attributable to Contractor's stopping the Work as permitted by this Paragraph.

ARTICLE 16 – DISPUTE RESOLUTION

16.01 *Methods and Procedures*

A. Either Owner or Contractor may request mediation of any Claim submitted to Engineer for a decision under Paragraph 10.05 before such decision becomes final and binding. The mediation will be governed by the Construction Industry Mediation Rules of the American Arbitration Association in effect as of the Effective Date of the Agreement. The request for mediation shall be submitted in writing to the American Arbitration Association and the other party to the Contract. Timely submission of the request shall stay the effect of Paragraph 10.05.E.

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

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

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

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

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

ARTICLE 17 – MISCELLANEOUS

17.01 *Giving Notice*

A. Whenever any provision of the Contract Documents requires the giving of written notice, it will be deemed to have been validly given if:

1. delivered in person to the individual or to a member of the firm or to an officer of the corporation for whom it is intended; or

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

17.02 *Computation of Times*

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

17.03 *Cumulative Remedies*

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

17.04 *Survival of Obligations*

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

17.05 *Controlling Law*

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

17.06 *Headings*

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

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SECTION 00800

SUPPLEMENTARY CONDITIONS TO THE GENERAL CONDITIONS

The following supplements modify, change from or add to the Standard General Conditions of the Construction Contract, EJCDC Document C-700, 2007 Edition. Where any Article of the General Conditions is modified or any Paragraph, Subparagraph or Clause thereof is modified or deleted by these supplements, the unaltered provisions shall remain in effect.

ARTICLE 1 – DEFINITIONS AND TERMINOLOGY

SC-1.01.A Add the following sentence to "27. Notice of Award": "When requested by OWNER, the Notice of Award may be issued by the ENGINEER."

SC-1.01.A Add the following sentence to "28. Notice to Proceed": "When requested by OWNER, the Notice to Proceed may be issued by ENGINEER."

SC 1.01.A Add the following new Defined Terms:

53. ARCHITECT/ENGINEER – The person, firm or corporation named as the ENGINEER in the Agreement.

54. Provide – As used in the Project Manual, means to furnish and install, complete and ready for intended use.

55. Product - As used in the Project Manual, includes materials, fabrications, systems and equipment.

56. Proprietary Item - As used in the Project Manual, includes goods, equipment, or materials integrated into the operations; considered strategic; requires compatibility with existing goods, equipment, or materials; or which could not be replaced or incorporated without substantial expenditures and the CONTRACTOR shall include the specific item specified from the manufacturer or supplier indicated.

ARTICLE 2 – PRELIMINARY MATTERS

SC-2.02.A In the first line, change the term "…ten…" to read"…three…".

SC-2.03.A Delete Paragraph 2.03.A in its entirety and replace with the following:

"2.03 Commencement of Contract Times: Notice to Proceed

A. The date of commencement of the Work is the date established in a Notice to Proceed. If there is no Notice to Proceed, it shall be the date of the OWNER-CONTRACTOR Agreement or such other date as may be established therein."

SC-2.05.A Add the following new subparagraphs to paragraph 2.05A:

"4. CONTRACTOR shall perform no portion of the Work at any time without Contract Documents or, where specified, approved Shop Drawings for such portion of the Work.

5. By executing the Contract, CONTRACTOR represents that he has visited the site, familiarized himself with the local conditions under which the Work is to be performed, and correlated his observations with the requirements of the Contract Documents."

SC-2.05.B Add the following new subparagraphs to paragraph 2.05:

"B. *Notice of Commencement*: Prior to starting construction, the CONTRACTOR shall record a Notice of Commencement in the Clay County Clerk's office and forthwith post either a certified copy thereof or a notarized statement that the Notice of Commencement has been filed for recording along with a copy thereof at the job site.

1. The CONTRACTOR shall submit a copy of the Notice of Commencement to the OWNER and ENGINEER for review.

2. The Notice of Commencement shall comply with the requirements of Chapter 713.13 Florida Statues.

3. The Notice of Commencement shall reference that the CONTRACTOR has furnished a Payment Bond for the improvement of real property and the OWNER will look to the CONTRACTOR's Payment Bond for protection on the work in accordance with Chapter 713.23 Florida Statues."

ARTICLE 3 – CONTRACT DOCUMENTS: INTENT, AMENDING, REUSE

SC-3.01.B Add the following sentence to Paragraph 3.01B: "CONTRACTOR shall be responsible for the construction and coordination of the parts of the Project, and all systems provided shall be completely compatible and fully functional without additional cost to OWNER."

SC-3.02.A. Add the following new subparagraph to paragraph 3.02.A:

"3. Sections of Division One - General Requirements govern the execution of all sections of the Specifications."

ARTICLE 4 - AVAILABILITY OF LANDS; SUBSURFACE AND PHYSICAL CONDITIONS; REFERENCED POINTS

SC-4.02 Add the following new paragraph(s) immediately after paragraph 4.02.B:

"C. In the preparation of Drawing and Specifications, ENGINEER or ENGINEER's Consultants relied upon the following reports of explorations and tests of subsurface conditions at the Site:

1. *Report of Geotechnical Exploration, CCUA Fleming Island Wastewater Treatment Facility, prepared by Meskel & Associates Engineering dated September 1, 2020.*

D. These reports and drawings are not part of the Contract Documents, but the "technical data" contained therein upon which CONTRACTOR may rely as identified and established above are incorporated therein by reference. CONTRACTOR is not entitled to rely upon other information and data utilized by ENGINEER and ENGINEER's Consultants in the preparation of Drawings and Specifications."

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

"A. No reports on drawings related to Hazardous Environmental Conditions are known to Owner or Engineer.

B. Not Used."

ARTICLE 5 - BONDS AND INSURANCE

SC-5.04.A In the first line of Paragraph 5.04.A, following the word" ...maintain...", insert the words, "...in a company or companies licensed to do business in the State of Florida by an insurer holding a current certificate of authority pursuant to Chapter 624, F. S,...".

SC-5.04.A. 1 Add the following to the end of the paragraph. "Contractor's claiming a worker's compensation statutory exemption shall not be allowed to perform work under this Agreement without a separate worker's compensation policy;"

SC-5.04 Add the following new paragraph immediately after paragraph 5.04.B.6.

7. The General Liability and Workers Compensation policies shall be endorsed to provide a waiver of underwriter's rights of subrogation in favor of the Owner.

8. The General Liability policy shall designate the Owner as an Additional Insured.

9. Such insurance shall list the Owner as a named insurance certificate holder.

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

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

1. Worker's Compensation, and related coverages under paragraphs 5.04.A.1 and A.2 of the General Conditions:

a.	State	Statutory
b.	Applicable Federal (e.g. Longshoreman's, Harbor Workers' Compensation Act or Jones Act):	Statutory
c.	Employer's Liability	Limits Provide Below

2. Contractor's General Liability under paragraphs 5.04.A.3 through A.6 of the General Conditions which shall include completed operations and product liability coverages and eliminate the exclusion with respect to property under the care, custody and control of Contractor:

a.	General Aggregate	$2,000,000
b.	Products - Completed Operations Aggregate	$1,000,000
c.	Personal and Advertising Injury	$1,000,000
d.	Each Occurrence (Bodily injury and Property Damage)	$1,000,000
e.	Property Damage liability insurance will provide Explosion, Collapse and Underground coverages where applicable.	
f.	Excess or Umbrella Liability	
	1) General Aggregate	$1,000,000
	2) Each Occurrence	$1,000,000

3. Automobile Liability under paragraph 5.04.A.6 of the General Conditions:

   a. Combined Single Limit per occurrence of $ 1,000,000

4. The Contractual Liability coverage required by paragraph 5.04 of the General Conditions shall provide coverage for not less than the following amounts:

   a. Bodily Injury
      Each Accident $1,000,000
      Annual Aggregate $1,000,000

   b. Property Damage:
      Each Accident $1,000,000
      Annual Aggregate $1,000,000

5. Builders Risk Full Replacement

6. Installation Floater Full Replacement

7. Environmental Pollution Liability Bodily injury, Property Damage and Cleanup cost.

   a. Each Occurrence $1,000,000
      Annual Aggregate $1,000,000

8. Environmental Impairment Liability Insurance:
   a. sudden and accidental occurrences $1,000,000
      non-sudden occurrences $1,000,000

SC-5.05.A. Delete Section in its entirety and insert the following in its place:

5.05 Contractor's Liability Insurance

A. In addition to the insurance required to be provided by Contractor under Paragraph 5.04, Contractor may purchase and maintain at Contractor's expense Contractor's own liability insurance as will protect Owner against claims which may arise from operations under the Contract Documents.

B. In addition to the insurance required to be provided by Contractor under Paragraph 5.04, Contractor shall purchase and maintain at Contractor's expense ensuing loss

provision that includes faulty design, faulty materials, faulty workmanship or mechanical breakdown for the full replacement cost of the project.

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

A. The CONTRACTOR shall purchase and maintain property insurance upon the Work at the Site in the amount of the Total Project Cost thereof, including soft costs. Any exclusions or provisions in the insurance maintained by the CONTRACTOR that excludes coverage for work contemplated in this Agreement shall be deemed unacceptable and shall be considered breach of contract. CONTRACTOR's insurance coverage shall be primary insurance as respects to the OWNER for all applicable policies. The coverages, limits and/or endorsements required herein protect the primary interests of the OWNER, and these coverages, limits and/or endorsements shall in no way be required to be relied upon when assessing the extent or determining appropriate types and limits of coverage to protect the CONTRACTOR against any loss exposures, whether as a result of this Agreement or otherwise. This property insurance shall:

1. include the interests of OWNER, CONTRACTOR, Subcontractors, and any other individuals or entities identified in the Supplementary Conditions, and the officers, directors, partners, employees, agents and other consultants and subcontractors of any of them each of whom is deemed to have an insurable interest and shall be listed as an insured or additional insured. The CONTRACTOR's insurance coverage shall be primary insurance as respects to the Owner, its officials, employees, and volunteers. Any insurance or self-insurance maintained by the OWNER, its officials, employees, or volunteers shall be excess of the CONTRACTOR's insurance and shall be non-contributory.;

2. for the installation of property and/or equipment be written on a Builder's Risk All Risk, Special Risk, or Special Causes of loss policy form that shall at least include insurance for physical loss and damage to the Work, property, temporary buildings, temporary structures, temporary works, falsework, underground works, site work, paving, machinery, foundations, pipework, site preparation, excavations, equipment breakdown for cold testing, hot testing, waiver of occupancy clause endorsement, materials and equipment in transit and shall insure against at least the following perils or causes or loss: fire; explosion; lightning extended coverage; theft, vandalism and malicious mischief; flood with no coinsurance clause; rising water; collapse; debris removal; demolition occasioned by enforcement of Laws and Regulations; wind; hurricane, tornado, and windstorm with no coinsurance clause; water damage; mechanical breakdown; and such other perils or causes of loss as may be specifically required by the Supplementary Conditions. The Builders Risk should include waivers of subrogation to the extent damage is covered by the Builders Risk policy in favor of the OWNER, and the policy itself must allow for a written waiver of subrogation. Named Windstorm Deductibles, if any, must be disclosed. The policy shall contain no coinsurance clauses and note the individual coverages.

3. for the installation of materials and supplies include an Installation Floater that shall at least include all materials, equipment, and supplies in CONTRACTOR's care, custody or control intended for installation at the Work site including transit to and from the Work site, awaiting and during installation, equipment breakdown for cold testing and hot testing such as: plumbing,

HVAC, underground works, electrical systems, machinery, equipment, flooring, roofing, site piping, well casings, pumps, motors, meters, instrumentation and controls, windows, doors, generators, fixtures, hatches, lights, fencing, railings, ladders, walkways, instruments of transit, moveable goods, etc. The Installation Floater shall cover losses caused by: fire; lightning extended coverage; theft; explosion; vandalism and malicious mischief; flood with no coinsurance clause; rising water; hurricane, tornado, and windstorm with no coinsurance clause; water damage, and such other perils or causes of loss as may be specifically required by the Supplementary Conditions. The policy shall contain no coinsurance clauses and note the individual coverages.

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

5. cover property, supplies, materials and equipment stored at the Site or at another location in CONTRACTOR's care, custody or control including transit to and from the Work site;

6. allow for partial utilization of the Work by OWNER and include a waiver of occupancy clause endorsement;

7. include testing and startup including equipment breakdown for cold testing and hot testing;

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

B. The CONTRACTOR has the sole responsibility for all insurance premiums or self-insured retention and shall be fully and solely responsible for any costs or expenses as a result of a coverage deductible, co-insurance penalty, or self-insured retention; including any loss not covered because of the operation of such deductible, co-insurance penalty, self-insured retention, or coverage exclusion or limitation. Any costs for adding the OWNER as an Additional Insured shall be at the CONTRACTOR's expense.

C. The policies of insurance required to be purchased and maintained by CONTRACTOR in accordance with this paragraph SC-5.06 shall comply with the requirements of paragraph 5.06.C of the General Conditions.

SC-5.06.B Delete paragraph 5.06.B in its entirety and insert in its place:

B. Contractor shall be responsible for any deductibles or self-insured certificates.

SC–5.06.C Delete and replace the policies of insurance required to be purchased and maintained by the Contractor, in accordance with this paragraph SC-5.06 shall comply with the requirements of paragraphs in 5.06C of the general conditions.

SC-5.06.E Delete Paragraph 5.06 E and replace with the following:

E. Environmental Pollution Liability Insurance: Shall be maintained by the Contractor for sudden and gradual occurrences arising out of the work being performed by or on behalf of the Contractor under this Contract and include. Coverage shall include but not be limited to, all hazardous materials identified under said Contract and all materials and substances that are designated or defined as hazardous by Florida or Federal law or by the rules or regulations of Florida or any Federal Agency. Coverage shall respond to claims for pollution condition resulting in bodily injury and property damage to others and for clean-up costs. The extended claims reporting period following completion of the task, shall no be less than thirty-six (36) months. Deductible applicable subject to the written approval of the Owner and shall be the responsibility of the Contractor. The limit of coverage shall not be less than:

Bodily Injury, Property Damage and Clean Up Costs	$1,000,000.00 Each Occurrence and Aggregate

SC-5.06.F Add Paragraph 5.06 F with the following:

D. Environmental Impairment Liability Insurance: The CONTRACTOR shall designate the disposal site and furnish a Certificate of Insurance from the disposal facility for Environmental Impairment Liability Insurance, covering liability for sudden and accidental occurrences.

sudden and accidental occurrences	$1,000,000.00 Each Occurrence
non-sudden occurrences	$1,000,000.00 Each Occurrence

ARTICLE 6 - CONTRACTORS'S RESPONSIBILITIES

SC-6.01C Add the following after Paragraph 6.01.B: " The CONTRACTOR's Project Manager and Superintendent shall be employed by the CONTRACTOR's firm and have at least five (5) years of verifiable experience matching the scope, type and complexity of construction services performed on this project. Failure to provide experienced project management during the Agreement shall be deemed unacceptable and shall be considered breach of contract."

SC-6.03.B Add the following after Paragraph 6.03.B: "The use of asbestos or asbestos-based fiber materials is prohibited in this Project."

SC-6.06. Add the following sentence at the end of paragraph 6.06.G:

"H. OWNER or ENGINEER may furnish to any such Subcontractor, Supplier, or other individuals or entity, to the extent practicable, information about amounts paid to CONTRACTOR on account of Work performed for CONTRACTOR by a particular Subcontractor, Supplier, or other individual or entity."

SC-6.13 Add the following new paragraph:

"C. The Occupational Safety and Health Administration excavation safety standards, 29 CFR 1926.650 Subpart P trench safety standards are in effect during the period of construction of the Project. In compliance with current State of Florida statutes, the Contractor or subcontractor performing trench excavation work on the Project shall comply with the applicable trench safety standards."

SC-6.13 Add the following new paragraph at the end of paragraph 6.13 D:

"E. All Contractors or Entities performing or furnishing any work for Clay County Utility Authority ("CCUA") must carry Workers' Compensation insurance coverage for themselves and for any employees, independent contractors, and/or other individuals who perform work on the project under the supervision of the Contractor or Entity. All those providing work shall furnish CCUA with evidence, which shall be in form and content satisfactory to CCUA, of current Workers' Compensation insurance coverage secured by the Contractor or Entity for themselves and employees, independent contractors, and/or any other individuals performing or furnishing any of the work on the project before any Contractor or Entity, employees, independent contractors and/or any other individuals begin work on the project."

SC-6.16 Add the following at the end of paragraph 6.16 A:

"Emergencies affecting the safety or protection of persons or the Work or property at the Site or adjacent thereto shall be immediately corrected upon notification by the Owner/Engineer or within 60-minutes or less when notified after normal working hours."

SC-6.17 Delete Paragraph 6.17.D.1 and replace with the following:
"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 submittal is limited to conformance with general design concepts and overall compliance with the information in the Contract Documents only, and is not intended to be an exhaustive verification or an approval of any changes to the Contract Documents. Reviews shall not relieve the Contractor from the responsibility of conformance and compliance with the Contract Documents, specified parameters, coordinating with other trades, permit criteria, Jurisdictional Agencies, Owner Direct Purchases, inspection requirements, and other submittals."

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

"F. Contractor shall furnish required submittals with sufficient information and accuracy in order to obtain required approval of an item with no more than two submittals pursuant to paragraphs 6.17A and 6.17B. Engineer will record Engineer's time for reviewing subsequent submittals of Shop Drawings, samples or other items requiring approval. The Contractor shall reimburse Owner for the Engineer's reasonable charges for such time.

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

SC-6.20 Add the following new Paragraph:

"D. In conformance with the requirements of Section 725.06, Florida Statutes, the specific considerations for CONTRACTOR's promises are:

1. One dollar ($1.00) in hand paid by OWNER, ENGINEER, and ENGINEER's employees to CONTRACTOR, receipt whereof is hereby acknowledged and the adequacy of which CONTRACTOR accepts as completely fulfilling the obligations of OWNER, ENGINEER, and ENGINEER's employees under the requirements of Section 725.06, Florida Statutes, and;

2. The entry of OWNER and CONTRACTOR into the construction contract because, but for CONTRACTOR's promises as contained in the General Conditions, OWNER would not have entered into the construction contract with CONTRACTOR."

ARTICLE 7 - OTHER WORK AT THE SITE

SC-7.04 Add the following new paragraph immediately after paragraph GC-7.03:

SC-7.04 Claims Between Contractors

"A. Should Contractor cause damage to the work or property of any other contractor at the Site, or should any claim arising out of Contractor's performance of the Work at the Site be made by any other contractor against Contractor, Owner, Engineer, or the construction coordinator, Contractor shall promptly attempt to settle with such other contractor by agreement, or to otherwise resolve the dispute by non-binding mediation or at law.

B. Contractor shall, to the fullest extent permitted by Laws and Regulations, indemnify and hold harmless Owner, Engineer, the construction coordinator and the officers, directors, partners, employees, agents and other consultants and subcontractors of each and any of them from and against all claims, costs, losses and damages (including, but not limited to, fees and charges of engineers, architects, attorneys, and other professionals and court and arbitration costs) arising directly, indirectly or consequentially out of any action, legal or equitable, brought by any other contractor against Owner, Engineer, Engineer's Consultants, or the construction coordinator to the extent said claim is based on or arises out of Contractor's performance of the Work. Should another contractor cause damage to the Work or property of Contractor or should the performance of work by any other contractor at the Site give rise to any other Claim, Contractor shall not institute any action, legal or equitable, against Owner, Engineer, or the construction coordinator or permit any action against any of them to be maintained and continued in its name or for its benefit in any court or before any arbiter which seeks to impose liability on or to

recover damages from Owner, Engineer, or the construction coordinator on account of any such damage or Claim.

C. If Contractor is delayed at any time in performing or furnishing Work by any act or neglect of another contractor, and Owner and Contractor are unable to agree as to the extent of any adjustment in Contract Times attributable thereto, Contractor may make a Claim for an extension of times in accordance with Article 12. An extension of the Contract Times shall be Contractor's exclusive remedy with respect to Owner, Engineer, and construction coordinator for any delay, disruption, interference, or hindrance caused by any other contractor. This paragraph does not prevent recovery from Owner, Engineer, or construction coordinator for activities that are their respective responsibilities."

ARTICLE 8 – OWNER'S RESPONSIBILITIES

SC-8.01.A Add the following to the end of the sentence, "or Owner's Representative.

ARTICLE 12 – CHANGE OF CONTRACT PRICE; CHANGE OF CONTRACT TIMES

SC-12.01.B Add the following paragraph after Paragraph 12.01.B.3:

"4. where the work involved is covered by unit prices and the volume of work exceeds one hundred fifty percent (150%) of the quantity shown in the Bid Form or Approved Schedule of Values, the Owner reserves the right to renegotiate a better unit price. Or,

5. where the work involved is Lump Sum in the Contract Documents and the estimated quantity contained in the Bid Form is less than one hundred thirty percent (130%) of the actual quantities involved shall be considered included in the Contractor's Lump Sum price. Substantial differences from the estimated quantities to actual quantities are defined as greater than 130%, and the Owner reserves the right to renegotiate a better unit price, by mutually agreed Lump Sum (which may include a reasonable allowance for O&P not necessarily in accordance with Paragraph 12..01.C.2)."

SC-13.07.A Delete first sentence and replace with the following:

A. If within two (2) years after the date of Substantial Completion (or such longer period of time as may be prescribed by the terms of any applicable special guarantee required by the Contract Documents) or by any specific provision of the Contract Documents, any Work is found to be defective, or if the repair of any damages to the land or areas made available for Contractor's use by Owner or permitted by Laws and Regulations as contemplated in Paragraph 6.11.A is found to be defective, Contractor shall promptly, without cost to Owner and in accordance with Owner's written instructions:

SC-13.09 Add the following Paragraph 13.09.E.:

If at any time during the construction, the OWNER deems that work are to be unsafe and after proper notification to the CONTRACTOR of the unsafe conditions, the CONTRACTOR fails to

take within 24 hours the necessary precautions to rectify the unsafe conditions to the satisfaction of the OWNER, the OWNER may correct the unsafe conditions by whatever means the OWNER deems appropriate. The cost for correction of unsafe conditions shall be paid by the CONTRACTOR and any additional work the may result from the OWNER's actions needed to continue work on the project.

ARTICLE 14 - PAYMENTS TO CONTRACTOR AND COMPLETION

SC-14.02.C.1 In the first line of Paragraph 14.02.C.1, change "Ten days..."to read "Forty-five days...".

ARTICLE 16 - DISPUTE RESOLUTION

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

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

1. gives to the other party written notice of intent to submit the Claim to a court of competent jurisdiction, or
2. agrees with the other party to submit the Claim to another dispute resolution process.

SC-16.01.D Add the following new paragraph immediately after Paragraph SC-16.01.C.

D. Notwithstanding any applicable statute of limitations, a party giving notice under Paragraph SC-16.01.C.1 shall commence an action on the Claim within one year of giving such notice. Failure to do so shall result in the Claim being time-barred and Engineer's action or denial shall become final and binding."

END OF SECTION

SECTION 00900

ADDENDA AND MODIFICATIONS

Bidding addenda and/or modifications issued prior to signing of the construction agreement are to be attached hereto.

END OF SECTION

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SECTION 01010

SUMMARY OF WORK

PART 1 – GENERAL

1.1 Location of Work: Fleming Island Wastewater Treatment Facility
1770 Radar Road
Fleming Island, FL 32003

1.2 Description of Work: The Work consists of furnishing all labor, materials and equipment necessary to complete the following:

- The Contractor is responsible for mobilization and demobilization from the site. Contractor shall be responsible for general conditions, performance and payment bonds, insurance and permits.

- The Contractor shall schedule and conduct his work such that it will not impede any part of the treatment process, create potential hazards to operating equipment and/or personnel, reduce the quality of the plant finished water or cause treatment process upsets.

- The Contractor is responsible for demolition of above and below grade utilities including, but not limited to, above grade concrete walls and foundations, miscellaneous equipment, buried piping, wire, and conduit. Removed items not to be salvaged shall be disposed off-site by the Contractor in accordance with local, state, and federal codes and requirements.

- The Contractor shall be responsible for temporary bypass pumping to complete the modifications to the Influent Structure and installation of the Automatic Transfer Switch. Bypass pumping will be set-up and ready to power the effluent pump station in the event that the standby generator fails during replacement of the electrical service and during modifications to the main breaker, and in the event normal power fails during replacement of the standby generator.

- The Contractor shall be responsible for settlement monitoring of existing structures during construction.

- The Contractor shall be responsible for site clearing and site grading to provide level ground for construction of Biological Treatment Unit (BTU) No. 3. A swale will be added between BTU No. 3 and existing BTU No. 2 to ensure site drainage.

- The Contractor shall be responsible for installing temporary silt fences and/or barriers as required to avoid silt or turbid water transport from the work areas.

- The Contractor shall construct, install and test yard piping improvements, including; influent biological treatment unit (BTU) No. 3 influent piping, BTU No. 3 effluent piping, BTU No. 3 drain piping and non-potable water piping.

- The Contractor shall construct, install and test modifications to the Influent Structure. Within the Influent Structure, the distribution box shall be extended to accommodate splitting flow to the new BTU No. 3 and a future BTU No. 4, including new weir gates. Contractor shall construct, install and submit the proposed system of protection of the Influent Structure and Odor Control Tank signed and sealed by a professional engineer.

- The Contractor shall relocate equipment associated with the odor control system at the Influent Structure and reroute the odor control piping and ductwork.

- The Contractor shall provide, install, test and commission the new BTU No. 3. BTU No. 3 shall be an elliptical carrousel process, 2-stage oxidation ditch with anoxic and aerobic zones, three aerators and two turbine mixers. The BTU tank shall be pre-stressed concrete.

- The Contractor shall construct, install and test the expansion of the existing Motor Control Center (MCC) to accommodate the new equipment associated with BTU No. 3. New variable frequency drives (VFDs) for BTU No. 3 aerators shall be installed and tested. The Contractor shall update the instrumentation and controls to accommodate the modifications to the Influent Structure and the new BTU No. 3 including integration of the upgrades into the plant supervisory control and data acquisition (SCADA) system.

- The Contractor will replace the effluent control gate in the existing BTU No. 1. A structural evaluation will be performed by the Engineer once BTU No. 1 is removed from service. The Contractor shall assist with preparation of BTU No 1 for the evaluation and shall remove and dispose settled grit/debris/solids and sludge from BTU No. 1. Recommendations for repair will be provided by the Engineer after completion of the evaluation. The intent is to incorporated repair recommendations will be added to the Scope of Work through a change order.

- The Contractor shall construct, install and test buried conduits from the existing Electrical Building to BTU No. 3. Contractor shall construct, install and test new fiber optic cable from the existing WWTF Office and Lab Building to the WWTF Electrical Building.

- The Contractor shall disconnect, remove and salvage the existing generator set and

transport to a location on Site as directed by CCUA. The Contractor shall procure the services of the existing standby generator manufacturer to prepare the equipment for long-term outdoor storage in accordance with the equipment manufacturer's recommendations. The Contractor shall install and test a new standby generator, fuel piping and extend the existing generator pad.

- The Contractor shall be responsible for putting Project in operational order, adjusting, and balancing equipment, initial operation (startup) of equipment, operating equipment, starting systems, operations of systems, testing of equipment and systems, and demonstration and verification of the completed Work.

- The Contractor shall be responsible for site restoration, final cleaning, and project record drawings.

All materials, methods of construction, and standards must be in accordance with the AUTHORITY's approved materials manual, standards, and details.

1.3 Contractor's Duties: Except as specifically noted, the Contractor shall provide and pay for the following:

A. All labor, materials, and equipment.

B. Tools, construction equipment, and machinery.

C. Utilities required for construction.

D. Temporary portable bathrooms, and other services and facilities necessary for the proper execution of work completion including incidental items not detailed or called for, but which are required for the proper completion of the project.

E. All legally required sales, consumer, and use taxes.

F. All applicable permits, government fees, and licenses.

G. Survey services for construction layout and record drawings.

H. All required testing and clearances for placing into service.

1.4 Contractor Shall Also Be Required to Perform the Following:

A. Comply with all codes, ordinances, rules, regulations, orders and other legal requirements of public authorities which bear on the performance of work.

B. Promptly submit written notice to the Engineer of observed variances of Contract Documents from legal requirements; it is not the Contractor's responsibility to make certain drawings and specifications comply with codes and regulations.

C. Enforce strict discipline and good order among employees. Do not employ unfit persons or those not skilled in assigned tasks.

D. Provide and submit a Construction Work Plan and Quality Control Plan to the Owner.

1.5 Work Sequence:

A. Coordinate with Owner.

B. Contractor's construction schedule will be subject to acceptance by the Engineer and updated on a monthly basis.

C. Notify Engineer and Owner 96 hours (minimum) in advance of removing any facility from service, permanently or temporarily. Removal from service of any facility shall be pre-approved by Owner.

1.6 Contractors Use of the Premises:

A. Do not unreasonably encumber sites with materials or equipment.

B. Assume full responsibility for protection and safekeeping of products stored on premises.

C. Move any stored products interfering with the Owner's operations.

END OF SECTION

SECTION 01027

APPLICATIONS FOR PAYMENT

PART 1 - GENERAL

1.1 SECTION INCLUDES:

Administrative and procedural requirements governing the Contractor's Applications for Payment.

1.2 SCHEDULE OF VALUES

A. Coordination: Coordinate preparation of the Schedule of Values with preparation of the Contractor's Construction Schedule.

1. Correlate line items in the Schedule of Values with other required administrative schedules and forms, including:

   a. Contractor's Construction Schedule.
   b. Contractor’s Spend Down Schedule
   c. Application for Payment forms, including Continuation Sheets.
   d. List of subcontractors.
   e. Schedule of allowances.
   f. Schedule of alternates.
   g. List of products.
   h. List of principal suppliers and fabricators.
   i. Schedule of submittals.

2. Submit the Schedule of Values to the Engineer at the earliest possible date but no later than 7 days before the date scheduled for submittal of the initial Applications for Payment.

3. Subschedules: Where Work is separated into phases requiring separately phased payments, provide subschedules showing values correlated with each phase of payment.

B. Format and Content: Use the Project Manual table of contents as a guide to establish the format for the Schedule of Values. Provide at least one line item for each Specification Section.

1. Identification: Include the following Project information on the Schedule of Values:

    a. Project name and location
    b. Name of the Engineer
    c. Project number
    d. Contractor's name and address
    e. Date of submittal

2. Arrange the Schedule of Values in tabular form with separate columns to indicate the following for each item listed:

    a. Related Specification Section or Division
    b. Description of Work
    c. Name of subcontractor
    d. Name of manufacturer or fabricator
    e. Name of supplier
    f. Change Orders (numbers) that affect value
    g. Dollar value of both labor and materials

3. Provide a breakdown of the Contract Sum in sufficient detail to facilitate continued evaluation of Applications for Payment and progress reports. Coordinate with the Project Manual table of contents. Break principal subcontract amounts down into several line items.

4. Round amounts to nearest whole dollar; the total shall equal the Contract Sum.

5. Provide a separate line item in the Schedule of Values for each part of the Work where Applications for Payment may include materials or equipment, purchased or fabricated and stored, but not yet installed. Differentiate between items stored on-site and items stored off-site. Include requirements for insurance and bonded warehousing, if required.

6. Provide separate line items on the Schedule of Values for initial cost of the materials, for each subsequent stage of completion, and for total installed value of that part of the Work.

7. Unit-Cost Allowances: Show the line-item value of unit-cost allowances, as a product of the unit cost, multiplied by the measured quantity. Estimate quantities from the best indication in the Contract Documents.

8. Schedule Updating: Update and resubmit the Schedule of Values and Drawdown Schedules prior to the next Applications for Payment when Change Orders or Construction Change Directives result in a change in the Contract Sum. Update Schedules and Drawdown Schedules when Change Orders or Construction Changes directive result in change in contract duration prior to the next application for Payment.

1.3 APPLICATIONS FOR PAYMENT

A. Each Application for Payment shall be consistent with previous applications and payments as certified by the Engineer and paid for by the Owner. The initial Application for Payment, the Application for Payment at time of Substantial Completion, and the final Application for Payment involve additional requirements.

B. Payment-Application Times: The date for each progress payment is the 15th day of each month. The period covered by each Application for Payment starts on the day following the end of the preceding period and ends 15 days prior to the date for each progress payment.

C. Payment-Application Forms: Use forms provided by the Owner for Applications for Payment. Same copies are included in Section 00640, "Application and Certification for Payment."

D. Application Preparation: Complete every entry on the form. Include notarization and execution by a person authorized to sign legal documents on behalf of the Contractor. The Engineer will return incomplete applications without action.

1. Entries shall match data on the Schedule of Values and the Contractor's Construction Schedule. Use updated schedules if revisions were made.

2. Include amounts of Change Orders and Construction Change Directives issued prior to the last day of the construction period covered by the application.

E. Transmittal: Submit three (3) signed and notarized original copies of each Application for Payment to the Engineer by a method ensuring receipt within 24 hours. One copy shall be complete, including waivers of lien and similar attachments, when required.

F. Waivers of Mechanics Lien: With each Application for Payment, submit waivers of mechanics liens from subcontractors, sub-subcontractors, vendors, and suppliers for the construction period covered by the previous application.

1. Submit partial waivers on each item for the amount requested, prior to deduction for retainage, on each item.

2. When an application shows completion of an item, submit final or full waivers for such items.

3. Waiver Forms: Submit waivers of lien on forms which comply with State statutes, and executed in a manner, acceptable to the Owner.

G. Initial Application for Payment: Administrative actions and submittals, that must precede or coincide with submittal of the first Application for Payment, include the following:

1. List of subcontractors.

2. List of principal suppliers and fabricators.

3. Schedule of Values.

4. Contractor's Construction Schedule (preliminary if not final).

5. Schedule of principal products.

6. Schedule of unit prices.

7. Submittal Schedule (preliminary if not final).

8. List of Contractor's staff assignments.

9. List of Contractor's principal consultants.

10. Copies of building permits.

11. Copies of authorizations and licenses from governing authorities for performance of the Work.

12. Initial progress report.

13. Report of preconstruction meeting.

14. Certificates of insurance and insurance policies.

15. Performance and payment bonds.

16. Data needed to acquire the Owner's insurance.

17. Initial settlement survey and damage report, if required.

H. Application for Payment at Substantial Completion: Following issuance of the Certificate of Substantial Completion, submit an Application for Payment.

1. This application shall reflect Certificates of Partial Substantial Completion issued previously for Owner occupancy of designated portions of the Work.

2. Administrative actions and submittals that shall precede or coincide with this application include:

a. Occupancy permits and similar approvals.
b. Warranties (guarantees) and maintenance agreements.
c. Test/adjust/balance records.
d. Maintenance instructions.
e. Meter readings.
f. Startup performance reports.
g. Changeover information related to Owner's occupancy, use, operation, and maintenance.
h. Final cleaning.
i. Application for reduction of retainage and consent of surety.
j. Advice on shifting insurance coverages.
k. Final progress photographs.
l. List of incomplete Work, recognized as exceptions to Engineer's Certificate of Substantial Completion.

I. Final Payment Application: Administrative actions and submittals that must precede or coincide with submittal of the final Application for Payment include the following:

1. Completion of Project closeout requirements.

2. Completion of items specified for completion after Substantial Completion.

3. Ensure that unsettled claims will be settled.

4. Ensure that incomplete Work is not accepted and will be completed without undue delay.

5. Transmittal of required Project construction records to the Owner.

6. Certified property survey.

7. Proof that taxes, fees, and similar obligations were paid.

8. Removal of temporary facilities and services.

9. Removal of surplus materials, rubbish, and similar elements.

10. Change of door locks to Owner's access.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION

SECTION 01060

REGULATORY REQUIREMENTS

PART 1 – GENERAL

1.1 Related Documents:

The general provisions of the Contract, including General and Supplementary Conditions apply to the work specified in this Section.

1.2 Specified Codes:

A. The design of the work is based on the requirements of the latest edition of the Florida Building Code, National Electric Code and National Fire Protection Association Requirements, whichever is most stringent.

B. The site work is based on the latest edition of the Florida Department of Transportation, Standard Specifications for Road and Bridge Construction, hereinafter referred to as the Florida DOT Specifications or DOT Spec.

C. The Contractor shall ensure the work complies to the aforementioned codes and regulations as they apply to the project whether or not specifically referenced elsewhere.

1.3 Reference Standards:

A. Except as otherwise required by Paragraph 1.2 all products and workmanship shall conform to best quality materials and practices recognized by agencies, associations, councils, etc., specified in individual sections.

B. In the absence of specified agencies, associations, councils, etc., the Contractor shall conform to the requirements of the most widely recognized standards for each particular portion of the work.

1.4 Permits:

Determination of necessity and/or application for and receipt of the following permits will be required of the Contractor, unless otherwise noted. The Contractor shall comply with all provisions of these permits. No work shall commence until all required permits are in hand.

A. The Contractor shall secure any and all permits as required by SJRWMD for dewatering activities to occur at the job sites.

B. The Contractor shall secure any NPDES – Generic Permit for the Discharge of Produced Groundwater from any Non-Contaminated Site Activity. Contact Florida Department of Environmental Protection (FDEP), Northeast District. The Contractor shall comply with any applicable conditions of the permit.

C. The Contractor shall secure any Generic Permit for Stormwater Discharge from Large & Small Construction Activities. The Contractor shall comply with all General Conditions and Specific Conditions, where applicable.

D. The Contractor shall secure any and all permits required by the Clay County Building Department, Planning Department or Public Works Department for all work included for this project.

E. The Contractor shall secure any permit required for temporary or permanent electrical service by the Clay Electric Cooperative.

F. The Contractor shall conform with the Environmental Resource Permit (ERP) to be issued by FDEP.

G. The Contractor shall conform with National Pollutant Discharge Elimination System (NPDES) permit to be issued by FDEP.

END OF SECTION

SECTION 01101

SPECIAL PROCEDURES FOR MAINTENANCE OF PLANT OPERATION AND SEQUENCE OF CONSTRUCTION

PART 1 - GENERAL

1.1 SUMMARY

A. The Fleming Island Wastewater Treatment Facility (WWTF) is operated 24 hours a day, seven days a week. The existing facility will be maintained in continuous operation by the Owner at all times during the entire construction period, except for periods specifically delineated within this Section. The Contractor shall schedule and conduct his work such that it will not impede any part of the treatment process, create potential hazards to operating equipment and/or personnel, reduce the quality of the plant finished water or cause treatment process upsets. It shall be the Contractor's responsibility to ensure complete compatibility with the facility operations in his working schedules and sequenced construction activities.

B. Detailed startup and testing activities for Maintenance of Plant Operations (MOPO) affected equipment and facilities will be provided in this Section.

C. The construction progress schedule required under Section 01300, "Submittals" shall reflect the conditions presented in this Section.

D. Contractor shall coordinate his activities in the interface or common areas with other contractors who are working on site and the Owner's operation personnel.

E. The Owner reserves the right to postpone shutdowns due to operational and/or weather-related concerns.

F. Contractor shall be responsible for temporary bypass pumping, as required. Refer to Section 01535, "Temporary Bypass Pumping System" for requirements.

1.2 SEQUENCE OF CONSTRUCTION - GENERAL

A. In order to maintain continuous plant operations during construction, a phased construction sequence shall be required. Specific constraints and steps are outlined and are intended to suggest a sequence for specific activities. This sequence shall be coordinated with the Owner and the Engineer and submitted for review and approval. Work will not commence unless the sequence has been approved.

B. The detailed sequence of construction shall be based upon the schedule submitted by the Contractor and approved by the Engineer as specified above. However, a suggested sequence of construction is described below for specific portions of the work. The Contractor may alter the sequence as approved by the Engineer, providing plant operations are maintained.

C. The order of construction shall be subject to the approval of the Engineer and Owner; such approval or direction, however, shall in no way relieve the Contractor's responsibility to perform the work in strict accordance with the Contract Documents. The construction plans and specifications have been developed to minimize the construction impacts on the operation of the treatment facility. The Contractor shall note the requirements of this Section with regard to the operation of the facility and the phasing of construction when developing his work sequence. The Contractor's work sequence must be specifically detailed in the required schedule.

D. The following work sequence provides for completing the construction of the project within the requirements of the Owner's plant operation and schedule limitations. It does not purport to cover any sequences necessitated by the actual construction methods. This is a partial outline only. Portions of the work not specifically itemized must be scheduled by the Contractor in accordance with the requirements of the approved construction sequence. The Contractor is required to account for all details in formulating his own complete plan for implementation of the project.

E. Some of the tasks below may overlap one another in performance of the work. Numerical and alphabetical identification of the tasks does not necessarily conform with actual order of construction.

F. The sequence outline included herein provides a required general order of the work. When listed, work described herein, will require certain activities to occur before additions, activities or outages are allowed. Some of the work, listed herein, can occur independent of a preceding activity.

1.3 SITE CONDITIONS

A. Erosion control and temporary fencing of all construction areas shall be performed within 30 days after the Notice to Proceed. All erosion control devices shown on the Drawings shall be installed prior to any clearing and grubbing in this area.

B. All underground pipes, conduits, cables, duct banks, and structures shall be located by electronic locator equipment and test pits in each area of excavation and flagged and mapped before any excavation is performed for structures, pipes, cables, conduits, duct banks, or removals. Working drawings of existing and proposed new work shall be prepared to scale and submitted to the Engineer in advance of excavation. The Contractor shall be fully responsible for any process outages caused by disruption of underground facilities including responsibility for regulatory fines and the Owner's costs of dealing with regulatory agencies.

C. Various interconnections within the plant will depend on the closure of various valves and gates. Many of these valves and gates are old and may not seal properly. Coordinate with the Plant Operation Personnel to request any such closure and provide any corrective measure of temporary facilities necessary to attain the shut off needed to perform the work at no additional cost to the Owner and without interrupting the plant operation.

D. Various interconnections within the plant may require temporary partial power shutdown. Make every effort necessary to minimize the shutdown time and coordinate with the Plant Operating Personnel and/or utility authorities prior to attempting any such power shutdown.

Furthermore, provide any corrective measure or temporary facilities necessary to perform the work at no additional cost to the Owner and without interrupting the plant operation.

E. Where water is required in large quantity (BTU No. 3 Construction and Testing) for preoperational testing or other use, Contractor shall promptly request it to the Owner, though it may be available for limited use at the Plant Operators' discretion.

F. Regulatory discharge requirements for the plant effluent mandate adequate treatment of discharged wastewater from the plant. The intent of this section is to provide a framework for the Contractor to perform the work in a sequence and manner such that continuous, uninterrupted treatment of wastewater and waste flows are maintained operational throughout the construction period, except as noted in this Section.

G. During Start Up Testing, make available the manpower, equipment and manufacturer's representatives required to make any necessary adjustments and training.

H. The Contractor shall develop a detailed description of the complete sequence of construction. The sequence shall be submitted to the Engineer and Owner for review and approval thirty (30) days following the execution of the Contract Agreement.

1.4 SEQUENCE OF CONSTRUCTION

A. Influent Structure Distribution Box & Odor Control (Refer to Drawings S-2 to S-4, M-2 to M-5)

1. There is no limitation to the start of construction of the Influent Structure Distribution Box.
2. Contractor shall plan for this structure to be preloaded with water for 30 days to mitigate future settlement prior to making any final piping connections at or below grade
3. While this work is being performed, odor control will not be available. Duration of odor control being offline shall be minimized to all extents possible.
4. As much of the addition to the Influent Structure Distribution Box is to be constructed in advance of tie-in to the existing Influent Structure as possible. After construction of the additional channels to Biological Treatment Units (BTUs) No.3 and 4, this Work will need to be tied into the existing structure by demolishing a portion of the existing Influent Structure wall. While this work is being performed, all flow from the channel following the screens (approx. 2.0 to 6.0 MGD) will need to be bypass pumped. The bypass flow shall be split between BTUs No. 1 and 2 and shall be pumped to the downstream portion of the Influent Structure Distribution Box heading to these two units. Duration of the bypass pumping is to be minimized to all extents possible.
5. It is the responsibility of the Contractor to configure the selection of the bypass pumping system to achieve the construction of the Effluent Channel to BTU No. 3 and Effluent Channel to Future BTU No. 4. Contractor shall maintain operations such that the existing flow-splitting to BTU No. 1 and BTU No. 2 is not altered during construction and effluent channel bypassing.

B. Biological Treatment Unit No. 3 (Refer to Drawings M-7 to M-11)

1. There is no limitation to the start of construction of the BTU No. 3.
2. Two BTUs are to remain fully in service at all times during construction.
3. Contractor shall plan for this structure to be preloaded with water for 30 days to mitigate future settlement prior to making any final piping connections at or below grade.
4. Tie-ins of the BTU effluent and drain lines must be complete before influent flow can be brought to BTU No. 3.
5. Modifications to the Influent Structure Distribution Box are to be completed before influent flow can be split to BTU No. 3.
6. Contractor shall seed the biological treatment using seed from the one of the existing BTUs. Contractor shall submit a detailed plan for bringing the BTU online, testing of the unit and receiving clearance from the Florida Department of Environmental Protection (FDEP).

C. Biological Treatment Unit No. 1 (Refer to Drawing MD-1)

1. Work at BTU No. 1 is not to start until work at BTU No. 3 is complete and has been put into service, meet performance requirements under Section 11378, "Biological Treatment Unit Equipment" and cleared by FDEP. Two BTUs are to remain fully in service at all times during construction.
2. After BTU No. 1 is removed from service, a structural evaluation will be conducted by the Engineer to assess required structural improvements. During this evaluation period, Contractor shall replace the existing BTU No. 1 Effluent Weir Gate, in accordance with Drawing MD-1, Detail C and the Gate Schedule.
3. Contractor will seed the biological treatment using seed from BTU No. 2. Contractor shall submit a detailed plan for bringing the BTU online.

D. Electrical improvements (Refer to Electrical Drawings)

1. Power outages will be required for upgrade of the electrical service and main breaker, replacement of the automatic transfer switch (ATS), and replacement of the standby generator. Contractor shall coordinate.
2. Upgrade of the electrical service and main breaker shall occur before the ATS and generator can be replaced. Existing electrical loads can be run on the existing standby generator while the service and main breaker are upgraded. Contractor shall have a plan in place if the standby generator fails.
3. Sequencing of electrical work must be done to ensure that there are no equipment power outages that will impact plant operations. Emergency generator service must be available to all operational equipment at all times during construction.
4. The Contractor shall be responsible for temporary bypass pumping to complete the installation of the Automatic Transfer Switch. Bypass pumping will be set-up and ready to power the effluent pump station in the event that the standby generator fails during replacement of the electrical service and during modifications to the main breaker, and in the event normal power fails during replacement of the standby generator.

E. Non-potable Water Line (Refer to C-3)

1. Contractor shall coordinate with Owner for isolation of tie-in location of new piping to existing non-potable water piping.
2. Minimize interruptions to non-potable water service.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

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SECTION 01300

SUBMITTALS

PART 1 - GENERAL

1.1 Section Includes

A. Administrative and procedural requirements for submittals required for performance of the Work, including the following:

1. Contractor's construction schedule and work plan such as the Critical Path Method (CPM)

2. Shop Drawings.

3. Product Data.

4. Samples.

5. Quality assurance submittals.

1.2 Definitions

A. Coordination Drawings show the relationship and integration of different construction elements that require careful coordination during fabrication or installation to fit in the space provided or to function as intended.

B. Field samples are full-size physical examples erected on-site to illustrate finishes, coatings, or finish materials. Field samples are used to establish the standard by which the Work will be judged.

C. Mockups are full-size assemblies for review of construction, coordination, testing, or operation; they are not Samples.

1.3 Submittal Procedures

A. Coordination: Coordinate preparation and processing of submittals with performance of construction activities. Transmit each submittal sufficiently in advance of performance of related construction activities to avoid delay.

1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.

2. Coordinate transmittal of different types of submittals for related elements of the Work so processing will not be delayed by the need to review submittals concurrently for coordination. The Engineer reserves the right to withhold action on a submittal requiring coordination with other submittals until all related submittals are received.

3. Processing: To avoid the need to delay installation as a result of the time required to process submittals, allow sufficient time for submittal review, including time for resubmittals.

    a. Allow 15 working days for initial review. Allow additional time if the Engineer must delay processing to permit coordination with subsequent submittals.
    b. If an intermediate submittal is necessary, process the same as the initial submittal.
    c. Allow 15 working days for reprocessing each submittal.
    d. No extension of Contract Time will be authorized because of failure to transmit submittals to the Engineer sufficiently in advance of the Work to permit processing.

B. Submittal Preparation: Place a permanent label or title block on each submittal for identification. Indicate the name of the entity that prepared each submittal on the label or title block.

1. Provide a space approximately 4 by 5 inches (100 by 125 mm) on the label or beside the title block on Shop Drawings to record the Contractor's review and approval markings and the action taken.

2. Include the following information on the label for processing and recording action taken.

    a. Project name.
    b. Date.
    c. Name and address of the Engineer.
    d. Name and address of the Contractor.
    e. Name and address of the subcontractor.
    f. Name and address of the supplier.
    g. Name of the manufacturer.
    h. Number and title of appropriate Specification Section.
    i. Drawing number and detail references, as appropriate.

C. Submittal Transmittal: Package each submittal appropriately for transmittal and handling. Transmit each submittal from the Contractor to the Engineer using a

transmittal form. The Engineer will not accept submittals received from sources other than the Contractor without Contractor's review and approval markings and the action taken.

D. Provide required Product Code Certification with Shop Drawings. Submittals that do not have Product Code Certification included will be returned for resubmission.

1.4 Contractor's Construction Schedule

A. Bar-Chart Schedule and Spend Down Schedule: Prepare a fully developed, horizontal bar-chart-type, Contractor's Construction Schedule and spend down schedule. Submit within 20 days after the date established for "Commencement of the Work."

1. Provide a separate time bar for each significant construction activity. Provide a continuous vertical line to identify the first working day of each week. Use the same breakdown of units of the Work as indicated in the "Schedule of Values."

2. Coordinate the Contractor's Construction Schedule with the Work Plan, (CPM) Schedule of Values, list of subcontracts, Submittal Schedule, progress reports, payment requests, spend down plan, and other schedules.

3. Identify critical paths.

4. Identify Milestone dates.

B. Phasing: On the schedule, show how requirements for phased completion to permit Work by separate contractors and partial occupancy by the Owner affect the sequence of Work.

C. Distribution: Following response to the initial submittal, print and distribute copies to the Engineer, Owner, subcontractors, and other parties required to comply with scheduled dates. Post copies in the Project meeting room and temporary field office. When revisions are made, distribute to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in construction activities.

D. Schedule Updating: Revise the schedule after each meeting, event, or activity where revisions have been recognized or made. Issue the updated schedule concurrently with the report of each meeting.

1.5 Shop Drawings

A. Submit newly prepared information drawn accurately to scale. Highlight, encircle, or otherwise indicate deviations from the Contract Documents.

1. Do not reproduce Contract Documents or copy standard information as the basis of Shop Drawings.

2. Standard information prepared without specific reference to the Project is not a Shop Drawing.

B. Shop Drawings include fabrication and installation Drawings, setting diagrams, schedules, patterns, templates and similar Drawings. Include the following information:

1. Dimensions.

2. Identification of products and materials included by sheet and detail number.

3. Compliance with specified standards.

4. Notation of coordination requirements.

5. Notation of dimensions established by field measurement.

6. Do not use Shop Drawings without an appropriate final stamp indicating action taken.

C. Submittals: Submit one reproducible and two blue or black line print; the reproducible will be returned.

1.6 Product Data

A. Collect Product Data into a single submittal for each element of construction or system. Product Data includes printed information, such as manufacturer's installation instructions, catalog cuts, standard color charts, roughing-in diagrams and templates, standard wiring diagrams, and performance curves.

1. Mark each copy to show applicable choices and options. Where printed Product Data includes information on several products that are not required, mark copies to indicate the applicable information. Product Data not so marked will be returned without review. Include the following information:

a. Manufacturer's printed recommendations.
b. Compliance with trade association standards.
c. Compliance with recognized testing agency standards.
d. Application of testing agency labels and seals.
e. Notation of dimensions verified by field measurement.
f. Notation of coordination requirements.

2. Do not submit Product Data until compliance with requirements of the Contract Documents has been confirmed.

B. Submittals: Submit 3 copies of each required submittal; submit 4 copies where required for maintenance manuals. Submit additional copies as required by the Contractor for distribution. The Engineer will retain one and will return the others marked with action taken and corrections or modifications required.

C. Distribution: Furnish copies of final submittal to installers, subcontractors, suppliers, manufacturers, fabricators, and others required for performance of construction activities.

1.7 Samples

A. Submit full-size, fully fabricated Samples cured and finished as specified and physically identical with the material or product proposed. Samples include partial sections of manufactured or fabricated components, cuts or containers of materials, color range sets, and swatches showing color, texture, and pattern.

1. Mount or display Samples in the manner to facilitate review of qualities indicated. Prepare Samples to match the Engineer's sample. Include the following:

a. Specification Section number and reference.
b. Generic description of the Sample.
c. Sample source.
d. Product name or name of the manufacturer.
e. Compliance with recognized standards.
f. Availability and delivery time.

2. Submit Samples for review of size, kind, color, pattern, and texture. Submit Samples for a final check of these characteristics with other elements and a comparison of these characteristics between the submittal and the actual component as delivered and installed.

a. Where variation in color, pattern, texture, or other characteristic is inherent in the material or product represented, submit at least 3 multiple units that show approximate limits of the variations.

b. Refer to other Specification Sections for requirements for Samples that illustrate workmanship, fabrication techniques, details of assembly, connections, operation, and similar construction characteristics.

3. Submit a full set of choices where Samples are submitted for selection of color, pattern, texture, or similar characteristics from a range of standard choices. The Engineer will review and return preliminary submittals with the Engineer's notation, indicating selection and other action.

4. Maintain sets of Samples, as returned, at the Project Site, for quality comparisons throughout the course of construction.

B. Distribution of Samples: Prepare and distribute additional sets to subcontractors, manufacturers, fabricators, suppliers, installers, and others as required for performance of the Work. Show distribution on transmittal forms.

1.8 Quality Assurance Submittals

A. Submit quality-control submittals, including design data, certifications, manufacturer's instructions, manufacturer's field reports, and other quality-control submittals as required under other Sections of the Specifications.

B. Certifications: Where other Sections of the Specifications require certification that a product, material, or installation complies with specified requirements, submit a notarized certification from the manufacturer certifying compliance with specified requirements.

C. Signature: Certification shall be signed by an officer of the manufacturer or other individual authorized to sign documents on behalf of the company.

D. Inspection and Test Reports: Requirements for submittal of inspection and test reports from independent testing agencies are specified in Section 01400, “Quality Control.”

E. Contractor shall submit for approval a “Contractor Quality Control Plan” which shall contain, as a minimum, Contractor’s quality control plan for earthwork, concrete reinforcement, and poured-in-place concrete.

1. The Contractor Quality Control Plan (CQCP) is the documentation of the Contractor's process for delivering the level of construction quality required by the Contract. The following paragraph provides requirements for the CQCP, and what the criteria for accepting and using the requirements for these plans will be.

2. The CQCP is a framework for the Contractor's process for delivering quality construction. The plans and specifications define the expected results or outcome. The CQCP shall outline how those results will be achieved. While it is not possible to determine from the CQCP whether the level of construction quality will be acceptable, it is possible to verify that the Contractor, as an organization, has addressed the basic elements of its quality process.

1.9 Engineer's Action

A. Except for submittals for the record or information, where action and return is required, the Engineer will review each submittal, mark to indicate action taken, and return promptly. Compliance with specified characteristics is the Contractor's responsibility regardless of action indicated.

B. Action Stamp: The Engineer will stamp each submittal with a uniform, action stamp. The Engineer will mark the stamp appropriately to indicate the action taken. Do not use, or allow others to use, submittals marked "Not Approved, Revise and Resubmit", or "Rejected" at the Project Site or elsewhere where Work is in progress.

C. Other Action: Where a submittal is for information or record purposes or special processing or other activity, the Engineer will return the submittal marked "Action Not Required", "Reviewed, No Comment", or "Reviewed, Comments As Noted."

D. Unsolicited Submittals: The Engineer will return unsolicited submittals to the sender without action.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION

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SECTION 01301

ADMINISTRATIVE REQUIREMENTS

PART 1 – GENERAL

1.01 DEFINITIONS

A. Decision/Action Tracking Report – A report prepared by the Contractor recording all actions, commitments, and decisions (items) made at various Project Meetings and conferences. At a minimum, the report must track the name of the person responsible for the items, a description of the required action or decision, the initiation date of the item, the due date for the item, actual completion date of the item, and the current status of the item. Provide one (1) copy of the Decision/Action tracking report to all attendees and three (3) copies to Owner within forty-eight (48) hours of the meetings.

B. General Superintendent (Superintendent) – Is responsible for administration of the Contractor's Work and the coordination of the Work of the Contractor, subcontractors, and suppliers. The Superintendent must be on-site at all times work is being performed. No Work may proceed on the site without the presence of the Superintendent or the Owner-accepted Alternate. The Superintendent may not be absent from the project site for more than two (2) consecutive weeks and/or 20 total workdays in the course of any 12-month period.

C. Progress Reports - A daily report prepared by the Contractor recording all actions, testing, daily activities, subcontractors, work progress, weather conditions, quality assurance, received materials and equipment, workforce, visitors, and decisions relating to the work performed on the project at the site.

1.02 COORDINATION

A. Contractor must not delegate Contractor's responsibility for coordination of the Work to any subcontractor.

B. Contractor must provide a Superintendent whose sole responsibility is administration of the Contractor's Work at the site and the coordination of the Work of the Contractor's subcontractors and suppliers.

C. Contractor must provide administrative and supervisory personnel as needed or required for times compliance with all administrative requirements of the Contract Documents and proper coordination of the performance of the Work.

D. Contractor must ensure that each subcontractor provides personnel as reasonably required for the management and coordination of the subcontractor's work and for the coordination of the subcontractor's work with the Work of the entire Project.

E. Contractor must coordinate the Work to ensure efficient and orderly installation of each part of the Work of the entire project including but not limited to:

1. Coordinating all aspects of the Work as required to provide the Owner with a complete and operable facility.

2. Coordinating the Work with the work of other contractors and entities to ensure efficient and orderly installation of each part of the Work of the entire project.

3. Coordinating installation of different components and systems of the Work to ensure maximum accessibility for required maintenance, service, and repair.

4. Coordinating the Work included in different Sections of the Project that depend on each other for proper installation, connection, and operation.

5. Coordinating the Work of all subcontractors and suppliers.

6. Coordinating the Work in such a manner to avoid delays and permit proper and efficient installation of the Work by all subcontractors.

7. Coordinating Work, particularly between trades, including the work of Owner and other contractors, so that sleeves, hangers, chases, openings, etc., required for pipe, conduit, and other installations of like character are duly and properly provided and installed as Work progresses.

8. Coordinating all cutting, fitting and patching that may be required to make the parts of the Work come together properly for the completed Project as shown, specified, or as reasonably implied by the Contract Documents.

9. Coordinating for future installation of work by others that is not included in the Contractor's Work but is shown or specified in the Contract Documents.

10. Coordinating delivery of materials in accordance with the Progress Schedule.

11. Coordinating and cooperating in the timing and sequencing of Contractor's Work with the work of other contractors or the Owner.

12. Sequencing the Work to obtain the best results where installation of one component of the Work depends on installation of other components, before or after its own installations.

13. Making adequate provisions to accommodate items scheduled for later installation by Contractor, Owner, or other contractors.

14. Checking the drawings of the Engineer, Owner or other contractors for interferences with Contractor's Work and promptly reporting to Owner, in writing, any potential interferences between the Contractor's Work and the work of Owner or the work of other contractors.

15. Utilizing the Contract Documents and Owner accepted Submittals to check and coordinate the Work so that no interferences or conflicts between trades occur. This checking and coordination must be performed and completed before construction is commenced in each affected area and may require the preparation and submission of Coordination Drawings.

16. Furnishing to other contractors, whose work is fitted to Contractor's Work, copies of accepted Submittals including but not limited to Record Documents, Coordination Drawings, details, and erection drawings; and furnishing other contractors with full information regarding the fabrication, assembly, and installation of the Contractor's Work.

17. Preparing memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and list of attendees at meetings. Prepare similar memoranda for the Owner and separate contractors if coordination of their Work is required.

1.03 PRE-WORK VERIFICATION

A. Prior to starting a particular type or kind of Work:

1. Review all Contract Documents and other relevant data related to the type or kind of Work to be performed.

2. Check Owner accepted Submittals and verify dimensions at Project Site;

3. Review manufacturer's instructions applicable to conditions under which Work is to be installed;

4. Inspect areas, surfaces or construction receiving the Work.

5. Report to Owner in writing any concerns, issues, or problems observed during Contractor's Pre-Work verification.

6. Start of Work shall signify compliance with the above requirements and acceptance of previously placed construction or substrates as being in satisfactory conditions to achieve proper installations and first quality workmanship as intended under these Contract Documents. Failure to so inspect and report to Owner shall constitute an acceptance of the previously placed construction or substrates.

1.04 ADMINISTRATIVE ACTIONS

A. Administrative actions include, but are not limited to, the following:

1. Project Meetings;
2. Preparation, update, and revision of Contractor's Progress Schedule;
3. Delivery and review of Submittals. (See Section 01300, "Submittals")
4. Project closeout activities. (See Section 01701, "Project Closeout")
5. Coordinate timing of required administrative actions with construction activities and activities of Owner and other contractors to avoid conflicts and ensure orderly progress of the Work.
6. Coordinate timing and format of mandatory submittal of daily Progress Reports (weekly/monthly) with the Owner at the pre-construction meeting.

1.05 CONSERVATION

A. Coordinate Work to ensure that operations are carried out with consideration given to conservation of energy, water, and materials.

B. Salvage materials and equipment involved in performance of, but not actually incorporated into, the Work.

1.06 PROJECT MEETINGS

A. General

1. Contractor must inform participants of date and time of each meeting and preside at all required meetings throughout progress of the Work unless otherwise directed by Owner.

2. Contractor must prepare agenda for all meetings and provide to all attendees prior to the meetings.

3. Contractor must attend all meetings as required by the Contract Documents.

4. Contractor must attend and/or conduct all additional meetings as Directed by the Owner's Project Manager.

5. Contractor must conduct meetings and conferences at the Project Site in the Contractor's on-site, temporary job trailer, unless otherwise indicated or required by Owner.

6. Contractor must prepare and distribute meeting minutes as required.

7. Whether or not Contractor is responsible for the meeting minutes, Contractor must maintain notes from all meetings and conferences in the form of a Decision/Action Tracking report.

B. Preconstruction Conference

1. The Owner's Project Manager will schedule and conduct a Preconstruction Conference.

2. The Preconstruction Conference will be held at the Owner's office, Project Site or another convenient location designated by Owner's Project Manager.

3. Participants:

   a. Owner's Project Manager
   b. Owner's Project Inspector
   c. Engineer of Record
   d. Contractor's Authorized Representative (Mandatory Attendance Required)
   e. Contractor's QC Manager (Mandatory Attendance Required) (See Section 01400, "Quality Control")
   f. Major Subcontractors (Mandatory Attendance Required)
   g. Appropriate Manufacturers
   h. Appropriate Suppliers
   i. Other interested parties

4. All participants at the conference must be familiar with Project and authorized to conclude matters relating to the Work.

5. Agenda – Items of significance to be discussed at the Preconstruction Conference include:

a. Introductions
b. Notice To Proceed (NTP)
c. Directions from the Owner/Engineer
d. Emergencies
e. Required Notifications
f. Contractor's Quality Control (QC) System
g. Contractor's Daily Log
h. Contractors Daily Construction Reports (submitted weekly)
i. Testing and Inspection Laboratory
j. Coordination
k. Normal Hours of Work
l. Workplace Environment
m. Use of Project Site
n. Security
o. Disruption of Owner's Normal Operations
p. Use of Owner's Facilities
q. Temporary Facilities and Controls
r. Accepting Material Deliveries
s. General Correspondence
t. Additional Detailed Instructions
u. Field Modifications
v. Requests for Information (RFI)
w. Change Orders
x. Progress Payments
y. Submittals (List of Owner's Submittal reviewers)
z. Record Documents
aa. Owner Furnished Contractor Installed (OFCI) Equipment
bb. Procurement Issues
cc. Direct Purchase Items
dd. Project Meetings
ee. Permits
ff. Subcontractor Issues
gg. Waste Management
hh. Utilities
ii. Environmental Issues
jj. Schedule
kk. Liquidated Damages

ll. Project Close-Out
mm. As-built Procedures

6. The Owner will prepare meeting minutes of the Preconstruction Conference and distribute minutes to all attendees.

C. The Contractor will schedule and conduct the following meetings:

1. Schedule Orientation Meeting
2. Project Partnering Meeting
3. Solid Waste Management Plant Meeting
4. Quality Control Meetings
5. Closeout Conference
6. Commissioning\Start-up Meetings
7. Demonstration and Training Meetings

D. Progress Meetings

1. The Engineer of Record will establish a schedule of construction Progress Meetings. The frequency of these Progress Meetings shall be at the acceptance of Owner's Project Manager and shall be at a minimum of once per month. Contractor must attend Progress Meetings at the times and locations scheduled. The progress meetings will be located at the Contractor's on-site field office unless the Owner's Project Manager approves an alternate location.

2. Attendees:

a. Owner's Project Manager
b. Owner's Project Inspector
c. Engineer of Record
d. Contractor Authorized Representative
e. Contractor's QC Manager
f. Appropriate Subcontractor(s)
g. Appropriate Suppliers
h. Other entities concerned with current progress or involved in planning, coordination, or performance of future activities must be represented at these meetings.

3. Agenda:

   a. Review and update Contractor's Decision/Action Tracking Report from previous Progress Meeting.

   b. Schedule Review

      1. Review progress since the last meeting;
      2. Compare current progress against Progress Schedule
      3. Determine how any construction behind schedule will be expedited;
         A. Present any remedial action plan(s)
         B. Present any proposed Crashed Scheduling
         C. Fast Tracking
      4. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.

   c. Review present and future needs of each entity present, including the following:

      1. Interface requirements
      2. Sequence of operations
      3. Status of Submittals
      4. State of key deliveries
      5. Status of off-site fabrication
      6. Site access issues
      7. Site utilization
      8. Temporary facilities and controls
      9. Normal hours of work

   d. Progress Payments

   e. Change Orders

   f. Review updated reports:

      1. Submittal Log
      2. RFI Log
      3. Testing Plan and Log

4. At a minimum, the Contractor must maintain notes for all Progress Meetings in the form of a Decision/Action Tracking Report and updated schedule. One copy of the Decision/Action Tracking Report and any updated schedules must be provided to all attendees and three (3) copies must be submitted to the Owner within forty-eight (48) hours of the meetings.

PART 2 – PRODUCTS (Not Applicable)

PART 3 – EXECUTION (Not Applicable)

ENF OF SECTION

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SECTION 01320

CONSTRUCTION VIDEO AND PHOTOGRAPHS

PART 1 – GENERAL

1.01 DESCRIPTION:

A. Provide construction video and photographs that depict preconstruction conditions.

B. Provide construction photographs that depict the progress of the Work and conditions at the final inspection.

1.02 SUBMITTALS:

A. Submit electronic version of preconstruction video and photographs prior to construction.

B. Submit two (2) copies of each set of progress photographs weekly to the CCUA inspector.

C. All projects constructed within the Clay County Utility Authority ("CCUA") systems shall have construction photographs taken by the Contractor who is installing those utility mains, services, or other appurtenances, which will be owned and maintained by or under the control of CCUA as follows in PART 3 – EXECUTION.

D. Submit final photographs with final pay request.

PART 2 – PRODUCTS (Not Applicable)

PART 3 – EXECUTION:

3.01 Photographs shall be taken with a conventional digital camera and show the area affected by the Work. The photographs shall be in color, 5-inches by 7-inches in size, printed on 8½" x 11" paper with a maximum of two pictures per page. The Contractor shall use a minimum photography resolution of 2048 x 1536 pixel (3 megapixels).

3.02 Photographs shall be taken prior to any Work on the Site, upon completion of underground piping or structures installation and prior to backfilling, and upon completion of the backfilling and grading.

3.03 The photographs taken daily during a given weekly period shall be delivered to CCUA at the beginning of the following week. Photographs may be delivered by electronic mail.

3.04 Each photograph shall be dated and labeled in a manner that will clearly describe the Work and the location of the photograph in relation to the project. The location

description shall include the roadway name, lot number, station number, physical address if available, or other means of providing information to determine the accurate location where the photograph was taken.

3.05 The Contractor shall use color video with a minimum resolution of 1920 x 1080 pixels (1080p) for full high definition (HD).

3.06 Color video and photographs shall be taken prior to any work on the site documenting all existing conditions.

3.07 Digital versions of video or photographs shall be submitted on a USB flash drive or archival quality DVD.

END OF SECTION

SECTION 01370

SCHEDULE OF VALUES

PART 1 - GENERAL

1.1 Description:

A. Work Included: Provide a detailed breakdown of the agreed Contract Sum showing values allocated to each of the various parts of the work, as specified herein, and in other provisions of the Contract Documents.

B. Related Work: Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, and Supplementary Conditions.

1.2 Quality Assurance:

A. Use required means to assure arithmetical accuracy of the sum described.

B. When so required by the Engineer, provide copies of the subcontracts or other data acceptable to the Engineer substantiating the sums described.

1.3 Submittals:

A. Prior to commencement, submit a proposed schedule of values to the Engineer.

B. Meet with the Engineer and determine data, if any, required to be submitted.

C. Secure the Engineer's approval of the values prior to commencement.

END OF SECTION

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SECTION 01400

QUALITY CONTROL

PART 1 - GENERAL

1.1 Section Includes

A. Administrative and procedural requirements for quality control services and testing and inspection laboratory services.

1.2 General

A. Specific quality control requirements for individual construction activities are specified in the Sections that specify those activities. Those requirements, including inspections and tests, cover production of standard products as well as customized fabrication and installation procedures.

B. Inspections, test and related actions specified are not intended to limit the Contractor's quality control procedures that facilitate compliance with Contract Document requirements.

C. Requirements for the Contractor to provide quality control services required by the Engineer, Owner, or authorities having jurisdiction are not limited by provisions of this Section.

1.3 Contractor Responsibilities

A. Provide inspections, tests and similar quality control services specified in individual Specification Sections as the Contractor's responsibility and as required by governing authorities, except for those specifically indicated as being the Owner's responsibility; these services include those specified to be performed by an independent agency and not by the Contractor. Include costs for these services in the Contract Sum.

B. Provide and pay for costs of retesting and other related costs when:

1. Results of required inspections, tests or similar services prove unsatisfactory and do not indicate compliance with Contract Document requirements, regardless of whether the original test was the Contractor's responsibility.

2. Construction is revised or replaced by the Contractor, where tests were required on original construction.

3. Additional testing is needed or required by the Contractor.

4. Additional trips to the project are necessary by an agency when scheduled times for tests and inspections are cancelled and the agency is not notified sufficiently in advance of cancellation to avoid the trip.

C. Cooperate with agencies performing required inspections, tests and similar services and provide reasonable auxiliary services as requested.

1. Notify the agency sufficiently in advance of operations to permit assignment of personnel.

2. Provide access to the Work and furnish incidental labor and facilities necessary to facilitate inspections and tests.

3. Take adequate quantities of representative samples of materials that require testing and assist the agency in taking samples.

4. Provide facilities for storage and curing of test samples.

5. Provide the agency with a preliminary design mix proposed for use for materials mixes that require control by the testing agency.

6. Secure and protect samples and test equipment at the Project site.

D. Coordinate the sequence of activities to accommodate required services with a minimum of delay and coordinate activities to avoid the necessity of removing and replacing construction to accommodate inspections and tests.

E. Schedule times for inspections, tests, taking samples and similar activities.

1.4 Testing Agencies Responsibilities

A. Cooperate with the Engineer and Contractor in performance of their duties; provide qualified personnel to perform required inspections and tests.

B. Notify the Engineer and Contractor promptly of irregularities or deficiencies observed in the Work during performance of their services.

C. Agencies are not authorized to release, revoke, alter or enlarge requirements of the Contract Documents, or approve or accept any portion of the Work.

D. Agencies shall not perform any duties of the Contractor.

1.5 Submittals

A. Independent testing agencies shall submit three (3) copies of certified written reports of each inspection, test or similar service to the Engineer and to the Contractor.

B. Report Data: Written reports of each inspection, test or similar service shall include:

1. Date of issue.

2. Project title and number.

3. Name, address and telephone number of testing agency.

4. Dates and locations of samples and tests or inspections.

5. Names of individuals making the inspection or test.

6. Designation of the Work and test method.

7. Identification of product and Specification Section.

8. Complete inspection or test data.

9. Test results and an interpretations of test results.

10. Ambient conditions at the time of sample-taking and testing.

11. Comments or professional opinion as to whether inspected or tested Work complies with Contract Document requirements.

12. Name and signature of laboratory or inspector.

13. Recommendations on retesting.

1.6 Qualification of Service Agencies

A. Engage inspection and testing service agencies, including independent testing laboratories, which are prequalified as complying with "Recommended Requirements for Independent Laboratory Qualification" by the American Council of

Independent Laboratories, and which specialize in the types of inspections and tests to be performed.

B. Each independent inspection and testing agency engaged on the Project shall be authorized by authorities having jurisdiction to operate in the State in which the Project is located.

C. Inspection and testing agencies engaged by the Contractor shall be acceptable to Engineer and Owner.

D. The Contractor shall use appropriately certified labs for the material tested such as the Florida Department of Transportation, the Florida Department of Environmental Protection, etc.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 Repair and Protection

A. Upon completion of inspection, testing, sample-taking and similar services, repair damaged construction and restore substrates and finishes to eliminate deficiencies, including deficiencies in visual qualities of exposed finishes.

B. Protect construction exposed by or for quality control service activities and protect repaired construction.

C. Repair and protection are the Contractor's responsibility, regardless of the assignment of responsibility for inspection, testing or similar services.

END OF SECTION

SECTION 01500

CONSTRUCTION FACILITIES

PART 1 - GENERAL

1.1 Description: The following criteria shall govern the furnishing of and paying for temporary construction and service items. Such items shall be instituted at the beginning and maintained for the life of the work or until removal or termination is approved by the Engineer.

1.2 Temporary Facilities

A. Drinking Water: The Contractor shall provide cool water with dispensing utilities.

B. Construction Water: The Contractor shall provide temporary water for construction at the project site. The Contractor shall provide proper back flow devices in order to comply with regulations concerning back flow & cross connection.

C. It shall be the Contractor's responsibility to provide temporary electrical power for construction purposes.

D. Toilet Facilities: The Contractor shall furnish a portable, job-site toilet enclosure facility through a local company specializing and licensed in this business. The toilet enclosure shall be located on the project site at a point acceptable to the Owner. It shall be maintained daily by the supplying company and removed from the project site upon completion of the project.

1.3 Security

A. General: The Contractor shall provide security, as necessary or required, to protect work, property, materials and equipment at all times.

B. Rodents and Other Pests: The Contractor, through debris removal, etc., shall control the creation of rodent or pest problems. Should such develop, the Contractor shall secure the services of a licensed exterminator to control.

C. Debris Control: Keep premises clean and free from accumulation of debris and rubbish. Provide trash and debris receptacles and require its usage. Remove from site at least weekly. Dispose all debris and rubbish at a properly approved and permitted facility or by using a properly licensed and permitted vender at no cost

to the owner. The Contractor shall provide the Owner copies of all disposal tickets.

D. Cleaning: As work is completed by trades, areas of work shall be cleaned in preparation for next trade, inspections or general safety of property and person.

E. Project Safety: The Contractor shall comply with all applicable governmental and insuring company requirements relative to construction and project safety. Either the superintendent or another company representative must be on the site during all working hours, and shall be trained in project safety and designated as the Contractor's Site Safety Director.

1.4 Quality Assurance

A. Comply with industry standards and applicable laws and regulations of authorities having jurisdiction, including but not limited to:

1. Building Code Requirements

2. Health and Safety Regulations

3. Utility Company Regulations

4. Police, Fire Department and Rescue Squad Rules

5. Environmental Protection Regulations

6. Debris and rubbish transportation and disposal regulations and rules

END OF SECTION

SECTION 01535

TEMPORARY BYPASS PUMPING SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

A. Design, furnish, install, field test, operate, monitor, maintain, and remove temporary bypass pumping systems as proposed by the Contractor for the purpose of diverting flow around work areas as required by the provisions specified in Section 01101 “Special Procedures for Maintenance of Plant Operations and Sequence of Construction”.

B. The design, installation and operation of temporary bypass pumping systems shall be the Contractor's responsibility. The Contractor shall provide the services of a professional pump bypass company (system supplier) who can demonstrate to the Owner and Engineer that the company specializes in the design prepared by a licensed professional engineer and operation of temporary bypass pumping systems. The bypass systems shall meet the requirements of all codes and regulatory agencies having jurisdiction.

C. Maintain temporary bypass pumping systems so that they are completely functional throughout the required period of service.

D. Following the required period of service, remove temporary bypass pumping systems from site and return the site to its original condition.

E. Provide all maintenance including manufacturer recommended preventive maintenance and on-call repair services. Contractor shall provide repair services and/or replacement equipment 24-hours per day, 7-days per week within 4-hours of being called.

F. The total storage quantity of fuel allowable at the site to operate the temporary pumps shall not exceed the sum of the individual fuel tank capacities furnished with each pump's drive. Provide a refueling service to maintain continuous 24-hours per day, 7 days per week pumping system operation.

1.2 SUBMITTALS

A. Delegated-Design Submittal: For the temporary bypass pumping system.

Provide a bypass pumping plan signed by a licensed Professional Engineer registered in the State of Florida containing detailed plans and descriptions outlining all provisions and precautions to be taken to establish compliance with this Section and the Contract Drawings.

B. Submit in accordance with Section 01300 “Submittals”, the following:

1. Detailed plans and sections showing the proposed pumping system layout including dimensions and elevations.

2. Staging area and access requirements for all pumps.

3. Pump size, capacity, number of units, diesel/electric engine specifications, fuel tank capacity, fuel consumption requirements, method of refueling, and power consumption.

4. Calculations of static lift, pipe size selection, friction losses, flow velocity and pump selection.

5. Pump curves showing pump operating range.

6. Proposed method of noise control for each pump.

7. Number, size, material, location and method of installation of suction piping.

8. Number, size, material, location and method of installation of discharge piping.

9. Access stairs to cross over pipe, and below grade pipe casing at road crossings.

10. Temporary pipe supports, anchorage, cover material, and other accessories as required to distribute point loads and stabilize the piping system.

11. Installation schedule and maintenance schedule.

12. System supplier phone number for 24-hour service.

13. A minimum of five reference installation of projects with similar size in wastewater pumping applications. Include contact names and phone numbers.

14. List of recommended spare parts to be stored on-site for emergency maintenance.

C. Provide information on the system supplier’s service staff capabilities and replacement parts inventory to show that the vendor has sufficient resources to provide emergency service and replacement equipment and/or parts to the project site within 4-hours of a service call.

D. A description of system operation and controls. Include procedures for controlling pumps to accommodate the varying influent flow range, a list of all alarm conditions and procedures for correcting problems including equipment replacement. Contractor shall work with plant operations to verify the bypass system is not causing operational problems with the plant and make proper adjustments to maintain proper operation.

E. A description and schedule for the proposed procedures for startup and testing of the bypass pumping system to demonstrate compliance with specified automatic operation and maintenance of a constant discharge pressure.

F. A plan of operations for inclement weather. The plan shall demonstrate the ability to maintain pumping system operations throughout inclement weather events.

G. A description and schedule for the proposed procedures for dismantling the system, and restoring normal operations.

1.3 QUALITY ASSURANCE

A. The Contractor shall employ the services of a system supplier who can demonstrate 5 years of recent and continuous specialization in the design, installation, operation and removal of temporary bypass pumping systems in wastewater applications. The complete system shall be furnished from a single system supplier who shall be capable of providing service staff, repair parts and replacement of any deficient system component within 4-hours of a service call, 24-hours per day, 7-days per week.

1.4 REFERENCE STANDARDS

A. Design, manufacturing and assembly of elements of the equipment specified herein shall be in accordance with the following:
1. American Institute of Steel Construction (AISC)
2. American Iron and Steel Institute (AISI)
3. American Society of Mechanical Engineers (ASME)
4. American National Standards Institute (ANSI)
5. American Society for Testing Materials (ASTM)
6. American Welding Society (AWS)
7. American Bearing Manufacturers Association (ABMA)
8. Institute of Electrical and Electronics Engineers (IEEE)
9. National Electrical Manufacturers Association (NEMA)
10. Occupational Safety and Health Administration (OSHA)
11. Underwriters Laboratories (UL)

B. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

1.5 SYSTEM SUPPLIER

A. Provide the services of the system supplier's representative as specified herein.

B. Provide the services of the system supplier's representative for physical checkout field testing and operation and maintenance instruction for a minimum of 1 person day per pumping system configuration. See requirements in PART 3.

C. Provide the services of the system supplier's representative or designated alternative, who shall be available 24-hours per day and able to be on site within 4-hours of being contacted at no additional cost to the Owner.

D. Provide on-site operation of the bypass pumping system 24-hours per day, 7-days per week.

PART 2 - PRODUCTS

2.1 GENERAL PUMPING EQUIPMENT

A. Furnish pumping units and all accessories from a single system supplier. Each temporary bypass pumping system shall be complete including pumps, drives, piping, piping restraint, piping supports, cross-over steps, piping headers, fittings, valves, isolation knife gate valves, flow meters, controls and appurtenances as required for a complete system.

B. The pumps, drives and controls shall be designed and built for 24-hour continuous service at any and all points within the required range of operation, without overheating, without cavitation, and without excessive vibration or strain. All parts shall be so designed and proportioned as to have the strength, stability and stiffness and be constructed to meet the specified requirements. Methods shall be provided for inspection, repairs, and adjustment.

C. All necessary foundation bolts, nuts, and washers shall be furnished.

D. Each piece of equipment shall be furnished with a nameplate (with embossed data) securely mounted to the body of the equipment. As a minimum, the nameplate for the pumps shall include the manufacturer's name and model number, serial number, rated flow capacity, head, speed and all other pertinent data. As a minimum, nameplates for drives shall include the manufacturer's name and model number, serial number, horsepower, speed, input voltage, amps, number of cycles and power and service factors.

E. All pumping units shall be provided as critically silenced units, complying with all Clay County ordinances relating to noise.

F. Provide pumps manufactured by one of the following:
   1. Thompson Pump & Manufacturing Co., Inc., Port Orange, FL
   2. Godwin Pumps of America, Inc., Bridgeport, NJ
   3. Acme Dynamics, Plant City, FL
   4. Or equal.

2.2 CONDITIONS OF OPERATION

A. Pumps of the same grouping shall be identical in every respect with all parts interchangeable. Each pumping system will be provided with a minimum of two installed pumps and one uninstalled stand-by.

B. Each pumping system shall be designed for the conditions of service specified in Section 01101 “Special Procedures for Maintenance of Plant Operations and Sequence of Construction” and below. All pumps shall have a rising head capacity curve for stable pump operation from the minimum head operating point to the shut-off head. Capacities listed below represent current

conditions and could increase over the course of construction. Peak hour flow includes wet weather flows. Pump conditions are as follows:

1. Influent Structure Modifications:
   a. Liquid: Raw Wastewater
   b. Capacity – Peak Hour (gpm): 6,400 gpm
   c. Capacity – Maximum Day (gpm): 3,900 gpm
   d. Capacity – Average (gpm): 1,500 gpm

2. Electrical Improvements – Effluent Pump Station:
   (Installation of ATS, Replacement of Electrical Service, Modifications to Main Breaker, Replacement of Standby Generators)
   a. Liquid: Disinfected Effluent
   b. Capacity – Peak Hour (gpm): 6,400 gpm
   c. Capacity – Maximum Day (gpm): 3,900 gpm
   d. Capacity – Average (gpm): 1,500 gpm

2.3 PUMPING SYSTEM COMPONENTS

A. All pumps shall be centrifugal, end suction, fully automatic self-priming units that do not require the use of foot-valves, vacuum pumps, diaphragm pumps, or isolation knife gate valves or float apparatus in the priming system.

B. Pump seals shall be high pressure, mechanical self-adjusting type with solid carbide faces capable of withstanding suction pressures to 100 psi without the pump running. The mechanical seal shall be cooled and lubricated in an oil bath reservoir, requiring no maintenance or adjustment. The oil bath reservoir shall not come in contact with or leak into the pumped water. Each pump shall be capable of running dry, with no damage for extended periods of time. All pump seal metal parts shall be stainless steel. All elastomers shall be Viton.

C. Each pump shall be driven by a diesel engine. Diesel engine shall be water cooled. If the Contractor proposes to use electric motor driven pumps, power costs will be the responsibility of the Contractor.

D. Each pump and diesel engine shall be skid mounted with integral fuel tank and skid lifting bracket.

E. Provide automatic start/stop controls for the pumping system to automatically maintain system flow within the flows specified above. Controls shall be contained in a local control panel with provision to manually operate each pump, provide indication of pump operation, and indicate the total flow being pumped.

F. Provide all required suction and discharge pipe and fittings, discharge manifold pipe and fittings, shutoff valves, check valves, flow meter, pressure regulating valves, insulation, and all required accessories. All pipe and fittings shall be suitable for service conditions including buried conditions, as applicable. All joints must be 100 percent restrained. Suction piping shall be rated for 25-in Hg vacuum. Discharge piping, fittings, connections, isolation knife gate

valves, and other discharge piping accessories shall be rated for a minimum working pressure of 150 psi.

G. All piping shall be provided with temporary support structures, preventing any lateral movement.

H. Provisions shall be made for dewatering each temporary pipe configuration when taken out of service.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Installation shall be in accordance with the system supplier's recommendations and approved shop drawing submittals.

B. Install pumping units on a firm level surface.

C. Furnish the services of the pump system supplier's representative for a minimum of one day per temporary bypass system to assist equipment installation and physical checkout.

D. When working inside the influent structure, Contractor shall exercise caution and comply with the OSHA requirements for confined spaces and in the potential presence of combustible or oxygen-deficient atmospheres.

3.2 FLOW CONTROL MEASURES

A. CONTRACTOR shall be responsible and liable for any wastewater overflows resulting from inadequate construction, maintenance or operation of the bypass system, including reporting to the State of Florida and any resulting fines.

B. In the event of accidental spill or overflow, immediately stop the discharge and take action to clean up and disinfect the spill. Promptly notify Owner and Engineer so that required reporting can be made.

3.3 FIELD QUALITY CONTROL – BYPASS PUMP TEST

A. Provide field testing in accordance with the approved shop drawing submittal. Field tests shall demonstrate conformance with system requirements.

B. The Contractor shall require that field testing be conducted by the pump system supplier's representative in the presence of the Engineer. Furnish the services of the pump system supplier's representative for a minimum of one day per temporary bypass system to conduct required testing.

C. Field testing shall demonstrate a minimum of 24 hours of continuous operation. During the 24 hours of continuous operation, the system shall demonstrate the ability to automatically start and stop pumps in response to changing flow conditions.

D. Remove and replace any system component that fails to perform in accordance with specified requirements.

3.4 EQUIPMENT REMOVAL

A. At the completion of the period of service, dewater and disconnect all temporary piping and remove all system components from the site. See Drawings for modifications identified to remain. Restore the work site to its original condition.

3.5 DAMAGES

A. Without cost to the Owner, repair any damage that may result from installation, operation, maintenance, and removal of the bypass pumping system. This includes, but is not limited to, damages resulting from inadequate demobilization, or improper installation, operation and maintenance of the bypass system, mechanical failures, and electrical failures.

END OF SECTION

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SECTION 01600

MATERIAL AND EQUIPMENT

PART 1 - GENERAL

1.01 REQUIREMENTS INCLUDED

A. Products.

B. Transportation and Handling.

C. Storage and Protection.

D. Product Options.

E. Product List.

F. Substitutions.

G. Product Demonstrations.

1.02 RELATED REQUIREMENTS

A. General Conditions.

B. Section 01010 – "Summary of Work."

C. Section 01400 – "Quality Control." Submittal of manufacturer's certificates.

D. Section 01655 – "Equipment Testing and Startup."

E. Section 01740 – "Warranties and Bonds."

1.03 PRODUCTS

A. Products include material, equipment, manufactured or fabricated products, and systems.

B. Comply with Specifications and referenced standards as minimum requirements.

C. Components required to be supplied in quantity within a Specification Section shall be the same and shall be inter-changeable.

D. Do not use materials and equipment removed from existing structure, except as specifically required, or allowed, by Contract Documents.

1.04 TRANSPORTATION AND HANDLING

A. Order and arrange deliveries of products and equipment in accordance with progress schedules to prevent conflicts with work conditions at the site.

B. Transport products by methods to avoid product damage and in accordance with manufacturer's instructions. Deliver materials to job site in manufacturer's original unopened containers clearly labeled with manufacturer's name, brand designation and reference specification.

C. Provide equipment and personnel to handle products by methods to prevent soiling or damage. Handle products in such a manner as to prevent breakage of containers and damage of any kind.

D. Promptly inspect shipments to assure that products comply with Contract Documents and approved submittal requirements, quantities are correct, and products are undamaged. Damage sustained by products in transit to job site shall be repaired to the satisfaction of the Field Representative. If damage sustained while transporting products to job site is non-repairable, the products shall be replaced with new ones at no cost to Owner.

1.05 STORAGE AND PROTECTION

A. Store products in accordance with manufacturer's instructions, with seals and labels intact and legible. Exposed metal surfaces, not provided with manufacturer specific storage instructions, shall be protected with a light oil or silicone coating to prevent rust while in storage. Maintain within temperature and humidity ranges required by manufacturer's instructions.

B. For exterior storage of fabricated products, place on sloped supports, blocking, or skids above ground. Cover products subject to deterioration with impervious sheet covering; provide ventilation to avoid condensation.

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

D. Arrange storage to provide access for inspection. Periodically inspect to assure products are undamaged and are maintained under required conditions.

E. Cement, sand, and lime shall be stored under a roof and off the ground and kept dry at all times.

F. All structural, miscellaneous, and reinforcing steel shall be stored off the ground to prevent the accumulation of dirt, grease, or standing water from accumulating. Beams shall be stored with the webs vertical.

G. Precast concrete shall be stored to prevent the accumulation of dirt, standing water, staining, chipping, or cracking.

H. Brick, block or similar masonry products shall be stored to prevent accumulation of dirt and water, and to prevent breakage, chipping, cracking, staining, and spalling.

I. All materials and equipment incorporated into the Work shall be handled and stored by the Contractor before, during, and after shipment in a manner to prevent warping, twisting, breaking, chipping, rusting, injury, theft, or damage of any kind.

J. Any material or equipment that has become damaged as to become unfit for use or specified, in the opinion of the Engineer, shall be promptly removed from the work and the damaged material or equipment replaced by the Contractor at no additional cost to the Owner.

K. Arrange storage in a manner to provide easy access for inspection.

L. The Contractor shall be responsible for all material, equipment, and supplies sold and delivered to the Owner under this Contract until Final Completion of the Work and acceptance by the Owner. In the event that any such material, equipment, and supplies are lost, stolen, damaged, or destroyed prior to final inspection and acceptance, the Contractor shall replace same without any additional cost to the Owner.

M. Should the Contractor fail to take proper action on the storage and handling of materials or equipment supplied under this Contract within seven (7) days after written notice, the Owner retains the right to correct all deficiencies noted and deduct the cost associated with the corrections from the Contractor's Contract. These costs may comprise expenditures for labor, equipment usage, administrative, clerical, engineering, vendor, and legal fees or any other reasonable costs associated with making the necessary corrections.

1.06 ENCLOSED STORAGE

A. The Contractor shall furnish a covered, weather-protected storage structure providing a clean, dry, noncorrosive environment for all mechanical equipment, valves, electrical and instrumentation equipment, architectural items, and special equipment incorporated into the project in compliance with manufacturer's instructions.

B. Store products, subject to damage by the elements, in accordance with manufacturer's instructions.

C. Maintain temperature and humidity within ranges stated in manufacturer's instructions.

D. Provide humidity control and ventilation for sensitive products as required by manufacturer's instructions.

E. Store unpacked and loose products on shelves, in bins, or in neat groups of like items.

1.07 EXTERIOR STORAGE

A. Provide substantial platforms, blocking, or skids, to support fabricated products above ground; slope to provide drainage. Protect products from soiling, staining, and corrosion.

B. For products subject to discoloration or deterioration from exposure to the elements, cover with impervious sheet material. Provide ventilation to avoid condensation.

C. Store loose granular materials on clean, solid surfaces such as pavement, or on rigid sheet materials, to prevent mixing with foreign matter.

D. Provide surface drainage to prevent erosion and ponding of water.

E. Prevent mixing of refuse or chemically injurious materials or liquids.

1.08 MAINTENANCE OF STORAGE

A. Periodically inspect stored products on a scheduled basis. Maintain a log of inspections, make available to Field Representative on request.

B. Verify that storage facilities comply with manufacturer's product storage instructions.

C. Verify that stored products exposed to the elements are not adversely affected; that any weathering of finishes is acceptable under requirements of Contract Documents.

1.09 MAINTENANCE OF EQUIPMENT STORAGE

A. For mechanical and electrical equipment in long-term storage, provide manufacturer's service instructions to accompany each item, with notice of enclosed instructions shown on exterior of package.

B. Service equipment on a regularly scheduled basis, maintaining a log of services; submit as a record document.

C. All equipment having moving parts such as gears, electric motors, etc. shall be rotated a minimum of once weekly to ensure proper lubrication and to avoid metal-to-metal "welding." Upon installation of the equipment the Contractor shall start the equipment, at partial load, once weekly for an adequate period to ensure that the equipment does not deteriorate from lack of use.

D. Lubricants shall be changed upon completion of installation and as frequently as required thereafter in accordance with the manufacturer's instructions during the period between installation and acceptance.

1.10 PRODUCT OPTIONS/SUBSTITUTIONS

A. Product Options/Substitutions shall be in accordance with the requirements of the General Conditions.

1.11 SPARE PARTS

A. Spare parts for equipment provided under Division 11: Equipment; Division 15: Mechanical; and Division 16: Electrical are specified in the pertinent Specification Sections. The Contractor shall collect and store the spare parts as required and specified in a climate controlled enclosed storage area until final completion. The Contractor shall furnish the Engineer an inventory list of all spare parts, the equipment it is associated with, the name and contact of the supplier, and the delivered cost associated with each item on the inventory list.

1.12 OIL, GREASE, AND FUEL

A. All grease, oil, and fuel required for testing of equipment shall be furnished with the respective equipment.

B. The Contractor shall change the oil in all drives and intermediate drives of each of the provided equipment at the manufacturer's recommended interval period until final acceptance by the Owner.

C. The Contractor shall re-lubricate all grease fittings of each of the provided equipment at the manufacturer's recommended intervals and upon completion of installation and as frequently as required thereafter during the period between installation and final acceptance by the Owner.

PART 2 – PRODUCTS (Not Applicable)

PART 3 – EXECUTION (Not Applicable)

END OF SECTION

SECTION 01655

EQUIPMENT TESTING AND START-UP

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. Facility Startup: Includes putting Project in operation, cleaning, adjusting, and balancing equipment, initial operation (startup) of equipment items, operating equipment, starting systems, operations of systems, testing of equipment and systems, and demonstration and verification of the completed facility as a unit.

B. Functional Test: A test or tests in the presence of the Owner and Engineer to demonstrate that the installed equipment or system meets manufacturer's installation and adjustment requirements and other requirements specified.

C. Operation Period: The operation period begins when the facility has been successfully started up as defined in the Specifications and has met all Substantial Completion requirements.

D. Performance Test: A test performed in the presence of the Owner and Engineer after any required functional test specified, to demonstrate and confirm that the equipment and/or system meets the specified performance requirements.

E. Significant Interruption: May include any of the following events:

1. Failure of the Contractor/supplier to maintain qualified onsite startup personnel as scheduled.

2. Failure to meet specified performance for more than two (2) consecutive hours.

3. Failure of any critical equipment unit, system, or subsystem that is not satisfactorily corrected within four (4) hours after failure.

4. Failure of noncritical unit, system, of subsystem that is not satisfactorily corrected within eight (8) hours after failure.

5. As may be determined by Owner or Engineer.

F. Startup Test Period:

1. Startup of the entire facility or any portion thereof includes coordinated operation of the facilities by the Owner operating personnel and manufacturer's representatives for equipment items and systems after all required functional tests have been completed and those performance tests deemed necessary for the safe operation of the entire facility have been completed.

2. Startup of the entire facility or any portion thereof shall be considered complete when, in the opinion of the Owner and Engineer, the facility or designated portion has operated in the manner intended for five (5) continuous days without significant interruption. This period is in addition to any training, functional, or performance test period specified elsewhere. A significant interruption will require the startup then in progress to be stopped and restarted after corrections are made.

G. System: The overall process, or a point thereof, which performs a specific function. A system may consist of two or more subsystems as well as two or more types of equipment. Examples of systems on this project are as follows.

1. Influent Structure distribution to BTUs

2. Biological Treatment Unit

3. Electrical Systems

4. Instrumentation and Control System(s).

1.02 SUBMITTALS

A. Administrative Submittals:

1. Functional and performance test schedule and plan for equipment, units, and systems at least 15 days prior to start-up of related testing. Include test plan, procedures, and log format.

2. Schedule and plan of facility startup activities at least 21 days prior to commencement.

B. Quality Control Submittals:

1. Manufacturer's Certificate of Proper Installation as required.

2. Test Reports: Functional and performance testing, in format as shown in specification, and certification of function and performance test for each piece of equipment or system specified.

3. Operation and maintenance data.

4. Certification of Calibration: Testing equipment.

1.03 CONTRACTOR FACILITY STARTUP RESPONSIBLITIES

A. General:

1. Perform work for test specified, including items furnished by the Owner.

2. Demonstrate proper installation, adjustment, function, performance, and operation of equipment, system, control devices, and required interfaces individually and in conjunction with process instrumentation and control system.

1.04 OWNER FACILITY STARTUP RESPONSIBILITIES

A. General

1. Review Contractor's test plan and schedule.

2. Witness each functional or performance test.

3. Coordinate other plant operations, if necessary, to facilitate Contractor's test.

4. Provide start-up assistance to the Contractor when available.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.01 TESTING PREPARATION

A. General: Contractor/Equipment Supplier shall:

1. Complete work associated with the unit and related processes before testing, including related manufacturer's representative services.

2. Furnish related operating and maintenance manuals, and spare parts and special tools as specified before testing any unit or system.

3. Furnish qualified manufacturer's representatives when required to assist in testing.

4. Utilize the Manufacturer's Certificate of Proper Installation Form supplemented as necessary to document functional and performance procedures, results, problems, and conclusions.

5. Schedule and attend pretest (functional and performance) meetings related to test schedule, plan of test, materials, chemicals, and liquids required, facilities' operations interface, and Owner involvement.

6. Designate and furnish one or more persons to be responsible for coordinating and expediting Contractor/supplier's facility startup duties. The person or persons shall be present during facility startup meetings and shall be available at all times during the facility startup period.

7. Provide temporary valves, gauges, piping, test equipment and other materials and equipment required to conduct testing.

B. Cleaning and Checking: Prior to Starting Functional Testing:

Contractor/supplier shall:

1. Calibrate testing equipment for accurate results.

2. Inspect and clean equipment, devices, connected piping, and structures so they are free of foreign material.

3. Lubricate equipment in accordance with manufacturer's instructions.

4. Turn rotating equipment by hand and check motor-driven equipment for correct rotation.

5. Open and close valves by hand and operate other devices to check for binding, interference, or improper functioning.

6. Check power supply to electric-powered equipment for correct voltage.

7. Adjust clearances and torques.

8. Flush and pressure test piping for leaks.

9. Slowly fill each hydrostatic structure in the process flow stream and test for leaks.

10. Obtain completion of applicable portions of Manufacturer's Certificate of Proper Installation.

11. Obtain any required clearance letters from permitting agency having jurisdiction to place facilities in service.

C. Ready-to test determination will be based at least on the following:

1. Notification by Contractor/supplier of equipment and system readiness for testing.

2. Acceptable testing plan.

3. Acceptable operation and maintenance manuals incorporating review comments.

4. Receipt of Manufacturer's Certificate of Proper Installation, if specified.

5. Adequate completion of work adjacent to, or interfacing with, equipment to be tested, including items to be furnished by Owner.

6. Availability and acceptability of manufacturer's representative, when specified, to assist in manufacturers' responsibilities.

7. Equipment and electrical tagging complete.

8. All spare parts and special tools delivered to Owner.

3.02 FUNCTIONAL TESTING

A. General:

Contractor shall:

1. Begin testing at a time mutually agreed upon by the Owner, Engineer, and manufacturer's representative(s).

2. Notify in writing the Engineer, Owner and manufacturer's representative at least 15 days prior to scheduled date of functional tests.

3. Separate items of equipment demonstrated to function properly during subsystem testing that may require no further functional test if documentation of subsystem testing is acceptable to Owner.

4. Conduct functional test until each individual component item or system has achieved 24 continuous hours of satisfactory operation. Demonstrate all operational features and controls function during this period in automatic modes.

5. If, in Owner's and/or Engineer's opinion, each system meets the functional requirements specified, such system will be accepted as conforming for purposes of advancing to performance testing phase, if required. If, in Owner's and/or Engineer's opinion, functional test results do not meet requirements specified, the systems will be considered as nonconforming.

6. Performance testing shall not commence until the equipment or system meets functional test specified.

7. Contractor/supplier, in conjunction with the manufacturer's representative, shall provide interfacing materials and adjustments to the installation as required to achieve a satisfactory report.

3.03 PERFORMANCE TESTING

A. General:

1. The performance test will be the responsibility of the Contractor.

2. Begin testing at time mutually agreed upon by the Owner, Engineer, and manufacturer's representative(s), as appropriate.

3. Contractor shall follow approved testing plan and detained procedures specified.

4. Source and type of fluid, gas, or solid for testing shall be as specified.

5. Unless otherwise indicated, Contractor shall furnish all labor, materials, and supplies for conducting the test and talking all samples and performance measurements.

6. Contractor shall prepare performance test report summarizing test method. Include test logs, pertinent calculations, and certification of performance.

7. Performance test to be as detailed in the specifications.

3.04 STARTUP TEST PERIOD

A. Test Reports: As applicable to the equipment furnished, Contractor/supplier shall certify in writing that:

1. Necessary hydraulic structures, piping systems and valves have been successfully tested.

2. Equipment systems and subsystems have been checked for proper installation, started, and successfully tested to indicate that they are operational.

3. Systems and subsystems are capable of performing their intended functions.

4. Facilities are ready for intended operation.

B. Owner, Engineer, and Contractor/supplier shall attend planning meetings and arrange for attendants by key major equipment manufacturer representatives as required by the Contract Documents.

C. When facility startup has commenced, Contractor shall schedule remaining work so as not to interfere with or delay the completion of facility startup. Contractor shall support the facility startup activities with adequate staff to prevent delays and process upsets. This staff shall include, but not be limited to, major instrumentation personnel, electricians, mechanics, millwrights, pipe fitters and plumbers.

D. Contractor shall supply and coordinate specified manufacturer's facility startup services.

E. Contractor shall make adjustments, repairs, and corrections necessary to complete facility startup.

F. After the facility is operating, Contractor shall complete the testing of those items of Equipment, systems, and subsystems which could not be or were not adequately or successfully tested prior to startup period.

3.05 PARTIAL UTILIZATION

A. 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. Such operation will not interfere with testing of other equipment and systems that may still be underway, and shall not preclude the need to startup that portion operated in combination with the rest of the facility when testing is completed.

3.06 CONTINUOUS OPERATIONS

A. Owner will accept equipment and systems as substantially complete and ready for continuous operation only after successful facility startup is completed and documented, disinfection is complete for potable water facilities and reports submitted, and manufacturer's services completed for training of Owner's personnel, and as described within Section 01010, "Summary of Work."

END OF SECTION

SECTION 01701

PROJECT CLOSEOUT

PART 1 - GENERAL

1.1 Section Includes

A. Administrative and procedural requirements for project closeout.

1. Inspection procedures.

2. Project record document submittal.

3. Final cleaning.

1.2 Substantial Completion

A. Before requesting inspection for certification of Substantial Completion, complete the following. List exceptions in the request.

1. If 100 percent completion cannot be shown, include a list of incomplete items, the value of incomplete construction, and reasons the Work is not complete.

2. Advise Owner of pending insurance change-over requirements.

3. Submit specific warranties, workmanship bonds, maintenance agreements, final certifications and similar documents - refer to Section 01740, “Warranties and Bonds.”

4. Obtain and submit lien releases enabling the Owner unrestricted use of the Work and access to services and utilities; include occupancy permits, operating certificates and similar releases.

5. Submit record drawings, maintenance manuals, and similar final record information.

6. Complete start-up testing of systems, and instruction of the Owner's operating and maintenance personnel. Discontinue or change over and remove temporary facilities from the site, along with construction tools, mock-ups, and similar elements.

7. Complete final clean up requirements, including touch-up painting. Touch-up and otherwise repair and restore marred exposed finishes.

B. When the Contractor considers the Work to be substantially complete, they shall submit a written notice to the Engineer that the Work, or designated portion of the Work, is complete and ready for inspection.

C. Within 14 days of receipt of a request for inspection, the Engineer will either proceed with inspection or advise the Contractor of unfulfilled requirements. When the Engineer and Owner concur that the Work, or designated portion of the Work, is substantially complete, the Engineer will prepare the Certificate of Substantial Completion following inspection.

D. Should the Engineer determine that the Work is not substantially complete, they will advise the Contractor of construction or other requirements that must be completed or corrected before the certificate will be issued.

1. The Engineer will repeat inspection when requested and assured that the Work has been substantially completed.

2. Results of the completed inspection will form the basis of requirements for final acceptance.

1.3 Final Completion

A. When the Contractor considers the Work to be complete, they shall submit written certification to the Engineer that the Work is completed and ready for final inspection. Include the following:

1. Submit the final payment request with lien releases or waivers of claims and supporting documentation not previously submitted and accepted. Include all inspection certificates, guarantees and warrantees for products, equipment, processes, operations and completed facilities.

2 Submit an updated final statement.

3. Submit a certified copy of the Engineer's final inspection list of items to be completed or corrected, stating that each item has been completed or otherwise resolved for acceptance, and the list has been endorsed and dated by the Engineer.

4. Submit final meter readings for utilities, a measured record of stored fuel, and similar data as of the date of Substantial Completion, or when the Owner

took possession of and responsibility for corresponding elements of the Work.

5. Submit consent of surety to final payment.

6. Submit evidence of final, continuing insurance coverage complying with insurance requirements.

B. The Engineer will inspect the Work upon receipt of notice that the Work, including inspection list items from earlier inspections, has been completed, except items whose completion has been delayed because of circumstances acceptable to the Engineer.

1. Upon completion of inspection, the Engineer will prepare a certificate of final acceptance, or advise the Contractor of Work that is incomplete, or of obligations that have not been fulfilled but are required for final acceptance.

2. If necessary, re-inspection process will be repeated.

1.4 Record Document Submittals

A. Maintain at the site one complete set of record documents; protect from deterioration and loss in a secure, fire-resistive location.

1. Provide access to record documents for the Engineer's reference during normal working hours.

2. Label each document "PROJECT RECORD" in 2-inch-high printed letters.

3. Do not use for construction purposes.

B. Record Drawings: Maintain a clean, undamaged set of blue or black line white-prints of Contract Drawings and Shop Drawings. Mark the set to show the actual installation where the installation varies substantially from the Work as originally shown. Mark whichever drawing is most capable of showing conditions fully and accurately; where Shop Drawings are used, record a cross-reference at the corresponding location on the Contract Drawings. Give particular attention to concealed elements that would be difficult to measure and record at a later date.

1. Mark record sets with red erasable pencil; use other colors to distinguish between variations in separate categories of the Work.

2. Mark new information that was not shown on Contract Drawings or Shop Drawings.

3. Show elevations and horizontal control dimensions of storm sewers, gravity sewers including laterals, electric cables, television cables, telephone cables, force mains, water mains crossed, and any other underground utilities and structures. Information shall be obtained by surveying by a professional engineer or land surveyor registered in the State of Florida.

4. Note related Change Order numbers where applicable.

5. Organize record drawing sheets into manageable sets, bind with durable paper cover sheets, and print suitable titles, dates and other identification on the cover of each set.

C. Record Specifications: Maintain one complete copy of the Project Manual, including addenda, and one copy of other written construction documents such as Change Orders and modifications issued in printed form during construction.

1. Mark these documents to show substantial variations in actual Work performed in comparison with the text of the Specifications and modifications.

2. Give particular attention to substitutions, selection of options and similar information on elements that are concealed or cannot otherwise be readily discerned later by direct observation.

3. Note related record drawing information and Product Data.

D. Record Product Data: Maintain one copy of each Product Data submittal.

1. Mark these documents to show significant variations in actual Work performed in comparison with information submitted. Include variations in products delivered to the site, and from the manufacturer's installation instructions and recommendations.

2. Give particular attention to concealed products and portions of the Work which cannot otherwise be readily discerned later by direct observation.

3. Note related Change Orders and mark-up of record drawings and Specifications.

E. Record Sample Submitted: Immediately prior to the date or dates of Substantial Completion, the Contractor will meet at the site with the Engineer and the Owner to determine which of the submitted Samples that have been maintained during progress of the Work are to be transmitted to the Owner for record purposes. Comply with delivery to the Owner's Sample storage area.

F. Record Survey: Provide as-built survey prepared in accordance with the CCUA As-Built specifications standards manual (www.clayutility.org/engineering/documents/As-BuiltSpecificationsStandardsManual.pdf) and minimum technical standards for surveying as set forth by the Florida Board of Professional Surveyors and Mappers in Chapter 61G17-6 Florida Administrative Code, pursuant to Section 472.027 Florida Statutes.

G. Miscellaneous Record Submittals: Refer to other Specification Sections for requirements of miscellaneous record-keeping and submittals in connection with actual performance of the Work.

H. At Contract close-out, deliver one copy of Record Documents to Engineer for Owner. Accompany submittal with transmittal letter in duplicate containing the following information:

1. Date

2. Project title and number

3. Contractor's name and address

4. Title and number of each Record Document

5. Signature of Contractor or his authorized representative

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 Final Cleaning

A. Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to the condition expected in a normal, commercial building cleaning and maintenance program.

B. Complete the following cleaning operations before requesting inspection for Certification of Substantial Completion and maintain until final completion, except in areas occupied or designated by Owner.

1. Remove labels that are not permanent labels.

2. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compound and other substances that are noticeable vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials.

3 Clean exposed exterior and interior hard-surfaced finishes to a dust-free condition, free of stains, films and similar foreign substances. Restore reflective surfaces to their original reflective condition.

4. Leave concrete floors broom clean.

5. Vacuum carpeted surfaces.

6. Wipe surfaces of mechanical and electrical equipment. Remove excess lubrication and other substances.

7. Clean plumbing fixtures to a sanitary condition.

8. Clean light fixtures and lamps.

9. Clean the site, including landscape development areas, of rubbish, litter and other foreign substances.

10. Sweep paved areas broom clean; remove stains, spills and other foreign deposits.

11. Rake grounds that are neither paved nor planted, to a smooth even-textured surface.

C. Engage an experienced exterminator to make a final inspection and rid the Project of rodents, insects and other pests.

D. Remove temporary protection and facilities installed for protection of the Work during construction.

E. Comply with regulations of authorities having jurisdiction and safety standards for cleaning. Do not burn waste materials. Do not bury debris or excess materials on the Owner's property. Do not discharge volatile, harmful or dangerous materials into drainage systems. Remove waste materials from the site and dispose of in a lawful manner.

F. Where extra materials of value remaining after completion of associated Work, they shall become the Owner's property, arrange for any disposition of these materials as directed.

CERTIFICATE OF SUBSTANTIAL COMPLETION

Date of Issuance: _____

Owner: Clay County Utility Authority

Contractor: _____

Project: Fleming Island Wastewater Treatment Facility, BTU No. 3 Expansion

CCUA Bid No. 19/20-A9

OWNER's Project No. 2203-132 ENGINEER's Project No. 259364-242828

This Certificate of Substantial completion applies to all Work under the Contract Documents or to the following specified parts thereof:

To: Clay County Utility Authority/CDM Smith Inc.
OWNER/ENGINEER

And To: _____
CONTRACTOR

The Work to which this Certificate applies has been inspected by authorized representative of OWNER, CONTRACTOR and ENGINEER, and the Work is hereby declared to be substantially complete in accordance with the Contract Documents on

_____
DATE OF SUBSTANTIAL COMPLETION

A tentative list of items to be completed or corrected is attached hereto. This list may not be all-inclusive, and the failure to include an item in it does not alter the responsibility of CONTRACTOR to complete all the Work in accordance with the Contract Documents by

_____ _____.
OWNER ENGINEER

CERTIFICATE OF FINAL COMPLETION

Date of Issuance: _____

Owner: Clay County Utility Authority

Contractor: _____

Project: Fleming Island Wastewater Treatment Facility, BTU No. 3 Expansion

CCUA Bid No. 19/20-A9

OWNER's Project No. 2203-132 ENGINEER's Project No. 259364-242828

This Certificate of Final completion applies to all Work under the Contract Documents or to the following specified parts thereof:

To: Clay County Utility Authority/CDM Smith Inc.
OWNER/ENGINEER

And To: _____
CONTRACTOR

The Work to which this Certificate applies has been inspected by authorized representative of OWNER, CONTRACTOR and ENGINEER, and the Work is hereby declared to be substantially complete in accordance with the Contract Documents on

_____
DATE OF FINAL COMPLETION

A tentative list of items to be completed or corrected is attached hereto. This list may not be all-inclusive, and the failure to include an item in it does not alter the responsibility of CONTRACTOR to complete all the Work in accordance with the Contract Documents by

_____ _____.
OWNER ENGINEER

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SECTION 01720

RECORD DOCUMENTS

PART 1 – GENERAL

1.01 DESCRIPTION

A. Scope of Work

1. During construction: At the construction site, maintain for the Owner one (1) record copy of:

   a. Drawings

   b. Specifications

   c. Addenda

   d. Change Orders and other modifications of the Contract

   e. Engineer's Field Orders or written instructions

   f. Approved Shop Drawings, Working Drawings, and Samples

   g. Field Test Records

   h. Construction Photographs

2. After completion of construction: Contractor shall prepare and deliver to Owner "As-Built" plans which have been prepared in strict accordance with CCUA "As-Built Specifications Standards Manual" latest edition.

B. Related Requirements Described Elsewhere:

1. Submittals: Section 01300

2. Construction Facilities: Section 01500

3. CCUA "As-Built Specifications Standards Manual" (https://www.clayutility.org/engineering/development_permitting.aspx)

1.02 TERMINOLOGY

A. The terms "Record Documents" and "As-Built" are used interchangeably and have the same meaning.

1.03 MAINTENANCE OF DOCUMENTS AND SAMPLES

A. Store documents and samples in Contractor's field office apart from documents used for construction.

1. Provide files and racks for storage of documents.

2. Provide locked cabinet or secure storage space for storage of samples.

B. File documents and samples in accordance with CSI format with section numbers as provided herein.

C. Maintain documents in a clean, dry, legible condition and in good order. Do not use record documents for construction purposes.

D. Make documents and samples available at all times for inspection by the Engineer or the Owner.

E. As a prerequisite for monthly Progress payments, the Contractor is to exhibit the currently updated "Record Documents" for review by the Engineer and Owner. Payment may be withheld if record documents are not satisfactorily maintained.

1.04 RECORDING

A. Specifications and Addenda: Legibly mark each section to record:

1. Manufacturer, trade name, catalog number of Supplier of each product and item of equipment actually installed.

2. Changes made by Field Order or by Change Order.

B. Shop Drawings (after final review and approval): Provide six (6) sets of record shop drawings within the Operation and Maintenance Manual, for each process equipment, piping, electrical system and instrumentation system.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION

3.01 AS-BUILT SUBMITTALS

A. Procedure

1. Contractor's surveyor shall obtain all required field information.

2. Contractor shall obtain the electronic CAD files from Engineer.

3. Contractor shall incorporate the field information into the electronic CAD files.

4. Contractor shall insert the as-built certification block onto all CAD drawing files (regardless of whether information on the particular drawing file has changed from the design or not). The as-built certification block shall contain, as a minimum, the following information:

a. The words "AS-BUILT" in 1" high letter.

b. The Contractor's name, address and telephone number.

c. The Surveyor's name, address and telephone number.

d. The date the as-built drawings were prepared.

e. Information listed in the CCUA "As-Built Specifications Standards Manual".

f. Submit the modified electronic CAD files, along with a PDF document of the CAD drawings, to Engineer for review as a Shop Drawings submittal.

g. Incorporate comments received and resubmit.

B. At Contract closeout, deliver Record Documents to the Engineer for the Owner. Record Documents which do not comply fully and completely with CCUA Standard As-Built Specification Manual will be rejected.

C. For water/wastewater plant facilities include the following requirements in the "As-builts":

A. Buildings: Coordinates of all ground floor corners (x, y, z) and finished floor elevations.

B. Rectangular tanks/treatment units: Coordinates (x, y, z) of all corners with top, bottom, and finished grade elevations.

C. Circular tanks/ Treatment units: Coordinate at center (x, y, z) and four (4) quadrants of outer walls with top, floor and finished grade elevations.

D. Roadways/Driveways: Coordinates (x, y, z) of edge of road/driveways/ sidewalks and centerlines at a maximum interval of fifty (50) feet.

D. Accompany submittal with transmittal letter in duplicate, containing:

1. Date
2. Project Title and number
3. Contractor's name and address
4. Title and number of each Record Document
5. Signature of Contractor or his authorized representative

END OF SECTION

SECTION 01730

OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.1 Section Includes

A. Administrative and procedural requirements, operation and maintenance manuals, and instruction of Owner's personnel.

1.2 Quality Assurance

A. Prepare instructions and data by personnel experienced in maintenance and operation of described products.

1.3 Format

A. Prepare data in the form of an instructional manual.

B. Binders: Commercial quality, 8-1/2 x 11 inch, 3-ring binders with hard back, cleanable, plastic covers. When multiple binders are used, correlate data into related consistent groupings.

C. Cover: Identify each binder with typed or printed title "OPERATION AND MAINTENANCE INSTRUCTIONS"; list title of Project; identify subject matter of contents.

D. Tabs: Provide tabbed fly leaf for each separate product and system, with typed description of product and major component parts of equipment.

E. Text: Manufacturer's printed data or typewritten data on 20 pound paper.

F. Drawings: Provide with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.

1.4 Contents, Each Volume

A. Table of Contents: Provide title of Project; names, addresses, and telephone numbers of Engineer and Manufacturer, local distributer and supplier with name of responsible parties; schedule of products and systems, indexed to content of the volume.

B. Products or Systems: For each product or system, list names, addresses and telephone numbers of subcontractors and suppliers, including local source of supplies and replacement parts.

C. Product Data: Mark each sheet to clearly identify specific products and component parts, and data applicable to installation; delete inapplicable information.

D. Drawings: Supplement product data to illustrate relations of component parts of equipment and systems; show control and flow diagrams. Do not use Project Record Documents as maintenance drawings.

E. Written Text: As required to supplement product data. Provide logical sequence of instructions for each procedure.

F. Warranties and Bonds: Include copy of each issued, not samples.

1.5 Manual for Materials and Finishes

A. Building Products, Applied Materials, and Finishes: Include product data, with catalog number, size, composition, and color and texture designations.

B. Instructions for Care and Maintenance: Include manufacturer's recommendations for cleaning agents and methods, precautions against detrimental agents and methods, and recommended schedule for cleaning and maintenance.

C. Moisture-protection and Weather-exposed Products: Include product data listing applicable reference standards, chemical composition, and details of installation. Provide recommendations for inspections, maintenance and repair.

1.6 Manual for Equipment and Systems

A. Each Item of Equipment and Each System: Include description of unit or system, and component parts. Give function, normal operating characteristics, and limiting conditions. Include performance curves, with engineering data and tests, and complete nomenclature and commercial number of replaceable parts.

B. Panelboard Circuit Directories: Provide electrical service characteristics, controls, and communications.

C. Include as-installed color-coded wiring diagrams.

D. Operating Procedures: Include start-up, break-in, and routine normal operating instructions and sequences. Include regulation, control, stopping, shutdown and emergency instructions. Include summer, winter and any special operating instructions.

E. Maintenance Requirements: Include routine procedures and guide for troubleshooting; disassembly, repair, and reassembly instructions; alignment, adjusting, balancing, and checking instructions.

F. Provide servicing and lubrication schedule, and list of lubricants required.

G. Include manufacturer's printed operation and maintenance instructions.

H. Include sequence of operation by controls manufacturer.

I. Provide original manufacturer's parts list, illustrations, assembly drawings and diagrams required for maintenance.

J. Provide as-installed control diagrams by controls manufacturer.

K. Provide Seller's coordination drawings, with as-installed color-coded piping diagrams.

L. Provide charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.

M. Provide list of original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.

N. Include test and balancing reports of mechanical and electrical systems.

O. Additional Requirements: As specified in individual Specifications Sections.

1.7 Instruction of Owner’s Personnel

A. Before substantial completion inspection, instruct Owner's designated personnel in operation, adjustment, and maintenance of products, equipment, and systems, at agreed upon times. For equipment requiring seasonal operation, arrange to perform instructions for other seasons within six months.

B. Use operation and maintenance manuals as basis of instruction. Review contents of manual with personnel in detail to explain all aspects of operation and maintenance.

C. Prepare and insert additional data in Operation and Maintenance Manual when need for such data becomes apparent during instruction.

1.8 Submittals

A. Submit two copies of preliminary draft or proposed formats and outlines of contents at least sixty (60) days prior to Substantial Completion. Engineer will review draft and return one copy with comments.

B. For equipment, or component parts of equipment put into service during construction and operated by Owner, submit documents within 10 days after acceptance.

C. Submit one copy of completed volumes in final form 15 days prior to final inspection. Copy will be returned after final inspection, with Engineer comments. Revise content of documents as required prior to final submittal.

D. Submit 2 copies of revised volumes of data in final form within 10 days after final inspection.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION

SECTION 01740

WARRANTIES AND BONDS

PART 1 - GENERAL

1.1 Related Requirements

A. General provisions of Contract, including General and Supplementary Conditions.

B. Warranties and certificates for specific products - respective specification sections.

C. Project Closeout - Section 01701.

1.2 Section Includes

A. Administrative and procedural requirements for warranties, bonds, and certifications required by the Contract Documents, including manufacturers standard warranties on products and special warranties.

1.3 Warranty Requirements

A. Contractor shall warrant all work covered under this Agreement to be free from defects for a period of 2-years after the date of final completion, unless an additional warranty period is otherwise specified in the technical specifications to provide a longer warranty period. In no event shall the Contractor's work be warranted for less than a 2-year period.

B. When correcting warranted Work that has failed, remove and replace other Work that has been damaged as a result of such failure or that must be removed and replaced to provide access for correction of warranted Work.

C. When Work covered by a warranty has failed and been corrected by replacement or rebuilding, reinstate the warranty by written endorsement. The reinstated warranty shall be equal to the original warranty with an equitable adjustment for depreciation.

D. Upon determination that Work covered by a warranty has failed, replace or rebuild the Work to an acceptable condition complying with requirements of the Contract Documents. The Contractor is responsible for the cost of replacing or rebuilding defective Work regardless of whether the Owner has benefited from use of the Work through a portion of its anticipated useful service life.

E. Written warranties made to the Owner are in addition to implied warranties, and shall not limit the duties, obligations, rights and remedies otherwise available under the law, nor

shall warranty periods be interpreted as limitations on time in which the Owner can enforce such other duties, obligations, rights, or remedies.

F. The Owner reserves the right to reject warranties and to limit selections to products with warranties not in conflict with requirements of the Contract Documents.

G. The Owner reserves the right to refuse to accept Work for the Project where a special warranty, certification, or similar commitment is required on such Work or part of the Work, until evidence is presented that entities required to countersign such commitments are willing to do so. A "MAINTENANCE WARRANTY BOND" is equal to or greater than 10% of the total contract price.

1.4 Submittals

A. Submit written warranties to the Owner before requesting inspection for Substantial Completion. If the Owner's Certificate of Substantial Completion designates a commencement date for warranties other than the date of Substantial Completion for the Work, or a designated portion of the Work, submit written warranties upon request of the Owner.

B. When a designated portion of the Work is completed and occupied or used by the Owner, by separate agreement with the Contractor during the construction period, submit properly executed warranties to the Owner within fifteen days of completion of that designated portion of the Work.

C. When a special warranty is required to be executed by the Contractor, or the Contractor and a subcontractor, supplier or manufacturer, prepare a written document that contains appropriate terms and identification, ready for execution by the required parties. Submit a draft to the Owner for approval prior to final execution.

D. Provide written certifications of compliance and other commitments and agreements for continuing services in a form which includes all pertinent information including:

1. Quantities and dates of shipments.

2. Attestment that materials incorporated into the Work comply with specified requirements. Certification shall not be construed as relieving the Contractor from furnishing satisfactory materials, if the material is later found to not meet specified requirements.

3. Signature of officer of company.

4. Laboratory test reports submitted with certificates of compliance shall show dates of testing, specification requirements under which testing was performed, and results of tests.

E. Refer to individual Sections of Divisions 2 through 16 for specific content requirements, and particular requirements for submittal of special warranties.

F. Form of Submittal:

1. Compile three (3) copies of each required warranty and bond properly executed by the Contractor, or by the subcontractor, supplier, or manufacturer.

2. Organize the warranty documents into an orderly sequence based on the table of contents of the Project Manual.

3. Bind warranties and bonds in heavy-duty, commercial quality, durable 3-ring vinyl covered loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2 in. by 11 in. paper.

4. Provide heavy paper dividers with celluloid covered tabs for each separate warranty. Mark the tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product, and the name, address and telephone number of the installer.

5. Identify each binder on the front and the spine with the typed or printed title "WARRANTIES AND BONDS", the Project title or name, and the name of the Contractor.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

MAINTENANCE WARRANTY BOND

CLAY COUNTY, FLORIDA

KNOW ALL MEN BY THESE PRESENTS, that we, _____ as Principal and _____, as Surety, are held and firmly bound unto the CLAY COUNTY UTILITY AUTHORITY, as Obligee, in the sum of _____($) Dollars, for the payment of which said Principal and Surety bind themselves, their heirs, administrators, executors, successors and assigns, jointly and severally, firmly by the presents.

WHEREAS, the Principal is the contractor which installed the _____ for the project known as Fleming Island Wastewater Treatment Facility BTU No. 3 Expansion Bid No. 19/20-A9 has agreed that it shall accept certain _____improvements located within County right-of-ways or easements, for maintenance, provided that the Principal and Surety deliver to the CLAY COUNTY UTILITY AUTHORITY a maintenance warranty bond, guaranteeing said improvements against faulty workmanship and materials, said bond and guarantee to be in full force and effect for a minimum of **two (2) years,** beginning the ____ day of _____ _____, _____ (date of Substantial Completion); and this bond shall serve as said maintenance warranty bond; and this bond shall be and remain in full force and effect from its effective date for a minimum period of at least **two (2) years**.

NOW THEREFORE, THE CONDITIONS OF THIS OBLIGATION ARE SUCH, that if the Principal shall fully guaranty, indemnify and save harmless Clay County Utility Authority from any and all loss, costs, expenses and damages, for any repairs or replacements arising out of defective workmanship or materials in the construction or installation of said improvements, then this obligation shall be null and void; otherwise to be and remain in full force and effect.

Signed, sealed and dated this _____ day of _____, _____.

CONTRACTOR:

_____

WITNESS:

_____ By:_____(Seal)

Print Name: _____ Print Name:_____

Date:_____

APPROVED:
CLAY COUNTY UTILITY AUTHORITY

BY:

_____

BY:_____
Jeremy D. Johnston, P.E., MBA
Executive Director

_____
(SURETY)

WATER AND WASTEWATER
MAINTENANCE WARRANTY BOND
CONTACT INFORMATION

Surety: _____
Contact Name: _____
Mailing Address: _____
_____
_____
Telephone No.: _____
Fax No.: _____

Bonding Agent: _____
License Identification No.: _____
Contact Name: _____
Mailing Address: _____
_____
_____
Telephone Number: _____
Fax Number: _____

CONTRACTOR WARRANTY

TO OWNER: CLAY COUNTY UTILITY AUTHORITY
3176 Old Jennings Road
Middleburg, Florida 32068

FROM CONTRACTOR: _____
_____
_____

PROJECT: Fleming Island Wastewater Treatment Facility - BTU No. 3 Expansion Project
Bid No. 19/20-A9

CONTRACTOR hereby warrants all materials and workmanship furnished for the _____ installations for the above-referenced project, against any defects for a period of **two (2) years** from the _____ day of _____, _____ (date of Substantial Completion). This Warranty also includes the "as-built" data recorded on the as-built drawings for this project.

This Warranty includes all expenses incurred in servicing or replacing defective material, including cost of all parts, labor and/or replacement material.

This Warranty does not apply to any of the above equipment which has been subjected to misuse, improper storage, neglect, accident, acts of God and/or alterations or repairs by other than factory or the Guarantor's authorized service personnel. Nor does it cover expenses incurred for service requested by the OWNER on material which does not prove defective.

CONTRACTOR:

_____

Date: _____ _____

Print Name: _____

Title: _____

END OF SECTION

SECTION 01881

TIGHTNESS TESTING PERFORMANCE REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Tightness testing of cast-in-place reinforced concrete liquid retaining structures.

B. Related Requirements:

1. Section 03150 "Concrete Joints and Accessories" for joints in concrete structures.
2. Section 03300 " Cast-In-Place Concrete" for concrete related construction.
3. Section 13231 “Wire and Strand Wrapped Prestressed Concrete Tank”.
4. Section 15108 “Common Requirements for Process Valves” for valves and valve actuators.

1.3 PRETESTING MEETINGS

A. Pretesting Conference: Conduct conference at Project site.

1. Discuss:

a. Testing methods to be used.
b. Measurement of precipitation and evaporation.
c. Pre-testing preparations.
d. Water filling and disposal operations, including coordination with Owner.
e. Cleanup activities.
f. Emergency actions, in case they are required.
g. Procedures necessary to obtain a specified special warranty.

2. Attendees:

a. Owner.
b. Contractor.
c. Engineer.

1.4 INFORMATIONAL SUBMITTALS

A. Submit in accordance with Section 01300 “Submittals”:

1. Action Plan: Submit a detailed plan and schedule for each structure, which shows method of filling, testing and disposal of water.
2. Repair Procedures: Submit for acceptance the proposed repair methods, materials, and modifications needed, if structure does not meet tightness testing.
3. Test Reports: Submit a completed Tightness Test Report, Figure A, appended at the end of this Section of each test for each structure.

1.5 FIELD CONDITIONS

A. Coordinate timing and procedures for obtaining water for testing, structure testing, and water disposal with the Engineer and Owner a minimum of 30 days in advance of actual testing.

B. Water Source:

1. Use water for testing from Owner’s plant water system unless otherwise approved by Owner. Obtain water at a time, flow rate, and location approved by Owner.
2. Provide labor, materials, equipment, incidentals, and power required to convey water to the structure.

C. Water Disposal:

1. Dispose of test water in an approved manner. Do not dispose by discharging onto the ground surface of public or private land.
2. Coordinate disposal of test water by reintroduction into the Plant process at a time, flow rate, and location with Owner.
3. Provide labor, materials, equipment, incidentals, and power required to convey water from the structure.

D. Environmental Conditions: Do not schedule test measurements for a period when the weather forecast indicates a substantial change in weather patterns that would affect testing.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 GENERAL

A. Perform tightness testing of cast-in-place reinforced concrete liquid retaining structures conforming to ACI 350.1 and as specified herein. Perform tightness testing of prestressed concrete tank in accordance with AWWA D110 as specified in Section 13231 “Wire and Strand Wrapped Prestressed Concrete Tank”.

B. Perform tightness tests prior to waterproofing and dampproofing and prior to placing backfill around structures in order to permit observation and detection of leakage points.

C. Individually test each cell of multi-cell tanks.

D. Multi-cell tanks may be tested as a single unit where indicated.

3.2 PREPARATION

A. Remove soil, mud, debris and all other contaminants from structures prior to initiating tightness tests. Flush floor and sumps with water to provide a clean surface that is ready for testing.

B. Prior to testing, temporarily seal or bulkhead inlet and outlet pipes not required to be operational for testing procedures.

C. Confirm that valves and slide gates are completely closed. Repair and reset seals that do not completely close or leak. Test valves, and slide gates for leakage in accordance with requirements of respective Sections as part of the preparation for final tightness testing under this Section.

3.3 EXAMINATION

A. Examine structures to be tested for potential leakage paths including cracks, voids, honeycombs, and unsealed joints. Repair such paths to prevent leakage prior to testing.

B. Proceed with testing only after unsatisfactory conditions have been corrected.

3.4 TESTING PROCEDURES

A. Testing Conditions:

1. Do not begin filling of reinforced concrete structure until concrete elements of the structure have attained specified design strength, but not less than 14 days after placement of all concrete elements.
2. Fill reinforced concrete structure not exceeding a rate of 4 feet per 1 hour.
3. To minimize water absorption by concrete during testing, fill reinforced concrete structure to maximum operating water surface level and maintain water at that level for at least 3 days, prior to beginning tightness tests. Observe the exterior surfaces of the structure in both the early mornings and late afternoons during 3 days prior to tightness testing. Note any water observed on the structure exterior surfaces.
4. Test only a single structure at a time. Concurrent testing of contiguous or adjacent structures will not be allowed.

B. Testing Procedures:

1. Test Duration / Test Period: At least the time required to lower the water surface 3/8 inch, assuming a loss of water at the maximum allowable rate, but not longer than 5 days.

2. Measure water surface elevations at 24-hour intervals. The vertical distance to the water surface shall be measured to within 1/16 inch from a fixed point on the structure above the water surface. Measure water surface elevations at the same four locations, 90 degrees apart. Record water temperature 18 inches below water surface when taking the first and last sets of measurements.

    a. Use methods to determine amount of precipitation or evaporation as approved by the Engineer.
3. Compute percentage of water volume loss based on measured change in water surface elevation, area of the horizontal water surface, initial water volume, and correction for precipitation or evaporation where applicable.
4. Restart test when test measurements become unreliable due to unusual precipitation or other external factors.

C. Reports: Prepare and submit as referenced in this Section.

3.5 ACCEPTANCE

A. Estimates of gate and valve leakage will not be allowed as adjustments to the measured structure leakage.

B. Following conditions are considered as not meeting the criteria for acceptance, regardless of actual loss of water volume from the structure:

1. Groundwater seeping or flowing into the structure through floors, walls, or wall-floor joints.
2. Structures which exhibit seeping or flowing water from joints, cracks, voids, honeycombs, or from beneath the foundation.
3. Damp spots on concrete surfaces.
4. Moisture can be deposited on a dry hand held against the exterior surface of the structure.

C. Tightness of concrete tanks and structures will be considered acceptable when the conditions included in the paragraph above are not present and when loss of water volume does not exceed 0.05 percent of the starting volume per day.

3.6 REPAIRS AND RETESTING

A. Structures failing the tightness test and not exhibiting visible leakage may be retested after an additional stabilization period of 7 days. Structures failing this second test shall be repaired prior to further testing.

B. Retest repaired structures until the structure meets all requirements.

3.7 SCHEDULE

A. Test following structures for tightness:

1. Influent Structure – New Distribution Box
2. BTU No. 3. Refer to Section 13231 "Wire and Strand Wrapped Prestressed Concrete Tank" for additional requirements.

END OF SECTION

FIGURE A
TIGHTNESS TEST REPORT

PROJECT _____ SUBMITTED BY _____

STRUCTURE * _____ TEST DATES _____

Allowable loss of water volume _____ percent in 24 hours

Measured loss of water volume _____ percent in 24 hours

TEST READINGS

Water Temperature at Start _____ [_____] degrees F

Water Temperature at End _____ [_____] degrees F

Operating Water Surface Level _____

			Water Surface Elevation				
Entry	Date**	Time	Location 1	Location 2	Location 3	Location 4	Initials**
0							
1							
2							
3							
4							
5							
Change in level (difference between entry 5 and entry 0)							
Average change in level (sum of change in level / 4)							
Correction for precipitation/evaporation							
Corrected change in level = CL =							
Measured percent water loss in 24 hrs. = $\frac{(CL) \times (\text{surface area}) \times (100)}{(\text{initial water volume}) (\text{number of test days})}$							

Notes and Field Observations ** _____

_____

_____

_____

_____

* Attach a sketch showing a plan of structure and measurement locations.

** Place date and initials at the beginning of each entry.

END OF TIGHTNESS TEST REPORT FORM

SECTION 02030

GEOTECHNICAL INSTRUMENTATION AND MONITORING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes performing pre-construction surveys and installing and monitoring geotechnical instrumentation and survey markers to measure.

1. Performance of excavation support systems.
2. Groundwater levels inside and outside excavation limits.
3. Vertical deformation of ground surface adjacent to and directly over the Work.
4. Vertical and horizontal deformation of existing utilities and structures adjacent to and over the Work.
5. Ground vibration levels at adjacent facilities due to Contractor activities, including but not limited to demolition, pile installation, blasting, and rock excavation.

B. Related Requirements:

1. Section 01101 ‘Special Procedures for Maintenance of Plant Operations and Sequence of Construction”.
2. Section 01881 ‘Tightness Testing Performance Requirements”.
3. Section 01320 “Construction Video and Photographs”.
4. Section 02240 "Dewatering" for lowering and disposing of groundwater during construction.
5. Section 02260 "Excavation Support and Protection" for temporary support of excavation.
6. Section 02300 "Earthwork" for earthwork related activities.
7. Section 02333 “Trenching and Backfilling” for trenching, backfilling, and compaction in trench excavation.
8. Various Sections in Division 2 relating to different types of demolition.

1.3 DEFINITIONS

A. Groundwater Observation Wells: Screened or slotted pipe with solid riser pipe installed in a drilled hole with the annulus around the pipe backfilled with sand. Near surface groundwater levels are measured in the well.

B. Settlement Monitoring Points (SMPs): Inscribed marking or approved surveyor's nail installed to measure vertical (elevation) movement on existing structures.

1.4 ACTION SUBMITTALS

A. Submit in accordance with Section 01300, “Submittals”.

B. Submit for the Engineer’s review four weeks prior to instrument installation:

1. Installation Plan and Schedule: Full details and plan/layout of proposed instruments/points, schedule for installing and monitoring instruments/points, equipment types, installation methods, reference points, and monitoring and data reporting schedule for instruments/points, and instrumentation protection.
2. Description of methods for installing and protecting all instrumentation including but not limited to observation wells and settlement monitoring points.
3. Groundwater observation well construction details including casing type, filter gradation, screen interval, grout mix, drilling methods, and well depths.

C. Installations Records: Within five working days of installing each instrument, submit to the Engineer, specified as-built instrument location and its corresponding installation record sheet.

1. Include in installation record sheet, location with instrument identification numbers, established elevations, initial elevations and coordinates (baseline readings), boring log, installation, and monitoring date and time.
2. Furnish details of installed instruments showing dimensions, materials used, and as-built drawings of each instrument.
3. Submit field calibrations.

D. Reports and Records: Provide reports of monitoring data to the Engineer. include following minimum information:

1. Preconstruction survey.
2. As-installed location plan, installation records, and baseline values for instrumentation.
3. Monitoring data for instruments with plots against threshold values.
4. Discussion and associated action related to results exceeding threshold values.

E. Submit proposed remedial measures to the Engineer of action to be taken in event that instrument Threshold Values are reached.

1.5 INFORMATIONAL SUBMITTALS

A. Submit names, qualifications, and experience of personnel who will install instruments, perform optical level survey , read instruments, and report data to the Engineer demonstrating compliance with “Quality Assurance” Article in this Section.

1.6 QUALITY ASSURANCE

A. Geotechnical Instrumentation Engineer Qualifications: Professional engineer registered in the state of Florida with at least 5 years' experience in installation of specified instrumentation and will supervise and direct technicians and be responsible for instrument installation. Be present at installation sites to direct and supervise installations, oversee instrumentation reading, and supervise geotechnical instrumentation data interpretations.

B. Surveyor Qualifications: Professional Land Surveyor registered in the state of Florida with at least 3 years' experience in surveying of similar instruments. Establish Settlement Monitoring Points, Elevation of top of Groundwater Observation Wells, and take baseline readings.

C. Manufacturer Qualifications: Provide instruments and components from an approved manufacturer currently engaged in manufacturing specified geotechnical instrumentation hardware.

D. Preconstruction Survey Engineer Qualifications: Professional engineer registered in the state of Florida with at least 5 years' experience in structural evaluations and condition surveys.

E. Monitoring Technicians Qualifications: Minimum 3 years' experience for personnel responsible for optical level surveys, instrument readings, and report data.

F. Instrument Installation Technicians: Experienced in installation and reading of specified geotechnical instrumentation.

G. Be responsible for installation, maintenance, and monitoring of geotechnical instrumentation.

PART 2 - PRODUCTS

2.1 DESIGN AND PERFORMANCE REQUIREMENTS

A. Project Requirements:

1. Install geotechnical instrumentation to monitor ground conditions, ground response, and facilities to achieve specified project requirements and prevent damage to facilities potentially affected.
2. Install instrumentation in accordance with approved Instrumentation Schedule.
3. Engineer's monitoring of installed instruments does not relieve Contractor of its obligation to complete project within the requirements specified herein taking necessary additional measurements.

B. Pre-Construction Survey:

1. Prior to start of demolition, excavation work, installation of excavation support and dewatering work, engage the services of an independent licensed professional engineer, to conduct a pre-construction survey of existing structures and conditions within 100 feet

of the anticipated demolition, excavation work, installation of excavation support, and dewatering work.

a. Coordinate activities, issue notices, obtain clearances and provide photographic and secretarial assistance necessary to accomplish the survey.

2. Record observations of the existing structures surrounding the Influent Structure and new BTU No.3.

a. Provide the survey consisting of a description of interior and exterior conditions. Locate cracks, damage or other defects existing and include information to make it possible to determine the effect, if any, of the construction operations on the defect. Where significant cracks or damage exists, or for defects too complicated to describe in words, photographs shall be taken and made part of the record.
b. Records of each property examined must be signed by the representatives present and, if practicable, by property owners, whether or not they are present at the examinations.

3. Record of the pre-construction survey shall consist of written documentation, video and photographs of the conditions identified. At the completion of the survey, submit copies of the documentation to Owner.
4. Upon completion of all excavation work, installation of excavation support and dewatering work, the complete a similar examination of properties and structures where complaints of damage have been received or damage claims have been filed. Give notice to interested parties so that they may be present during the final examinations. Records of the final examination shall be signed and distributed as the original pre-construction survey.
5. Retain records in Contractor's file for at least 3 years after completion of the Contract. In the event of damage claims, prepare a report on the particular structures as requested by the Engineer from those notes and photographs and submitted to Owner. Repair damage attributed to Contractor’s activity promptly and completely to property owners’ satisfaction to restore the conditions of the property to that existing prior to work.

C. Secure required permits prior to the installation or removal of observation wells.

D. Provide and facilitate safe access to the instruments at all times. Engineer may perform additional monitoring in a manner that will minimize unnecessary work delays. Allow and facilitate instrument monitoring as required by the Engineer. No claim for lost production time due to this activity will be allowed.

E. Maintain instrumentation. Report damaged or non-functional instrumentation to the Engineer within 24 hours. Replace damaged instruments within 24 hours.

F. Availability of Data:

1. Instrumentation readings shall be collected by the Contractor's Geotechnical Instrumentation Monitoring Firm. Contractor may take their own supplementary readings in addition to those specified.
2. Monitoring data is the property of Owner and is not to be disclosed or published to third parties without Owner's written permission.
3. Contractor is expected to make their own interpretations for their own purposes without additional compensation.
4. Coordinate with the Engineer to verify consistency of collected data.

2.2 INSTRUMENTATION - GENERAL

A. Instruments and materials, including readout units, installation tools, materials, and miscellaneous instrumentation components.

B. Provide surface protection for instruments flush with surface in paved or other ground surface areas at the time that work is completed.

C. Minimum Quantity of Instruments: While quantities in following Paragraph are considered minimums, obtain data from instrumentation in quantity to monitor construction, performance, and safety aspects of the Work.

D. Following subparagraphs identify instrument type, minimum number to be provided, and approximate installed depth from below bottom of excavation / tunnel invert:

Instrument Type:

1.	Settlement Monitoring Points :	See Drawings for number and location
2.	Groundwater Observation Wells:	Minimum of 3 to a depth of 15-feet below ground surface

E. Locate instruments and obtain approval from the Engineer.

2.3 GROUNDWATER OBSERVATION WELLS

A. Pipe: ASTM D 1785, Schedule 80 PVC pipe, 1-inch minimum inside diameter.

B. Maximum Screen Size: 0.020 inch, unless otherwise approved by the Engineer.

C. Use observation wells to monitor groundwater levels outside excavations.

2.4 MONITORING POINTS

A. Settlement Monitoring Points (SMPs):

1. Use to monitor vertical deformation of existing structures, clearly identifying points with permanent easily readable letters and numbers as approved by the Engineer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions, with the Engineer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Existing Conditions: Locate vaults, structures, conduits and underground utilities in areas where wells are to be drilled and installed. Conduct utility clearance and contact utility companies prior to any drilling.

1. Modify instrument locations, as approved by the Engineer, to avoid interference with existing vaults, structures, conduits and utilities.
2. Repair damage to existing facilities resulting from instrument installations without additional compensation.

B. Prior to commencing installation of excavation support, excavation, and dewatering work, furnish instrumentation and related components that are to be installed during construction and conduct pre-construction surveys.

C. Protect from damage and maintain instruments. Repair or replace damaged instruments.

D. Drilling from Ground Surface: Obtain necessary permits for each instrument and conform to permit requirements during drilling and installation.

E. Implement remedial measures based on interpretations of monitoring data program.

3.3 GENERAL REQUIREMENTS

A. Perform a pre-construction survey prior to any dewatering, excavation, or installation of excavation support.

B. Install instruments at the Engineer approved locations in accordance with approved installation procedures. Engineer may modify instrument locations depending on field conditions and

monitoring objectives. Install instrumentation in accordance with approved installation schedule. Install instruments and obtain baseline data before construction starts.

C. Allow the Engineer access to instrument locations and assistance required in obtaining monitoring data.

D. Clearly mark and label instruments and protected to avoid being obstructed or otherwise damaged by construction operations or general public. Immediately following installation, survey location and top of instruments to provide horizontal and vertical coordinates.

1. Resurvey if the Engineer questions instrument locations.

E. Assign a unique identification number to each instrument and each point that is clearly marked in a non-destructible manner.

F. Initial Reading: Immediately following instrument installation take two sets of initial readings in the Engineer's presence to provide baseline readings and to demonstrate adequacy of completed installation.

3.4 MONITORING POINTS

A. Monitoring Points (SMPs): Monitor SMPs using surveying methods. Modify locations to meet site constraints with the Engineer's approval.

B. SMPs: Install as described near excavations and open trench locations. Additional SMPs may be required by the Engineer.

C. SMPs:

1. Install on exterior walls of buildings or structures located within 50 feet of open excavations. Preferred installations are on supporting walls or columns. Avoid installation in brick, unless no other option exists.

2. Install additional SMPs to monitor building movement at other locations when determined by the Engineer.

3. Install SMPs in cooperation with property Owners so that installations are inconspicuous and acceptable to them. Existing features of building foundations that are permanent and can be repeatedly surveyed may be substituted for SMPs, if approved by the Engineer.

4. Obtain two sets of measurements for each monitoring point to establish baseline data within three days of installation. Make at least 24 hours apart, but not more than 48 hours.

5. Check monitoring points with initial surveyed elevations differing by more than 0.01 inch for secure installation and resurvey.

6. Read monitoring points prior to installing excavation support, beginning excavation, operation of groundwater control system or start of installation of excavation support at the site.

7. Read daily during excavation, dewatering, water tightness testing, filling and backfilling, then at least twice a week until excavation, dewatering, and backfill has been completed.

3.5 GROUNDWATER OBSERVATION WELLS

A. Set screened interval of each well from 10 to 15 feet below ground surface to monitor groundwater levels.

B. Drill 4-inch minimum diameter holes for observation wells of required size and depth and case with temporary casing. Do not use bentonite drilling mud in drilling holes for observation wells.

C. Flush cased holes with clean water through an approved bit. Flush until discharge water is free of soil particles.

D. Construct observation well with 5 feet of slotted PVC well screen, filter sand, bentonite seal, couplings, a pipe cap, and a locking cover.

1. Place 6 inches of filter sand in bottom of drilled hole. Then place well screen and surround it with filter sand to 4 feet above the screen, as temporary casing is carefully withdrawn.
2. Insert solid PVC casing and cap and fill annular space with bentonite pellets then non-shrink cement grout.
3. Protect observation wells at ground surface by providing a roadway box or outer protective casing with lockable top and padlock. Design surface protection to prevent damage by vandalism or construction operations and to prevent surface water from infiltrating.

    a. Provide two keys for each padlock to the Engineer for access to each well.
    b. Develop observation wells to provide a reliable indication of groundwater levels. Re-developed wells if well clogging is observed, in event of apparent erroneous readings, or as directed by the Engineer.
    c. Submit observation well installation logs, top of casing elevation, and well locations to the Engineer within 24 hours of completion of well installation.

E. Observation Well Maintenance:

1. Maintain each observation well until adjacent to structures and pipelines are completed and backfilled. Clean out or replace any observation well which ceases to be operable before adjacent work is completed.
2. Maintain observation wells and repair or replace them without additional compensation, whether or not observation wells are damaged by Contractor's operations or by third parties.

F. Monitoring and Reporting of Observation Well Data:

1. Begin daily monitoring of groundwater levels in work areas prior to initial operation of drainage and dewatering system. Continue daily monitoring in areas where groundwater control is in operation until time that adjacent structures and utility pipelines are completed and backfilled and until time that groundwater control systems are turned off.

2. Be responsible for processing and reporting observation well data to the Engineer daily. Submit data to the Engineer on a form that includes following information.

   a. Observation well number.
   b. Depth to groundwater.
   c. Top of casing elevation.
   d. Groundwater level elevation.
   e. Date and time of reading.

G. Following construction, abandon new observation wells as directed by the Engineer.

1. Abandon observation wells by removing materials within original borehole, including casing, filter, and grout seal in accordance with applicable permits.
2. Using approved tremie methods, completely fill hole and voids with non-shrink cement grout prior to removal of drill casing, such that formation materials do not move into hole prior to grouting.
3. Restore ground surface to its original condition.
4. Abandon wells within paved areas by removing vaults and well caps to pavement subgrade.
5. Remove wells with as discussed above and repair or patch pavement with same surface type.

3.6 INSTRUMENT PROTECTION, MAINTENANCE AND REPAIR

A. Protect instruments from damage. Replace damaged or destroyed instruments within 72 hours of damage, without additional compensation. If necessary, suspend work in areas being monitored by damaged instrument and take remedial action.

B. Maintain instruments by draining water and flushing debris from under protective covers and keeping covers locked and sealed at all times.

3.7 MONITORING

A. Collect, tabulate, plot, and interpret survey monitoring data and provide the Engineer with tabulated and plotted data. Report status of excavation, bracing, groundwater levels, and backfilling at time of data collection with each report.

B. Monitoring frequency may be modified as directed and approved by the Engineer.

C. Submit data from readings of monitoring points to the Engineer within 24 hours of reading. Communicate verbally with the Engineer immediately after visual observations or data collection if excessive movements or other anomalies are indicated.

D. Make visual observations of ground conditions and building conditions in site vicinity and communicate immediately with the Engineer if signs of ground or building movements are observed.

E. Engineer may take independent instrumentation measurements. Cooperate with the Engineer during instrumentation monitoring by providing access to instrumentation locations in a timely manner and by providing and maintaining safe means of access to instrumentation locations for data collection. Data acquired by the Engineer will be made available to Contractor in a timely manner.

F. Contractor may make their own interpretations of monitoring data for their own purposes. Do not publish or disclose data or interpretations shall to other parties without advance written permission of Owner.

G. For data collected from an instrument that has been installed to replace a damaged instrument, use formal initial reading as an initial reading for replacement instrument so that data are continuously plotted, without an offset at time of damage. Note time of damage and replacement on plot.

3.8 INTERPRETATION AND RESPONSE VALUES

A. Make interpretations of data resulting from monitoring programs.

B. Threshold and Limiting Values for Instruments:

	Instrument	Threshold Value	Limiting Value
1.	Settlement Monitoring Points:	0.25 inch	0.5 inch
2.	Observation Wells	3 feet **	

NOTES: ** Below initial groundwater readings per approved Contractor's submittal.

C. Values are subject to adjustment by the Engineer as indicated by prevailing conditions or project circumstances.

D. If a Threshold Value is reached:

1. Engineer and Contractor will meet to discuss remedial measures.
2. Increase instrument monitoring frequency as directed by the Engineer.
3. Install and monitor additional instruments as directed by the Engineer.
4. Implement remedial measures in event Threshold Value is reached, so Limiting Value is not reached.

E. Take necessary steps so Limiting Value is not exceeded. Engineer may direct Contractor to suspend activities in affected area with exception of those actions necessary to avoid exceeding Limiting Value.

3.9 TOLERANCES

A. Survey Measurements: Initial location of each instrumentation elements consisting of determining elevation and horizontal positions with respect to the Engineer approved benchmarks.

B. Monitoring Points (SMPs):

1. Instrumentation Elevations: Determine to accuracy of plus/minus 0.01 foot

C. If actual field conditions prohibit installation at location and specified elevations, obtain prior acceptance from the Engineer for new instrument location and elevations.

3.10 DISPOSITION OF INSTRUMENTS

A. Settlement Monitoring Points: Remove monitoring points during cleanup and restoration work, unless directed otherwise by the Engineer.

B. Observation Wells: When required by the Engineer, abandon and remove protective housings and caps in accordance with required permits. Restore surfaces affected by installation of instruments to their original condition prior to completion of work.

1. Leave in place any casings located within plan limits of new or existing structures or pipelines or within zone below 1H:1V planes extending downward and out from edges of foundation elements, from downward vertical footprint of pipe, or where removal would otherwise result in ground movements causing adverse settlement to adjacent ground surface, utilities or structures.
2. Where casings are pulled, fill holes with sand. Where left in place, fill casings with non-shrink cement grout and cut off a minimum of 3 feet below finished ground level or 1 foot below foundation level so as not to interfere with finished structures or pipelines.
3. Following backfilling, remove precast boxes or vaults and reconstruct pavement in paved areas. Restore surface to conditions existing prior to instrument installation.

END OF SECTION

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SECTION 02060

SOILS AND AGGREGATES FOR EARTHWORK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Soils: Soil materials and topsoil materials.
2. Aggregates: Coarse aggregate materials and fine aggregate materials.

B. Related Sections:

1. Section 02300 “Earthwork” for earthwork related activities.
2. Section 02333 “Trenching and Backfilling” for trenching, backfilling, and compaction in trench excavation.
3. Section 02370 “Erosion and Sedimentation Control” for controlling surface-water runoff and ponding.

1.3 ACTION SUBMITTALS

A. Section 01300 “Submittals” for requirements of submittals.

B. Samples - Soils: Submit in 5-gallon air-tight containers, 50 lbs. sample of each type of subsoil and topsoil fill to testing laboratory.

C. Samples - Aggregates: Submit, in 5-gallon air-tight containers, 50 lbs. sample of each type of aggregate fill to Engineer at least 15 days prior to placement of backfill or fill.

D. Quality Control Testing: Submit conformance testing performed by a certified independent laboratory engaged by Contractor for all fill materials. Verify maximum density, gradation, Atterberg limits, sand equivalent, and other applicable criteria at least 72 hours prior to importing or placing any fill. Perform additional conformance testing

1. At a minimum frequency of 1 per every 2000 cubic yards or change in material.
2. At a minimum of two locations at Headworks foundation area.
3. One location for evert 500 square yards within the Oxidation Ditch footprint area.
4. One location for every 100 feet of below-grade pipeline.

1.4 INFORMATIONAL SUBMITTALS

A. Materials Source: Submit name and location of imported materials suppliers.

B. Source's Certificate: Certify materials meet or exceed specified requirements.

1.5 QUALITY ASSURANCE

A. Furnish each subsoil and topsoil material from single source throughout the Work, unless an alternate source is approved by the Engineer.

B. Furnish each coarse and fine aggregate material from single source throughout the Work, unless an alternate source is approved by the Engineer.

C. Perform Work according to Clay County, Florida standards.

D. Quality Control Testing for Off-site Borrow Materials:

1. Chemical testing will not be required where site characterization of off-site borrow sources indicates that soils are acceptable for use. If site characterization data or materials are suspected of being contaminated, perform chemical testing as directed by The Engineer with no additional compensation.

2. Chemical Test Data: Test each material source requiring testing by a person experienced in sample collection who is a registered Professional Engineer or geologist, or certified groundwater or environmental professional registered in the State of Florida. Submit samples of each proposed material to a chemical analytical laboratory, certified by the governing agency, for following analyses:

   a. Volatile Organic Compounds: EPA 8240 plus Hazardous Substance List (HSL) Parameters.
   b. Acid and Base Neutral Extractable Organic Compounds: EPA 8270.
   c. Pesticides and PCBs: EPA 8080.
   d. Total Petroleum Hydrocarbons: Infrared Method, EPA 9071/418.1.
   e. Thirteen Priority Pollutant Metals: EPA 7000 Series.
   f. Total Cyanide: EPA 9012.

3. Obtain and test off-site borrow samples in accordance with criteria established by the Engineer. Submit results for review and approval prior to use on site.

1.6 FIELD CONDITIONS

A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during earth-moving operations.

1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
2. Provide alternate routes around closed or obstructed traffic ways if required by Owner or authorities having jurisdiction.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

A. Provide fill composed of on site excavated material or imported fill material that is composed of durable, mineral soil, free of debris, organic matter, loam, broken concrete, masonry rubble, frozen soil, or other deleterious materials which may be compressible, or which cannot be readily spread or properly compacted.

B. Common Fill:

1. Contain no stones larger than 2 inches in largest diameter.
2. Contain a maximum of 40 percent passing the No. 200 sieve.
3. Have a maximum dry density of at least 95 pounds per cubic foot (pcf) as determined by ASTM D1557.

C. Structural Fill:

1. Consist of non-plastic, mineral soil free of organic material, loam, debris, frozen soil or other deleterious material which may be compressible, or which cannot be properly compacted, with the following gradation:

Sieve Size	Percent Finer by Weight
1-in	100
No. 4	20 to 70
No. 40	5 to 35
No. 200	0 to 10

2. Have a maximum liquid limit of 50 percent, maximum plasticity index of 10 percent.
3. Have a maximum dry density of at least 98 pcf as determined by ASTM D1557 for structural fill beneath foundations and slabs-on-grade. Have a maximum dry density of at least 95 pcf as determined by ASTM D1557 for structural fill within 10 feet around structures.
4. Exhibit moisture contents within ±2% of modified Proctor optimum moisture content according to ASTM D1557.

2.2 TOPSOIL MATERIALS

A. Topsoil:

1. Imported borrow.
2. Friable loam.
3. Reasonably free of roots, rocks larger than 1/2 inch, subsoil, debris, large weeds, and foreign matter.

a. Screening: Double screened.

4. Acidity range (pH) of 5.5 to 7.5.
5. Containing minimum of 4 percent and maximum of 25 percent inorganic matter.

2.3 COARSE AGGREGATE MATERIALS

A. Coarse Aggregate - Crushed Stone: Natural stone; washed, free of clay, shale, organic matter; conforming to FDOT standard.

1. Coarse Aggregate Designation: No. 57.

B. Coarse Aggregate - Screened Gravel: Natural stone; washed, hard, durable, rounded, or sub-angular particles of proper size and gradation, and shall be free from sand, loam, clay, excess fines, and other deleterious materials; to the following limits:

1. Percent Passing per Sieve Size:

a. 5/8- inch100 percent.
b. 1/2-inch: 40 to 100 percent.
c. 3/8-inch: 15 to 45 percent.
d. No. 10: 0 to 5 percent.

2.4 FINE AGGREGATE MATERIALS

A. Fine Aggregate - Sand: Natural river or bank sand; washed; free of silt, clay, loam, friable or soluble materials, and organic matter; graded according to ASTM C 33; within the following limits:

1. Percent Passing per Sieve Size:

a. No. 4 95 to 100.
b. No. 8 80 to 100.
c. No. 16 50 to 85.
d. No. 30 25 to 60.
e. No. 50 10 to 30.
f. No. 100 2 to 10.

2.5 SOURCE QUALITY CONTROL

A. Section 01400 “Quality Control”: Testing and inspection services. Submit test result reports to the Engineer.

B. Subsoil Material - Testing and Analysis: Perform in accordance with ASTM D 1557.

C. Topsoil Material - Testing and Analysis: Perform in accordance with ASTM D 1557.

D. Coarse Aggregate Material - Testing and Analysis: Perform according to ASTM D 1557.

E. Fine Aggregate Material - Testing and Analysis: Perform according to ASTM D 1557.

F. When tests indicate materials do not meet specified requirements, change material and retest.

G. Furnish materials of each type from same source throughout the Work.

PART 3 - EXECUTION

3.1 EXCAVATION - SOILS

A. Excavate subsoil and topsoil from areas designated. Strip topsoil to full depth of topsoil in designated areas.

B. Stockpile excavated material meeting requirements for subsoil materials and topsoil materials.

C. Remove excess excavated materials not intended for reuse, from site.

D. Remove excavated materials not meeting requirements for subsoil materials and topsoil materials from site.

3.2 STOCKPILING

A. Stockpile materials on site at locations designated by Owner/Engineer.

B. Stockpile in sufficient quantities to meet Project schedule and requirements.

C. Separate different soil and aggregate materials with dividers or stockpile individually to prevent mixing. Prevent intermixing of soil types or contamination.

D. Stockpile topsoil 72 inches high maximum.

E. Direct surface water away from stockpile site to prevent erosion or deterioration of materials.

F. Stockpile unsuitable materials on impervious liner and cover to prevent erosion and leaching, until disposed of.

3.3 STOCKPILE CLEANUP

A. Remove stockpile, leave area in clean and neat condition. Grade site surface to prevent free standing surface water.

B. When borrow area is indicated, leave area in clean and neat condition. Grade site surface to prevent free standing surface water.

END OF SECTION

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SECTION 02200

SITE CLEARING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Protecting existing vegetation to remain.
2. Removing existing vegetation.
3. Clearing and grubbing.
4. Stripping and stockpiling topsoil.
5. Stripping and stockpiling rock.
6. Removing above- and below-grade site improvements.

B. Related Requirements:

1. Section 02370 “Erosion and Sedimentation Controls” for temporary protection of erosion and sedimentation.

1.3 DEFINITIONS

A. Subsoil: Soil beneath the level of subgrade; soil beneath the topsoil layers of a naturally occurring soil profile, typified by less than 1 percent organic matter and few soil organisms.

B. Surface Soil: Soil that is present at the top layer of the existing soil profile. In undisturbed areas, surface soil is typically called "topsoil," but in disturbed areas such as urban environments, the surface soil can be subsoil.

C. Topsoil: Top layer of the soil profile consisting of existing native surface topsoil or existing in-place surface soil; the zone where plant roots grow. Its appearance is generally friable, pervious, and black or a darker shade of brown, gray, or red than underlying subsoil; reasonably free of subsoil, clay lumps, gravel, and other objects larger than 2 inches in diameter; and free of weeds, roots, toxic materials, or other nonsoil materials.

D. Plant-Protection Zone: Area surrounding individual trees, groups of trees, shrubs, or other vegetation to be protected during construction, includes all areas not indicated as part of the Construction on Drawings.

E. Vegetation: Trees, shrubs, groundcovers, grass, and other plants.

1.4 MATERIAL OWNERSHIP

A. Except for materials indicated to be stockpiled or otherwise remain Owner's property, cleared materials shall become Contractor's property and shall be removed from Project site.

1.5 INFORMATIONAL SUBMITTALS

A. Existing Conditions: Documentation of existing trees and plantings, adjoining construction, and site improvements that establishes preconstruction conditions that might be misconstrued as damage caused by site clearing.

1. Use sufficiently detailed photographs or video recordings.

2. Include plans and notations to indicate specific wounds and damage conditions of each tree or other plant designated to remain.

B. Record Drawings: Identifying and accurately showing locations of capped utilities and other subsurface structural, electrical, and mechanical conditions.

1.6 FIELD CONDITIONS

A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during site-clearing operations.

1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.

2. Provide alternate routes around closed or obstructed roadways if required by Owner or authorities having jurisdiction.

B. Salvageable Improvements: Carefully remove items indicated to be salvaged or moved and store on Owner's premises within the Contractor’s work area.

C. Utility Locator Service: Notify utility locator as shown on the Drawings before site clearing.

D. Do not commence site clearing operations until temporary erosion- and sedimentation-control and plant-protection measures are in place.

E. Soil Stripping, Handling, and Stockpiling: Perform only when the soil is dry or slightly moist.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Satisfactory Soil Material: Requirements for satisfactory soil material are specified in Section 02300 "Earthwork."

1. Obtain approved borrow soil material off-site when satisfactory soil material is not available on-site.

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect and maintain benchmarks and survey control points from disturbance during construction.

B. Protect existing site improvements to remain from damage during construction.

1. Restore damaged improvements to their original condition, as acceptable to Owner.

C. Notify the utility locator as noted on the drawings not less than three working days before performing Work.

1. Request underground utilities to be located and marked within and surrounding construction areas.

3.2 TEMPORARY EROSION AND SEDIMENTATION CONTROL

A. Provide temporary erosion- and sedimentation-control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to erosion- and sedimentation-control Drawings and requirements of authorities having jurisdiction.

B. Inspect, maintain, and repair erosion- and sedimentation-control measures during construction until permanent vegetation has been established.

C. Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

3.3 TREE AND PLANT PROTECTION

A. Repair or replace trees, shrubs, and other vegetation damaged by construction operations that are not located within the construction area within the silt fence area indicated on the Drawings.

3.4 CLEARING AND GRUBBING

A. Remove obstructions, trees, shrubs, and other vegetation to permit installation of new construction.

1. Do not remove trees, shrubs, and other vegetation indicated to remain or to be relocated.
2. Grind down stumps and remove roots larger than 2 inches in diameter, obstructions, and debris to a depth of 18 inches below exposed subgrade.
3. Use only hand methods or air spade for grubbing within protection zones.
4. Chip removed tree branches and dispose of off-site.

B. Fill depressions caused by clearing and grubbing operations with satisfactory soil material unless further excavation or earthwork is indicated.

1. Place fill material in horizontal layers not exceeding a loose depth of 8 inches and compact each layer to a density equal to adjacent original ground.

3.5 TOPSOIL STRIPPING

A. Remove sod and grass before stripping topsoil.

B. Strip topsoil in a manner to prevent intermingling with underlying subsoil or other waste materials.

1. Remove subsoil and nonsoil materials from topsoil, including clay lumps, gravel, and other objects larger than 2 inches in diameter; trash, debris, weeds, roots, and other waste materials.

C. Stockpile topsoil away from edge of excavations without intermixing with subsoil or other materials. Grade and shape stockpiles to drain surface water. Cover to prevent windblown dust and erosion by water.

1. Limit height of topsoil stockpiles to 72 inches.
2. Do not stockpile topsoil within protection zones.
3. Dispose of surplus topsoil. Surplus topsoil is that which exceeds quantity indicated to be stockpiled or reused.
4. Stockpile surplus topsoil to allow for re-spreading deeper topsoil.

3.6 STOCKPILING ROCK

A. Remove from construction area naturally formed rocks that measure more than 1 foot across in least dimension. Do not include excavated or crushed rock.

1. Separate or wash off non-rock materials from rocks, including soil, clay lumps, gravel, and other objects larger than 2 inches in diameter; trash, debris, weeds, roots, and other waste materials.

B. Stockpile rock away from edge of excavations without intermixing with other materials. Cover to prevent windblown debris from accumulating among rocks.

1. Limit height of rock stockpiles to 36 inches.
2. Do not stockpile rock within protection zones.
3. Dispose of surplus rock. Surplus rock is that which exceeds quantity indicated to be stockpiled or reused.
4. Stockpile surplus rock to allow later use by Owner.

3.7 SITE IMPROVEMENTS

A. Remove existing above- and below-grade improvements as indicated and necessary to facilitate new construction.

B. Remove slabs, paving, curbs, gutters, and aggregate base as indicated.

1. Unless existing full-depth joints coincide with line of demolition, neatly saw-cut along line of existing pavement to remain before removing adjacent existing pavement. Saw-cut faces vertically.
2. Paint cut ends of steel reinforcement in concrete to remain with two coats of antirust coating, following coating manufacturer's written instructions. Keep paint off surfaces that will remain exposed.

3.8 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Remove surplus soil material, unsuitable topsoil, obstructions, demolished materials, and waste materials including trash and debris, and legally dispose of them off Owner's property.

B. Separate recyclable materials produced during site clearing from other nonrecyclable materials. Store or stockpile without intermixing with other materials and transport them to recycling facilities. Do not interfere with other project work.

END OF SECTION

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SECTION 02215

TANK CLEANING AND SLUDGE/GRIT REMOVAL

PART 1 GENERAL

1.01 SCOPE OF WORK

A. Furnish all labor, materials, equipment and incidentals required and remove and dispose of settled grit/debris/solids and sludge from BTU No. 1.

B. The Owner does not imply by this Section that the volume of sludge or residual liquid in each structure are known absolutely. It is the Contractor's responsibility to verify the conditions of each structure and its contents, or the work site that will affect execution of this work.

C. Offsite disposal or offsite treatment and disposal of the sludge shall be performed while meeting all applicable Federal, State and local rules and regulations. Furnish details of the disposal methods. Furnish disposal of the sludge in a landfill approved to accept RCRA wastes. Also furnish copies of all forms generated during the transport and disposal of the sludge within ten days to the Owner.

D. Contractor shall confirm groundwater level is below the lowest point of the bottom slab of BTU No. 1 based on record drawings (approximately EL 18.35) prior to draining the tank. Contractor shall monitor groundwater level while the tank is empty.

1.02 RELATED WORK

A. Special project procedures are included in Section 01101 “Special Procedures for Maintenance of Plant Operations and Sequence of Construction”.

1.03 PROTECTION

A. Adequate protection of persons and property shall be provided at all times. The work shall be executed in such a way as to avoid hazards to persons and property.

B. Furnish signs, lights, barricades and other equipment as may be necessary for the safe prosecution of his work. All protection shall be removed when work is completed.

C. Assure that any electrical power connected to the tank or its ancillary equipment has been deactivated and the actual wiring properly dismantled at the circuit breaker.

D. Provide positive ventilation of tanks or structures whenever work is being performed inside them.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 SLUDGE REMOVAL

A. Sludge removal shall include removal from the structures of material of every description and of whatever substance encountered, down to the concrete slab and walls.

B. All residues, fluids, sludges, cleaning materials, fluids and rinse waters from the tanks shall be disposed of at an Owner approved waste disposal facility.

C. While sludge removal is in progress, traffic shall be maintained and all utilities and other property protected as provided in other related sections.

D. The mixed liquor/grit/sludge shall be removed in a two-step process – draining and clean-out – as further described below.

1. Draining involves the processing of the majority of the tank contents through the normal operations at the facility. At the time of cleaning, the structures will have been taken out of service. The Contractor shall submit his request for dewatering operations to the Owner for approval not less than fourteen (14) calendar days before operations are to commence. The Owner shall be responsible for draining the structure to the most extent possible. It is anticipated that the Owner will require the following time durations to drain the structures:
   a. BTU No. 1 will take 21days.

2. The draining stage shall continue until either the tank is completely empty or until the Owner deems the remaining material in the tank to be unsuitable for introduction into the liquid treatment process. Such unsuitable material shall be removed during the clean-out stage.

3. Clean-out involves the removal of any material remaining following the draining stage. This material shall be removed from the tank and disposed of off-site. The method of removal shall be determined by the Contractor and approved by the Owner and Engineer when the quantity and nature of this material is revealed during the draining stage.

END OF SECTION

SECTION 02222

SELECTIVE DEMOLITION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Demolition and removal of selected portions of Influent Structure and Odor Control System
2. Demolition and removal of existing vegetated mound (future footprint area of BTU No. 3)
3. Salvage of existing items to be reused or recycled of the Odor Control System.
4. Salvage of existing generator.

B. Related Requirements:

1. Section 01101 “Special Procedures for MOPO and Construction Sequence.”
2. Section 02200 "Site Clearing" for site clearing and removal of above- and below-grade improvements not part of selective demolition.

1.2 DEFINITIONS

A. Remove: Detach items from existing construction and dispose of them off-site unless indicated to be salvaged or reinstalled.

B. Remove Hazardous Materials: Isolate and remove hazardous materials from existing construction and properly dispose as required by existing regulations.

C. Remove and Salvage: Detach items from existing construction, in a manner to prevent damage, and deliver to Owner ready for reuse.

D. Remove and Reinstall: Detach items from existing construction, in a manner to prevent damage, prepare for reuse, and reinstall where indicated.

E. Existing to Remain: Leave existing items that are not to be removed and that are not otherwise indicated to be salvaged or reinstalled.

F. Dismantle: To remove by disassembling or detaching an item from a surface, using gentle methods and equipment to prevent damage to the item and surfaces; disposing of items unless indicated to be salvaged or reinstalled.

1.3 MATERIALS OWNERSHIP

A. Unless otherwise indicated, demolition waste becomes property of Contractor.

B. Historic items, relics, antiques, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, and other items of interest or value to Owner that may be uncovered during demolition remain the property of Owner.

1. Carefully salvage in a manner to prevent damage and promptly return to Owner.

1.4 PREINSTALLATION MEETINGS

A. Predemolition Conference: Conduct conference at Fleming Island Wastewater Treatment Facility.

1. Inspect and discuss condition of construction to be selectively demolished.
2. Review structural load limitations of existing structure.
3. Review and finalize selective demolition schedule and verify availability of materials, demolition personnel, equipment, and facilities needed to make progress and avoid delays.
4. Review requirements of work performed by other trades that rely on substrates exposed by selective demolition operations.
5. Review areas where existing construction is to remain and requires protection.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For refrigerant recovery technician.

B. Engineering Survey: Submit engineering survey of condition of building.

C. Proposed Protection Measures: Submit report, including Drawings, that indicates the measures proposed for protecting individuals and property, for environmental protection, for dust control and, for noise control. Indicate proposed locations and construction of barriers.

D. Schedule of Selective Demolition Activities: Indicate the following:

1. Detailed sequence of selective demolition and removal work, with starting and ending dates for each activity. Ensure Owner's building manager's on-site operations are uninterrupted.
2. Interruption of utility services. Indicate how long utility services will be interrupted.
3. Coordination for shutoff, capping, and continuation of utility services.
4. Use of elevator and stairs.
5. Coordination of Owner's continuing occupancy of portions of existing building and of Owner's partial occupancy of completed Work.

E. Predemolition Photographs or Video: Show existing conditions of adjoining construction, including finish surfaces, that might be misconstrued as damage caused by demolition

operations. Comply with Section 01320 "Construction Video and Photographs." Submit before Work begins.

F. Statement of Refrigerant Recovery: Signed by refrigerant recovery technician responsible for recovering refrigerant, stating that all refrigerant that was present was recovered and that recovery was performed according to EPA regulations. Include name and address of technician and date refrigerant was recovered.

G. Warranties: Documentation indicating that existing warranties are still in effect after completion of selective demolition.

1.6 CLOSEOUT SUBMITTALS

A. Inventory: Submit a list of items that have been removed and salvaged.

1.7 FIELD CONDITIONS

A. Owner will occupy portions of building immediately adjacent to selective demolition area. Conduct selective demolition so Owner's operations will not be disrupted.

B. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.

C. Notify Engineer of discrepancies between existing conditions and Drawings before proceeding with selective demolition.

D. Hazardous Materials: It is not expected that hazardous materials will be encountered in the Work.

1. Hazardous materials will be removed by Owner before start of the Work.
2. If suspected hazardous materials are encountered, do not disturb; immediately notify Engineer and Owner. Hazardous materials will be removed by Owner under a separate contract.

E. Hazardous Materials: Present in buildings and structures to be selectively demolished. A report on the presence of hazardous materials is on file for review and use. Examine report to become aware of locations where hazardous materials are present.

1. Hazardous material remediation is specified elsewhere in the Contract Documents.
2. Do not disturb hazardous materials or items suspected of containing hazardous materials except under procedures specified elsewhere in the Contract Documents.
3. Owner will provide material safety data sheets for suspected hazardous materials that are known to be present in buildings and structures to be selectively demolished because of building operations or processes performed there.

F. Storage or sale of removed items or materials on-site is not permitted.

G. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.

1. Maintain fire-protection facilities in service during selective demolition operations.

1.8 WARRANTY

A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during selective demolition, by methods and with materials and using approved contractors so as not to void existing warranties. Notify warrantor before proceeding.

B. Notify warrantor on completion of selective demolition, and obtain documentation verifying that existing system has been inspected and warranty remains in effect. Submit documentation at Project closeout.

1.9 COORDINATION

A. Arrange selective demolition schedule so as not to interfere with Owner's operations.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.

B. Standards: Comply with ASSE A10.6 and NFPA 241.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that utilities have been disconnected and capped before starting selective demolition operations.

B. Review Project Record Documents of existing construction or other existing condition and hazardous material information provided by Owner. Owner does not guarantee that existing conditions are same as those indicated in Project Record Documents.

C. Perform an engineering survey of condition of building to determine whether removing any element might result in structural deficiency or unplanned collapse of any portion of structure or adjacent structures during selective building demolition operations.

1. Perform surveys as the Work progresses to detect hazards resulting from selective demolition activities.

D. Steel Tendons: Locate tensioned steel tendons and include recommendations for de-tensioning.

E. Verify that hazardous materials have been remediated before proceeding with building demolition operations.

F. Survey of Existing Conditions: Record existing conditions by use of preconstruction photographs or video.

1. Comply with requirements specified in Section 01323 "Photographic Documentation."
2. Inventory and record the condition of items to be removed and salvaged. Provide photographs or video of conditions that might be misconstrued as damage caused by salvage operations.
3. Before selective demolition or removal of existing building elements that will be reproduced or duplicated in final Work, make permanent record of measurements, materials, and construction details required to make exact reproduction.

3.2 PREPARATION

A. Refrigerant: Before starting demolition, remove refrigerant from mechanical equipment according to 40 CFR 82 and regulations of authorities having jurisdiction.

3.3 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

A. Existing Services/Systems to Remain: Maintain services/systems indicated to remain and protect them against damage.

B. Existing Services/Systems to Be Removed, Relocated, or Abandoned: Locate, identify, disconnect, and seal or cap off utility services and mechanical/electrical systems serving areas to be selectively demolished.

1. Owner will arrange to shut off indicated services/systems when requested by Contractor.
2. Arrange to shut off utilities with utility companies.
3. If services/systems are required to be removed, relocated, or abandoned, provide temporary services/systems that bypass area of selective demolition and that maintain continuity of services/systems to other parts of building.
4. Disconnect, demolish, and remove fire-suppression systems, plumbing, and HVAC systems, equipment, and components indicated on Drawings to be removed.

    a. Piping to be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.

b. Piping to be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material and leave in place.
c. Equipment to be Removed: Disconnect and cap services and remove equipment.
d. Equipment to be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
e. Equipment to be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.
f. Ducts to be Removed: Remove portion of ducts indicated to be removed and plug remaining ducts with same or compatible ductwork material.
g. Ducts to be Abandoned in Place: Cap or plug ducts with same or compatible ductwork material and leave in place.

3.4 PROTECTION

A. Temporary Protection: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.

1. Provide protection to ensure safe passage of people around selective demolition area and to and from occupied portions of building.
2. Provide temporary weather protection, during interval between selective demolition of existing construction on exterior surfaces and new construction, to prevent water leakage and damage to structure and interior areas.
3. Protect walls, ceilings, floors, and other existing finish work that are to remain or that are exposed during selective demolition operations.
4. Cover and protect furniture, furnishings, and equipment that have not been removed.

B. Temporary Shoring: Design, provide, and maintain shoring, bracing, and structural supports as required to preserve stability and prevent movement, settlement, or collapse of construction and finishes to remain, and to prevent unexpected or uncontrolled movement or collapse of construction being demolished.

1. Strengthen or add new supports when required during progress of selective demolition.

C. Remove temporary barricades and protections where hazards no longer exist.

3.5 SELECTIVE DEMOLITION, GENERAL

A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:

1. Proceed with selective demolition systematically, from higher to lower level. Complete selective demolition operations above each floor or tier before disturbing supporting members on the next lower level.
2. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction.

Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping. Temporarily cover openings to remain.

3. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
4. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain portable fire-suppression devices during flame-cutting operations.
5. Maintain fire watch during and for at least half hour after flame-cutting operations.
6. Maintain adequate ventilation when using cutting torches.
7. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.
8. Remove structural framing members and lower to ground by method suitable to avoid free fall and to prevent ground impact or dust generation.
9. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
10. Dispose of demolished items and materials promptly.

B. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.

C. Removed and Salvaged Items:

1. Clean salvaged items.
2. Pack or crate items after cleaning. Identify contents of containers.
3. Store items in a secure area until delivery to Owner.
4. Transport items to Owner's storage area designated by Owner.
5. Protect items from damage during transport and storage.

D. Removed and Reinstalled Items:

1. Clean and repair items to functional condition adequate for intended reuse.
2. Pack or crate items after cleaning and repairing. Identify contents of containers.
3. Protect items from damage during transport and storage.
4. Reinstall items in locations indicated. Comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make item functional for use indicated.

E. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by Engineer, items may be removed to a suitable, protected storage location during selective demolition and cleaned and reinstalled in their original locations after selective demolition operations are complete.

3.6 SELECTIVE DEMOLITION PROCEDURES FOR SPECIFIC MATERIALS

A. Concrete: Demolish in small sections. Using power-driven saw, cut concrete to a depth of at least 3/4 inch at junctures with construction to remain. Dislodge concrete from reinforcement at

perimeter of areas being demolished, cut reinforcement, and then remove remainder of concrete. Neatly trim openings to dimensions indicated.

B. Concrete: Demolish in sections. Cut concrete full depth at junctures with construction to remain and at regular intervals using power-driven saw, and then remove concrete between saw cuts.

C. Concrete Slabs-on-Grade: Saw-cut perimeter of area to be demolished, and then break up and remove.

3.7 DISPOSAL OF DEMOLISHED MATERIALS

A. Remove demolition waste materials from Project site and dispose of them in an EPA-approved construction and demolition waste landfill acceptable to authorities having jurisdiction.

1. Do not allow demolished materials to accumulate on-site.
2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
3. Remove debris from elevated portions of building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.

B. Burning: Do not burn demolished materials.

3.8 CLEANING

A. Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before selective demolition operations began.

3.9 SELECTIVE DEMOLITION SCHEDULE

A. Remove: Existing concrete and piping as indicated on the Drawings.

B. Remove and Salvage: Lightning protection rod and grounding conduit at the Influent Structure as indicated on the Drawings. Reclaimed water system and electrical outlet at the Influent Structure as indicated on the drawings.

C. Remove and Reinstall: Reclaimed water piping and hose bib to be relocated at the Influent Structure, as indicated on the drawings. Odor control system blower and motor and control panel to be relocated and reinstalled, as indicated, during Influent Structure modification activities.

D. Existing to Remain: Odor Control System at Influent Structure.

END OF SECTION

SECTION 02240

DEWATERING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes construction dewatering and surface water control and incorporates the design, equipment, materials, installation, operation, protection, monitoring and removal of dewatering and drainage system. Provide dewatering system sufficient to lower groundwater and collect surface water, regardless of groundwater level or rainfall at any time during the work.

B. Obtain and pay for permits required for dewatering and drainage systems. Implement measurements to comply with dewatering and discharge permits requirements.

C. Related Requirements:

1. Section 01320 "Construction Video and Photographs" for recording preexisting conditions and dewatering system progress.
2. Section 02060 “Soils and Aggregates for Earthwork” for fill and grading materials.
3. Section 02030 “Geotechnical Instrumentation and Monitoring” for monitoring of existing structures and temporary construction support structures.
4. Section 02300 "Earthwork" for earthwork related activities.
5. Section 02333 “Trenching and Backfilling” for trenching, backfilling, and compaction in trench excavation.
6. Section 02370 “Erosion and Sedimentation Controls” for controlling surface-water runoff and ponding.
7. Section 02260 “Excavation Support and Protection” for support of excavations.

1.3 DEFINITIONS

A. In-the-Dry: An excavation subgrade where all of the following are met:

1. Groundwater level has been lowered to at least 2 feet below lowest excavation level.
2. Subgrade is stable with no ponded water, mud, or muck.
3. Subgrade is able to support construction equipment without rutting or disturbance.
4. Subgrade is suitable for placement and compaction of fill material, pipe, or concrete foundations.

B. Contractor's Engineered Design: Design prepared on behalf of Contractor by a registered Professional Engineer.

C. Professional Engineer: Registered Professional Engineer meeting project qualifications and who is hired by Contractor.

D. The Engineer: Engineer hired by Owner.

1. Approvals given by The Engineer shall not relieve Contractor of its responsibilities for performing the work in accordance with Contract Document requirements.

1.4 ACTION SUBMITTALS

A. Design Plan: Submit written dewatering and drainage system design plan, prepared by a qualified Professional Engineer, that includes:

1. Description of proposed dewatering system and installation methods to be used for system elements and observation wells.
2. Description of equipment, drilling methods, holes sizes, filter sand placement techniques, sealing materials, development techniques, number and location of dewatering points and observations wells.
3. Dewatering system design calculations demonstrating that the proposed system meets all requirements herein and elsewhere.
4. Sequence of well and well-point placement coordinated with support of excavation system installation and control procedures to be adopted, if dewatering problems arise.
5. Identification of anticipated area influenced by dewatering system and address impacts to adjacent existing and proposed structures.

6. Coordinate dewatering and drainage submittals with excavation and support of excavation submittals.

B. Shop Drawings: For dewatering system, prepared by a qualified Professional Engineer.

1. Include plans, elevations, sections, and details.
2. Show arrangement, locations, and details of wells and well points; locations of risers, headers, filters, pumps, power units, and discharge lines; and means of discharge, control of sediment, and disposal of water.
3. Include pump capacity and anticipated discharge rate.
4. Include layouts of piezometers and flow-measuring devices for monitoring performance of dewatering system.
5. Show areas and depths of excavation to be dewatered and adjacent structures or facilities within the anticipated area influence.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer land surveyor and Professional Engineer.

B. Field quality-control reports.

C. Existing Conditions: Using photographs or video recordings, show existing conditions of adjacent construction and site improvements that might be misconstrued as damage caused by dewatering operations. Submit before Work begins.

D. Record Drawings: Identify locations and depths of capped wells and well points and other abandoned-in-place dewatering equipment.

E. Discharge sampling log, testing results of effluent samples and flow rate record.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer that has specialized in installation of dewatering systems and dewatering work and having a minimum of 5 years' experience.

B. Professional Engineer Qualifications: Licensed Professional Engineer registered in the State of Florida; having a minimum of 5 years' experience in design and construction of dewatering and drainage systems; and having completed not less than 5 successful dewatering and drainage projects of equal type, size, and complexity to that required for the work.

C. Comply with authorities having jurisdiction for the following:

1. Drilling and abandoning of wells used for dewatering systems.
2. Water discharge and disposal from dewatering operations.

D. Obtain permit from EPA under National Pollutant Discharge Elimination System (NPDES), for storm water discharge from construction sites.

1.7 FIELD CONDITIONS

A. Project-Site Information: The geotechnical report (Appendix A) has been prepared for this Project and is available for information only. Owner and Engineer are not responsible for interpretations or conclusions drawn from this report.

1. Make additional test borings and conduct other exploratory operations necessary for dewatering according to the performance requirements.
2. Groundwater levels may vary during the work and should not be assumed to be accurately represented by groundwater level readings reported in the geotechnical report.
3. The geotechnical report is included elsewhere in Project Manual.

B. Survey Work: Engage a qualified land surveyor or Professional Engineer to survey adjacent existing buildings, structures, and site improvements; establish exact elevations at fixed points to act as benchmarks. Clearly identify benchmarks and record existing elevations.

PART 2 - PRODUCTS

2.1 DESIGN REQUIREMENTS

A. Dewatering Performance: Design, furnish, install, test, operate, monitor, and maintain dewatering system of sufficient scope, size, and capacity to control hydrostatic pressures and to lower, control, remove, and dispose of surface and ground water and permit excavation and construction to proceed in-the-dry in accordance with the requirements herein and elsewhere.

1. Design dewatering system, including comprehensive engineering analysis by the Contractor's Design Engineer.
2. Continuously monitor and maintain dewatering operations to ensure required groundwater lowering, erosion control, stability of excavations, excavation support, and constructed slopes, prevention of flooding in excavation, and prevention of damage to subgrades and permanent structures.
3. Prevent surface water from entering excavations by grading, dikes, or other means.
4. Accomplish dewatering without damaging existing buildings, structures, and site improvements adjacent to excavation.
5. Remove dewatering system when no longer required for construction.

B. Primary Purpose of Work: Preserve natural undisturbed condition of subgrade soils in areas of proposed excavations.

1. Prior to excavation, lower groundwater to at least 2 feet below lowest excavation subgrade elevation.
2. Additional groundwater lowering may be necessary beyond 2 feet requirement, depending on construction methods, equipment used, and prevailing groundwater and soil conditions. Lower groundwater as necessary to complete construction in accordance with Contract Documents without additional compensation

C. Design deep wells, well points and sumps, and other groundwater control system components to prevent loss of fines from surrounding soils. Use sand filters with dewatering installations, unless screens are properly sized by Contractor's design engineer to prevent passage of fines from surrounding soils.

D. Maintain standby pumping systems and sources of standby power at various sites.

E. Design dewatering system to prevent damage to adjacent properties, buildings, structures, utilities, and facilities from dewatering operations. Be responsible for damage to properties, buildings or structures, sewers and other utility installations, pavements, and work that may result from dewatering or surface water control operations.

F. Regulatory Requirements: Comply with governing EPA notification regulations before beginning dewatering. Comply with water- and debris-disposal regulations of authorities having jurisdiction.

2.2 MATERIALS

A. Pipe for Observation Wells: ASTM D 1785, PVC Schedule 80 with minimum interior diameter of 2 inches and machine slotted having a maximum slot size of 0.020 inch. Coordinate with Section 02030 “Geotechnical Instrumentation and Monitoring.”

B. Equipment: Piping, pumping, and other equipment and materials to provide control of surface water and groundwater in excavations.

C. Grout: Mixture of portland cement and bentonite clay or sand suitable for sealing abandoned wells and piping.

PART 3 - EXECUTION

3.1 GENERAL

A. Control surface water and groundwater such that:

1. Excavation to final grade is made in-the-dry.
2. Natural undisturbed conditions of subgrade soils are maintained.
3. Softening, instability, or disturbance due to presence or seepage of water does not occur.
4. Construction and backfilling proceeds in-the-dry.
5. Floatation of completed portions of work shall be prohibited.

B. Methods of groundwater control may include but are not limited to perimeter trenches and sump pumping, perimeter groundwater cutoff, well points, ejectors, deep wells, or any combination.

C. Where groundwater levels are above proposed bottom of excavation level, provide a pumped dewatering system for pre-drainage of soils prior to excavation and for maintaining lowered groundwater level until construction has been completed such that structure, pipeline, or fill will not be floated or otherwise damaged.

D. Vary type of system, spacing of dewatering units, and other details of the work depending on soil and water conditions at each location.

E. Do work in a manner to protect adjacent structures and utilities without causing loss of ground or disturbance to pipe bearing soils or soils supporting overlying or adjacent structures.

F. Install, monitor, and report data from observation wells. Evaluate collected data relative to groundwater control system performance and modify systems necessary to dewater site.

G. Locate groundwater control system components where they will not interfere with construction activities adjacent to the work area or interfere with installation and monitoring of geotechnical instrumentation including observation wells. Do not make excavations for sumps or drainage ditches within or below 1H:1V slopes extending downward and out from edges of existing or proposed foundation elements or from downward vertical footprint of pipe without approval by the Engineer.

3.2 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by dewatering operations.

1. Prevent surface water and subsurface or ground water from entering excavations, from ponding on prepared subgrades, and from flooding site or surrounding area.
2. Protect subgrades and foundation soils from softening and damage by rain or water accumulation.

B. Install dewatering system to ensure minimum interference with roads, streets, walks, and other adjacent occupied and used facilities.

1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways, if required by authorities having jurisdiction.

C. Provide temporary grading to facilitate dewatering and control of surface water.

D. Protect and maintain temporary erosion and sedimentation controls, which are specified in Section 02370 “Erosion and Sedimentation Controls” during dewatering operations.

3.3 INSTALLATION

A. Install dewatering system utilizing wells, well points, or similar methods complete with pump equipment, standby power and pumps, filter material gradation, valves, appurtenances, water disposal, and surface-water controls.

1. Space well points or wells at intervals required to provide sufficient dewatering.
2. Use filters or other means to prevent pumping of fine sands or silts from the subsurface.

B. Place dewatering system into operation to lower water to specified levels before excavating below ground-water level.

C. Provide sumps, sedimentation tanks, and other flow-control devices as required by authorities having jurisdiction.

D. Provide standby equipment on-site, installed and available for immediate operation, to maintain dewatering on continuous basis if any part of system becomes inadequate or fails.

3.4 SURFACE WATER CONTROL

A. Construct surface water control measures, including dikes, ditches, sumps and other methods to prevent flow of surface water into excavations and to allow construction to proceed without delay.

B. Grade excavation to divert surface water and seepage water within excavation areas into sumps and dewatering wells.

3.5 EXCAVATION DEWATERING

A. Provide and maintain equipment and facilities to promptly remove and properly dispose of water entering excavations. Maintain excavations in-the-dry.

B. Excavation dewatering shall maintain the subgrade in a natural undisturbed condition and be in operation until the fill, structure or pipes to be built thereon have been completed to such extent that they will not be floated or otherwise damaged by allowing water levels to return to natural elevations.

C. Do not place pipe, masonry, and concrete in water or submerge within 24 hours after being installed. Prevent water from flow over new masonry or concrete within four days after placement.

D. Prevent water from rising to cause unbalanced pressure on structures until concrete or mortar has set at least 24 hours. Prevent pipe flotation by promptly placing backfill.

E. Conduct dewatering to preserve natural undisturbed condition of subgrade soils at bottom of excavation.

F. If trench subgrade or excavation bottom becomes disturbed due to inadequate dewatering or drainage, excavate below normal grade as directed by the Engineer and refill with structural fill, screened gravel, or other material as approved by the Engineer without additional compensation.

G. It is expected that initial dewatering plan may be modified to suit variable soil and water conditions encountered. Dewater and excavate in a manner without causing loss of ground or disturbance to pipe bearing soil or soil that supports overlying or adjacent structures.

H. If methods do not properly dewater excavation, install additional groundwater observation wells as directed by the Engineer. Do not place pipe or structure until readings obtained from observation wells indicate that groundwater has been lowered to specified minimum of below bottom of final excavation.

I. Surround dewatering units with suitable filter sand with no fines being removed by pumping. Pump continuously from dewatering system until pipe or structure is adequately backfilled. Provide stand-by pumps.

J. Collect water entering excavations from precipitation or surface runoff in shallow ditches around excavation perimeter, drained to a sump, and pump from excavation to maintain a bottom free from standing water.

K. Dispose of drainage to an approved area as approved by the Engineer. Do not use existing or new sanitary sewers to dispose of drainage.

3.6 REMOVAL OF SYSTEMS

A. At completion of excavation and backfilling work and when approved by the Engineer, remove from site various pipe, deep wells, well-points, pumps, generators, observation wells, other equipment, and accessories used for groundwater and surface water control systems.

1. Removed materials and equipment become property of Contractor.

B. Restore areas disturbed by installation and removal of groundwater control systems and observation wells to their original condition.

C. Leave in place deep wells casings, well-points, and observation wells located:

1. Within plan limits of structures or pipelines.
2. Within zone below 1H:1V planes extending downward and out from edges of foundation elements or from downward vertical footprint of pipe.
3. Where removal would result in ground movements causing adverse settlement to adjacent ground surface, utilities, or existing structures.

D. Fill pulled casings holes with sand. Where left in place, fill casings with cement grout and cut off a minimum of 3 feet below finished ground level or 1 foot below foundation level to prevent interference with finished structures or pipelines.

E. When directed by the Engineer, leave observation wells in place for continued monitoring. Cut casings flush with final ground level when directed and provide protective lockable boxes with locking devices. Provide protective boxes suitable for traffic and other conditions to which observation wells will be exposed.

END OF SECTION

SECTION 02260

EXCAVATION SUPPORT AND PROTECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes temporary excavation and trench support and protection systems.

B. Related Requirements:

1. Section 01320 "Construction Video and Photographs " for recording preexisting conditions and excavation support and protection system progress.
2. Section 02030 “Geotechnical Instrumentation and Monitoring” for monitoring of existing structures and temporary construction support structures .
3. Section 02300 "Earthwork" for earthwork related activities.
4. Section 02200 "Site Clearing" for site stripping, grubbing, stripping and stockpiling topsoil, and removal of above- and below-grade improvements and utilities.
5. Section 02240 "Dewatering" for lowering and disposing of ground water during construction.

1.3 ACTION SUBMITTALS

A. Shop Drawings: For excavation support and protection system, prepared by or under the supervision of a qualified professional engineer, meeting the minimum performance requirements in Part 2 of this Section.

1. Include overall system plan, indicating clearances, dimensions, material properties, member sizes, locations, spacing and member penetrations depths, and locations of various types of lateral supports.
2. Show details, layout, arrangement, equipment requirements, and method of construction of proposed excavation support system.
3. Indicate existing and proposed utilities, structures or other obstructions.
4. Show wall elevations and locations of bracing.
5. Show overall installation sequence and removal of bracing. Indicate work levels to be performed before bracing is installed or removed.
6. Method of preloading bracing, if required, including preload for each member, and method of locking-off the preload. Submit detailed drawings of connections, jacking supports, and method of shimming.

7. Include procedures for resolving difficulties arising from misalignment of members exposed during excavation and criteria for implementing those procedures.

B. Design Calculations: For excavation support and protection system. Include analysis data prepared, signed, and sealed by professional engineer responsible for their preparation.

1. Include loads on excavation support system for all stages of excavation, bracing removal, and concrete placement, including material and equipment loads on adjacent ground during construction.
2. Include design of wall and bracing members including details for all construction stages.

a. Design: Account for water pressures associated with flood conditions.

3. Include theoretical deflections of excavation support system and deformation of structures, pipelines, and other improvements located within areas influencing excavations.

C. Submit to the Engineer for review and acceptance, a plan of action to be implemented in the event any deformation threshold value is reached as specified in Section 02030 "Geotechnical Instrumentation and Monitoring." Identify positive measures in action plan to further limit wall movement, including but not limited to trenching for struts and wales, placement of granular earth berms against the wall, installation of additional struts, or combinations thereof.

1. Include description and details of mitigating measures, work schedule, location and availability of materials, and structural details for connections to wall and support elements.
2. Be prepared to work 24 hours per day to implement such measures.
3. Perform remedial work and mitigating measures at no additional cost to Owner.

1.4 INFORMATIONAL SUBMITTALS

A. Submit quality control measures to ensure that performance of excavation support system complies with project requirements.

B. Submit welder qualifications and weld procedures in accordance with AWS D1.1.

C. Qualification Data: For land surveyor.

D. Maintain at least one copy of design at job site during excavation that includes a plan indicating sizes, types, and configurations of the materials to be used in protective system. Identity registered Contractor's design engineer who stamped the design.

E. Do not proceed with excavation support or protection activities until submittals have been reviewed by the Engineer.

F. Submit inspection documentation:

1. On-site inspections of excavation support system as the systems are constructed.
2. Review of quality control measures and performance data.

3. Certification that excavation support system is constructed per applicable design following completion of each support system and following Contractor modifications during construction.

1.5 QUALITY ASSURANCE

A. Contractor Qualifications: Minimum 5 years' experience compatible to indicated Work, and who employs labor and supervisory personnel similarly experienced in Work of this Section.

B. Contractor's Design Engineer: Registered Professional Structural Engineer in State of Florida with at least 5 years' professional experience in design and construction of support of excavation systems and having completed a minimum of 5 successful excavation support projects of equal type, size, and complexity to specified work.

C. Existing Conditions: Using photographs or video recordings, show existing conditions of adjacent construction and site improvements that might be misconstrued as damage caused by inadequate performance of excavation support and protection systems. Submit before Work begins.

D. Regulatory Requirements: Comply with authorities having jurisdiction, including OSHA requirements.

E. Record Drawings: Identify locations and depths of capped utilities, abandoned-in-place support and protection systems, and other subsurface structural, electrical, or mechanical conditions.

1.6 FIELD CONDITIONS

A. Project-Site Information: A geotechnical report has been prepared for this Project and is available for information only. The opinions expressed in this report are those of a geotechnical engineer and represent soil borings and tests, conducted by a geotechnical engineer. Owner is not responsible for interpretations or conclusions drawn from the data.

1. Make additional test borings and conduct other exploratory operations necessary for excavation support and protection according to the performance requirements.
2. The geotechnical report is included elsewhere in Project Manual.

B. Survey Work: Engage a qualified land surveyor or professional engineer to survey adjacent existing buildings, structures, and site improvements; establish exact elevations at fixed points to act as benchmarks. Clearly identify benchmarks and record existing elevations.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Provide, design, monitor, and maintain excavation support and protection system capable of supporting excavation sidewalls and of resisting earth and hydrostatic pressures and

superimposed and construction loads within specified movement criteria (Section 02030 "Geotechnical Instrumentation and Monitoring").

1. Contractor Design: Design excavation support and protection system, including comprehensive engineering analysis by a qualified professional engineer.
2. Prevent surface water from entering excavations by grading, dikes, or other means.
3. Install excavation support and protection systems to minimize horizontal and vertical movements without damaging existing buildings, structures, and site improvements adjacent to excavation.
4. Continuously monitor vibrations, settlements, and movements to ensure stability of excavations and constructed slopes and to ensure that damage to permanent structures is prevented.

B. Do not permit excavations below the level of the base of adjacent existing foundations or retaining walls, unless excavation design and bracing includes an analysis of stability of structure supported by foundation and if necessary, incorporates required bracing or underpinning of foundation.

C. For support systems in which bracing is installed between opposite sides of the excavation, design excavation support of both sides to be nearly the same as feasible.

D. Where necessary to resist point loads, fill pipe piles used as soldier piles with concrete. Do not consider concrete strength in design of pipe pile for bending stress.

E. Design, install, operate, and maintain ground water control system to control ground water inflows, prevent piping or loss of ground, and maintain stability of the excavation. Refer to the requirements of Section 02240 "Dewatering."

F. Design review and field monitoring activities by Owner or the Engineer does not relieve Contractor of its work responsibilities.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that instrumentation required under Section 02030 "Geotechnical Instrumentation and Monitoring" is installed and initialized prior to start of work required by this Section.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Obtain permits from local authority having jurisdiction prior to initiating excavation work.

B. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards that could develop during excavation support and protection system operations.

1. Shore, support, and protect utilities encountered.

C. Install excavation support and protection systems to ensure minimum interference with roads, streets, walks, and other adjacent occupied and used facilities.

1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by authorities having jurisdiction.
2. Install fencing, gates, lights, and signs around excavations and staging areas to provide for public safety.

D. Locate excavation support and protection systems clear of permanent construction so that construction and finishing of other work is not impeded.

3.3 GENERAL

A. Install excavation support systems in accordance with the shop drawings and applicable permits.

B. Fill voids between excavation support system and earth with materials acceptable to the Engineer.

C. If unstable material is encountered during excavation, take immediately measures to contain it in place and prevent ground displacement.

D. If settlement or deflections of supports indicate that support system requires modification to prevent excessive movements, redesign and resubmit revised shop drawings and calculations to the Engineer without additional compensation.

E. Maintain sufficient quantity of material on site for protection of work and for use in case of accident or emergency.

3.4 PORTABLE TRENCH BOXES

A. Use portable trench boxes or sliding trench shields only for worker protection.

B. Additional excavation, backfilling, and surface restoration required as result of trench box use shall be provided without additional compensation.

C. Design, construct, and maintain trench boxes or shields to meet acceptable engineering and industry standards.

D. Install shields in a manner to restrict lateral or other hazardous movement of the shield in the event of sudden lateral loads.

E. Maintain a written copy of trench box manufacturer's specifications, recommendations, and limitations at job site during excavation work.

3.5 SOLDIER PILES AND LAGGING

A. Install steel soldier piles before starting excavation.

1. Soldier Piles in Predrilled Holes:

a. Provide casing or other methods of support to prevent caving of holes and loss of ground.
b. Backfill with concrete from elevation of bottom excavation to pile tip elevation. Backfill remainder of predrilled hole with lean concrete or sand.
c. Predrilled hole of sufficient diameter allowing for proper alignment and concrete backfilling of pile.

2. Install driven piles with driving shoes where hard driving is anticipated.
3. Advance driven soldier piles without aid of a water jet.

B. Extend soldier piles below excavation grade level to depths shown on reviewed Shop Drawings. Space soldier piles at regular intervals not to exceed allowable flexural strength of wood lagging. Accurately align exposed faces of flanges to vary not more than 2 inches from a horizontal line and not more than 1:120 out of vertical alignment.

C. Install wood lagging within flanges of soldier piles as excavation proceeds. Trim excavation as required to install lagging.

1. Install lagging so ground loss does not occur between adjacent or below lowest board. As excavation proceeds, do not maximum height of 4 feet for unlagged face of excavation.
2. Do not exceed unlagged face of 2 feet, if water seeps or flows from excavation face or excavation face becomes unstable.

D. Fill voids behind lagging with soil, and compact.

E. Install wales at locations indicated on shop drawings and secure to soldier piles.

3.6 LINER PANELS

A. Install liner plates as soon as excavation has progressed sufficiently to install next complete circumferential ring of liner plates. Complete ring of liner plates prior to continuing excavation.

1. Do not install more than one ring of liner plates at any time.

B. Stagger plates in vertical direction to facilitate shaft strength and leakage resistance.

C. Grout liner plates in accordance with approved Shop Drawings.

3.7 INTERNAL BRACING

A. Bracing: Locate bracing to clear columns, floor framing construction, and other permanent work. If necessary to move brace, install new bracing before removing original brace.

1. Do not place bracing where it will be cast into or included in permanent concrete work, unless otherwise approved by the Engineer.
2. Install internal bracing if required to prevent spreading or distortion of braced frames.
3. Maintain bracing until structural elements are supported by other bracing or until permanent construction is able to withstand lateral earth and hydrostatic pressures.

B. Provide internal bracing to carry maximum design load without distortion or buckling.

C. Include web stiffeners, plates, or angles required to prevent rotation, crippling, or buckling of connections and points of bearing between structural steel members. Allow for eccentricities caused by field fabrication and assembly.

D. Install and maintain bracing support members in tight contact with each other and with the surface being supported.

E. Coordinate excavation work with installation of bracing. Extend excavation no more than 2 feet below any brace level prior to installation of the bracing.

F. Use procedures that produce uniform loading of bracing member without eccentricities, overstressing, or distortion of system members.

3.8 FIELD QUALITY CONTROL

A. Survey-Work Benchmarks: Resurvey benchmarks regularly during installation of excavation support and protection systems, excavation progress, and for as long as excavation remains open. Maintain an accurate log of surveyed elevations and positions for comparison with original elevations and positions. Promptly notify Engineer if changes in elevations or positions occur or if cracks, sags, or other damage is evident in adjacent construction.

B. Promptly correct detected bulges, breakage, or other evidence of movement to ensure that excavation support and protection system remains stable.

C. Promptly repair damages to adjacent facilities caused by installation or faulty performance of excavation support and protection systems.

3.9 REMOVAL

A. Where doing so will not disturb the Work performed or the existing structures, remove excavation support and protection systems when construction has progressed sufficiently to support excavation and earth and hydrostatic pressures. Remove in stages to avoid disturbing underlying soils and rock or damaging structures, pavements, facilities, and utilities.

1. Remove excavation support and protection systems to a minimum depth of 48 inches below overlying construction and abandon remainder.
2. Fill voids immediately with approved backfill compacted to density specified in Section 02300 "Earthwork."
3. Repair or replace, as approved by Engineer, adjacent work damaged or displaced by removing excavation support and protection systems.

B. Where appropriate to protect the Work performed and/or existing structures including but not limited to the Headwork, leave excavation support and protection systems permanently in place to save from undermining or washout.

C. Do not remove vertical support members that were installed within zone of influence of new or existing structures. Cut off support members installed within this zone at 5 feet below finished grade and abandon in place.

D. Do not remove internal bracing or transfer loads to permanent structure without prior acceptance of the Engineer.

E. Begin removal at excavation bottom and progress upward. Slowly release members noting indication of possible failure of remaining members or possible cave-in of excavation sides.

F. Progress backfilling together with removal of support systems from excavations.

G. Remove all portions of excavation support, unless otherwise indicated by approved Shop Drawings.

1. Zone of Influence Definition: Zone extending down and away from outer edge of the structure at 1 horizontal to 1 vertical.

H. Do not leave wood as part of abandoned portion of the work.

I. When removing excavation support system, do not disturb or damage adjacent buildings, structures, waterproofing material, or utilities. Fill voids immediately with lean concrete or well-graded cohesionless sand or as directed by the Engineer.

J. Immediately remove excavation support system material from site.

END OF SECTION

SECTION 02300

EARTHWORK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. General: Earthwork includes clearing and stripping, procurement of on-site and imported fill material, excavating, placing, and compacting fill and backfill, structural excavating and backfilling, transportation and storage of excess earthwork materials; disposal of unsuitable, waste, and surplus materials; restoration of excavation and trench surfaces; and subsidiary work necessary to complete the grading of developed areas to conform with required lines, grades, and slopes.

B. Work includes but is not necessarily limited to; excavation for structures, tanks, foundations, vaults, electrical manholes, conduits, cables, raceways and ducts, pipes, paving; grading; and related work such as sheeting, bracing and dewatering.

C. Provide services of a licensed Professional Engineer to prepare temporary excavation support system, dewatering system designs, and submittals.

D. Provide temporary excavation support systems, including sheeting, shoring, and bracing, to ensure the safety of personnel and protect adjacent structures, piping, and other materials in accordance with Federal, State and local laws, regulations, and requirements. Temporary excavation support systems are specified in Section 02260 “Excavation Support and Protection.”

E. Provide temporary dewatering, surface water control systems, and operate to dewater and maintain excavations in a dry condition. Control drainage into excavations and remove seepage water and rainwater. Dewatering and surface water control are specified in Section 02240 “Dewatering.”

F. Examine site and review available geotechnical report (Appendix A) prior to submitting a proposal, taking into consideration project conditions that may affect the work. Owner and Engineer do not assume responsibility for variations of subsurface conditions at locations other than places shown and at the time investigations were made.

G. Do not initiate extra work without written notification to Owner and Engineer and receiving Owner’s written approval in response.

H. Protect existing structures and utilities that remain.

I. Related Requirements:

1. Section 01320 "Construction Video and Photographs " for recording pre-excavation and earthwork progress.
2. Section 02030 “Geotechnical Instrumentation and Monitoring” to monitoring of existing structures and temporary construction support structures.
3. Section 02060 “Soils and Aggregates for Earthwork” for fill and grading materials.
4. Section 02200 "Site Clearing" for site preparation work, including stripping, grubbing, stripping and stockpiling topsoil, and removal of above- and below-grade improvements and utilities.
5. Section 02240 "Dewatering" for lowering and disposing of groundwater during construction.
6. Section 02333 “Trenching and Backfilling” for trenching, backfilling, and compaction in trench excavation.
7. Section 02370 “Erosion and Sedimentation Controls” for temporary stated work.
8. Section 02260 "Excavation Support and Protection" for support of excavations.

1.3 DEFINITIONS

A. Backfill: Soil material or controlled low-strength material used to fill an excavation.

1. Initial Backfill: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.
2. Final Backfill: Backfill placed over initial backfill to fill a trench.

B. Borrow Soil: Satisfactory soil imported from off-site for use as fill or backfill.

C. Coverage: Pass of compaction equipment over the complete surface area of exposed lift or subgrade to receive compaction.

D. Excavation: Removal of material encountered above subgrade elevations and to lines and dimensions indicated.

1. Authorized Additional Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions as directed by Engineer. Authorized additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.
2. Unauthorized Additional Excavation: Excavation as directed by Engineer to correct Contractor’s work not in compliance with Contract Documents, which will be performed without additional compensation.
3. Bulk Excavation: Excavation more than 10 feet in width and more than 30 feet in length.
4. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions without direction by Engineer. Unauthorized excavation, as well as remedial work directed by Engineer, shall be provided without additional compensation.

E. Finished Grade: Required final grade elevation indicated on Drawings. Spot elevations take precedent over proposed contours.

F. In-the-Dry: An excavation subgrade where groundwater level: has been lowered to at least 2 feet below lowest level of excavation; is stable with no ponded water, mud, or muck; is able to support construction equipment without rutting or disturbance; and is suitable for placement and compaction of fill material, pipe, or concrete foundations.

G. Objectionable Material: Includes topsoil, organic matter, contaminated soil, construction debris, perishable materials, snow, ice, frozen earth, and rocks or lumps of cemented soils over 6 inches in maximum dimension.

H. Optimum Moisture Content: Moisture content (percent by dry weight) corresponding to maximum dry density of the same material as determined by ASTM Test Method D1557 .

I. Overexcavation: Removal of unsuitable soil or objectionable material at or below the normal grade of excavation or subgrade as indicated on Drawings.

J. Percent Compaction: Required in-place dry density of the material, expressed as a percentage of the maximum dry density of the same material, as determined in the laboratory by ASTM Test Method D1557.

K. Structures: Buildings, wet wells, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, manholes and vaults, or other man-made stationary features constructed above or below the ground surface.

L. Subgrade: Required surface of subsoil, borrow fill, or compacted fill that is immediately beneath site improvements, especially dimensioned fill, paving, or other surfacing material.

M. Unsuitable Soil: Includes existing fill materials, organic soils, weak native soils, or clays with a plasticity index of greater than 30, and any materials that cannot be properly placed and compacted as specified.

N. Utilities: On-site underground pipes, conduits, ducts, and cables as well as underground services within buildings.

O. Zone of Influence: A line extending at least 2 feet beyond foundation or pipeline edge, then outward and downward at a slope of 1 horizontal to 1 vertical. Do no excavation below foundation of existing structures or pipeline.

P. Professional Engineer: Registered Professional Engineer meeting project qualifications and who is hired by Contractor.

Q. The Engineer: The Engineer or designated representative hired by Owner.

1. Approval given by the Engineer shall not relieve Contractor of its responsibilities for performing the work in accordance with Contract Document requirements.

1.4 ACTION SUBMITTALS

A. Coordinate various submittal types required by this Section with requirements of dewatering, support of excavation, and geotechnical instrumentation submittals specified in other Sections.

B. Submit laboratory test results for subgrade materials that include maximum density, gradation, Atterberg limits, sand equivalent, and other applicable criteria, at least 72 hours prior to compaction.

C. Submit field conformance testing results performed by a certified independent laboratory engaged by Contractor.

1.5 INFORMATIONAL SUBMITTALS

A. Construction and Operations Plan: Submit proposed methods of construction, including earthwork operations, excavation limits, slopes, fill material moisture conditioning and handling, compaction equipment, excavation support systems design, backfilling and filling and compaction, and material sources.

B. Submit copies of field daily reports by soil technician at the end of each work-day that earthwork and grading operations occur.

C. Upon completion of earthwork and grading operations, submit an as-graded map showing density test numbers and locations, a table of density test results and depths, and a certification of compliance by engineer in charge.

D. Qualification Data: For qualified testing agency to conduct geotechnical observation, testing and documentation. include qualifications of firm, resumes of soil technicians assigned to the project, and licensed engineer in charge.

1. Firm Qualifications: Meet ASTM D3740.
2. Soil Technicians: Have minimum three years demonstrated experience in earthwork and grading operations and satisfy certification requirements of agency having local jurisdiction.

    a. The Owner reserves right to request substitution of soil technicians assigned to field work. Do not substitute assigned soil technicians without prior approval of the Engineer.

E. Pre-excavation Photographs or Videotape: Show existing conditions of adjoining construction and site improvements, including finish surfaces that might be misconstrued as damage caused by earthwork operations. Submit before earthwork begins.

1.6 QUALITY ASSURANCE

A. Excavation, trenching, sheeting, bracing, and similar work shall comply with requirements of the Florida "Trench Safety Act", CS/SB 2626, which incorporates by reference, OSHA excavation safety standards, 29 CFR 1926 Subpart P.

B. At least three working days prior to starting any excavation, notify the appropriate regional notification center for underground utilities and underground utility owners who are not members of notification center. To obtain area specific information for project site, refer to www.call 811.com.

1.7 FIELD CONDITIONS

A. Be responsible for construction layout and reference staking necessary for proper control and satisfactory completion of structures, cutting, filling, grading, drainage, fencing, embankment improvements, curbing, and other appurtenances.

B. Perform construction layout and staking by a Professional Surveyor or Professional Engineer registered in State of Florida, experienced and skilled in construction layout and staking requirements.

C. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during earthwork operations.

1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
2. Provide alternate routes around closed or obstructed traffic ways if required by Owner or authorities having jurisdiction.

D. Utility Locator Service: Notify utility locator service as noted on the Drawings before beginning earthwork operations.

E. Do not commence earthwork operations until temporary site fencing and erosion- and sedimentation-control measures specified in Section 01500 "Construction Facilities" and Section 02200 "Site Clearing" are in place.

F. Do not commence earthwork operations until silt fence shown on the Drawings is in place.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

A. Fill materials designated for use in this Section are specified in Section 02060 “Soils and Aggregates for Earthwork.”

B. On-Site Fill Material: Earth and rock material obtained at project site during excavation, following clearing and stripping, from which any Unsuitable Soil or Objectionable Material has been removed.

C. General: Provide imported fill materials when sufficient satisfactory soil materials are not available from excavations.

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect structures, tanks, utilities, sidewalks, pavements, fencing, landscaping, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.

1. If necessary, remove and restore or replace curbing, driveway aprons, and fencing after performing backfilling work.
2. Replace existing facilities damaged by construction with new material fully equal to existing without additional compensation.

B. Prior to and During Earthwork Operations:

1. Provide, monitor, and maintain geotechnical instrumentation regarding settlement; coordinate with Section 02030 "Geotechnical Instrumentation and Monitoring."
2. Protect and maintain erosion and sedimentation controls; coordinate with Section 02370 "Erosion and Sedimentation Controls."
3. Provide, monitor, and maintain excavation support; coordinate with Section 02260 "Excavation Support and Protection."

    a. Use excavation support system for excavations within the zone of influence for existing structures or utilities.
    b. Do not permit excavations below base level of adjacent foundations or retaining walls, unless excavation design and bracing includes an analysis of structure's stability supported by the foundation. When necessary due to project conditions, incorporate required bracing and foundation underpinning.

4. Provide, monitor, and maintain dewatering and drainage systems; coordinate with Section 02240 "Dewatering."

C. Test Pits:

1. Perform exploratory excavation work, test pits, for purpose of verifying the location of underground utilities and structures and to check for unknown utilities and structures, prior to commencing excavation work.
2. As earthwork progresses, perform test pits for the purpose of compaction testing. Pause operations and provide safe access for testing personnel.
3. Backfill and compact test pits as soon as desired information has been obtained. Stabilize backfilled surfaces in accordance with approved erosion and sedimentation control plans.

D. Clearing and Stripping. Initially clear and strip ground surfaces beneath planned structures and in areas requiring excavation or filling of organic material and debris. Do not use those materials as On-Site Fill Material; remove from the site and properly disposed or reused as topsoil in landscape areas if suitable.

1. Stripping Depth Variance: From about 2 inches to 3 inches. Depth may vary greater than this depending on actual conditions. In addition, soils with significant organic content were encountered at Test Boring OD-4 and Test Pit TP-1 (See Geotechnical Report) between depths of 2 and 4 feet. Investigate and remove this unsuitable material as approved by the Engineer.

E. Protect subgrades and foundation soils from freezing temperatures and frost. Remove temporary protection before placing subsequent materials.

F. Saw cut existing concrete walkway and pavement with a saw, wheel, or pneumatic chisel along straight lines before excavating.

3.2 DEWATERING AND DRAINAGE

A. Provide dewatering and drainage in accordance with Section 02240 “Dewatering”.

B. Prevent surface water and ground water from entering excavations, from ponding on prepared subgrades, and from flooding Project site and surrounding area.

C. Protect subgrades from softening, undermining, washout, and damage by rain or water accumulation.

1. Reroute surface water runoff and groundwater seepage away from excavated areas. Do not allow water to accumulate in excavations. Do not use excavated trenches as temporary drainage ditches.

D. Prior to excavation, verify groundwater will be at required level indicated on approved dewatering and drainage submittal.

E. Accomplish dewatering by methods that preserve undisturbed state of subgrade soils. Dewater in a manner to prevent boiling, detrimental under-seepage, or disturbance at excavation base.

3.3 SUPPORT OF EXCAVATION

A. Provide excavation support in accordance with Section 02260 “Excavation Support and Protection”.

3.4 EXCAVATION

A. Include material of every description and of whatever substance encountered as an unclassified excavation.

B. General: Excavate on-site soils using standard earthmoving equipment. Excavation in dense soil or rock may require special equipment. Do not plough, scrape, or dig earth with machinery so near to finished subgrade to result in excavation of or disturbance of below grade material.

C. Make excavations to grades indicated on Drawings and in widths sufficient for laying of pipe, construction of the structure, installing bracing, excavation supports, dewatering and drainage facilities, and working clearances.

D. Perform excavation in-the-dry and accomplished by methods which preserve the natural undisturbed condition of subgrade soils.

E. Moisture Sensitive Soils: Use a smooth-edge bucket to excavate last one foot of depth when excavation is to end in such soils.

F. If excavation bottom is removed below the limits shown on Drawings, specified, or directed by the Engineer, refill with structural fill satisfactory to the Engineer without additional compensation.

G. When excavation has reached prescribed depths, notify the Engineer who will observe the conditions. If materials and conditions are not satisfactory, the Engineer will issue instructions for corrective procedures. The Engineer will be the sole judge as to whether the work has been accomplished satisfactorily.

H. Subgrade soils that have become soft, loose, quick, or otherwise unsatisfactory due to inadequate excavation, dewatering, or other construction methods in the opinion of the Engineer, remove existing soil and replaced with structural fill as acceptable to the Engineer at Contractor's expense.

I. Exposed subgrades in large open areas and for foundations shall be proof rolled with at least two overlapping coverages of a vibratory drum roller with a minimum static drum weight of 10 ton. Conduct proof-rolling in presence of the Engineer. The Engineer will waive this requirement, if in its opinion the subgrade will be rendered unsuitable by such proof-rolling.

    1. Confined Areas: Proof-roll with hand operated vibratory equipment that is approved by the Engineer.

J. Perform over-excavation at the Engineer’s request to remove unsuitable soil, objectionable material, or other materials as determined by the Engineer and to such depth and width as directed. Replace with suitable material as directed by the Engineer.

    1. Authorized additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.

K. Perform excavation for pipelines beneath structures and excavation for footings with excavating equipment operating from the subgrade for the structure, while in-the-dry and in a manner preserving the undisturbed state of subgrade soils.

L. When excavations have reached the required subgrade, including any allowances for working mats or base materials and prior to their placement, notify soils testing laboratory to verify suitability of existing subgrade soils for anticipated foundation and structural loadings.

    1. If existing subgrade soils are determined to be unsuitable, follow direction provided by the Engineer regarding removal and replacement with suitable materials.

2. Notify the Engineer if the revised work scope would modify Contractor's cost and thereby entitle a change to the Contract Sum. Authorized additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.

M. Replace over-excavation beyond the limits and depths required by Contract Documents using structural fill or other material satisfactory to the Engineer without additional compensation.

3.5 SUBGRADE PREPARATION

A. Notify Engineer when excavations have reached required subgrade.

B. Maintain excavated subgrade in-the-dry condition.

C. Prior to fill placement, remove objectionable material which includes, but not be limited to, pavement, topsoil, organic matter, contaminated soil, construction debris, perishable materials, snow, ice, frozen earth, and rocks or lumps of cemented soils over 6 inches in maximum dimension.

D. For subgrades consisting of granular soils, proof roll the final subgrade using at least four coverages of a vibrator plate compactor.

E. Where existing subgrade contains a significant amount of clay or cohesive soils, over-excavate sufficiently below the bottom of structure for placement of a lean concrete working mat. Remove loose or soft material from the subgrade immediately prior to placing lean concrete working mat.

F. Remove and replace soft subgrades or unusable material with structural fill, or other material satisfactory to the Engineer.

G. Notify the Engineer to observe conditions following subgrade preparation and prior to fill placement. If existing subgrade soils are determined to be unsuitable, follow direction provided by the Engineer regarding removal and replacement with suitable materials.

1. Authorized additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.

3.6 STORAGE OF SOIL MATERIALS

A. Stockpile borrow soil materials and excavated satisfactory soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust. Protect from precipitation.

1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

3.7 FILL PLACEMENT AND COMPACTION PROCEDURES

A. Fill and Backfill: Place materials in lifts to suit specified compaction requirements to required lines and grades, making allowances for settlement and placement of cover materials, such as topsoil or sod. Correct soft spots or uncompacted areas.

B. Do not place or compact fill and backfill when materials are too wet to properly compact.

1. In-place Soil Moisture Content: Maximum of three percentage points above optimum moisture content of soil, as determined by laboratory test of moisture-density relation appropriate to specified level of compaction.

C. Structural Fill and Common Fill: Construct to required lines and grades, making allowances for settlement and placement of cover materials, such as topsoil and sod. Correct soft spots or uncompacted areas.

D. Fill material shall be free of snow, ice, frost, and frozen earth. Do not place fill materials on frozen surfaces or surfaces covered by snow, ice, or frost.

E. Complete structure water-tightness tests and installation of dampproofing or waterproofing systems prior to placing various types of fill or backfill around structures.

F. If subgrade slopes more than 10 percent, step subgrade to produce a stable, horizontal surface for placement of fill materials. Scarify existing subgrade slope to a depth of at least 6 inches.

G. Compact filled slopes by slope rolling and trimming, or overfill and trim back to plan grade to expose a firm, smooth surface free of loose material.

H. Do not allow fill lifts to contain stones with a dimension larger than 2/3 the specified loose measure lift thickness.

I. Perform compaction in open areas using compaction equipment by any of the following methods:

1. Fully loaded ten-wheel trucks or front-end loaders.
2. Tractor dozers weighing minimum of 30,000 pounds.
3. Heavy vibratory rollers.

J. Confined Compaction: Perform compaction in confined areas, including areas within a 45-degree angle extending upward and outward from the base of a wall, and in areas where the use of large equipment is impractical, using hand-operated vibratory equipment or mechanical tampers.

1. Do not exceed lift thickness of 6 inches, measured before compaction, when using hand operated equipment.

K. Moisture condition on-site fill material prior to placement, unless Contractor demonstrates to the Engineer in-place moisture conditioning methods can achieve the required moisture content.

L. Conduct compaction of each specified lift of fill materials by a minimum of four complete coverages with acceptable compaction equipment to a specified density as a percentage of maximum dry density as determined by ASTM D1557, unless otherwise specified.

M. Use structural fill required beneath foundations or slabs on grade, except sidewalks. Place and compact structural fill in even lifts having a maximum thickness of 8 inches, measured before compaction.

N. Use select fill materials placed within 10 feet of all structures. Uniformly place and compact select fill around the structure in even lifts having a maximum thickness of 8 inches, measured before compaction.

O. Use common fill in areas beyond those designated for structural fill or select fill, unless shown or otherwise specified. Place in even lifts having a maximum thickness of 12 inches, measured before compaction.

P. Place impervious fill in controlled, even lifts having a maximum thickness (measured before compaction) of 6 inches.

1. Permeability: Compact to attain a reading of less than 1 x 10^{-7} cm/sec.
2. Moisture Content: Compact to optimum moisture content of minus 2 percent to plus 3 percent.

3.8 COMPACTION REQUIREMENTS

A. Perform in-place testing of compacted fill lifts to measure in-place density and water content according to ASTM D6938 and ASTM D1557.

B. Beneath Foundations and Slabs-on-Grade, except sidewalks: Compact top 24 inches of existing subgrade and each layer of fill, if applicable to:

1. Maximum Dry Density: Minimum of 98 percent for ASTM D1557.
2. Moisture Content: At or near its optimum moisture content of plus/minus 2 percent.

C. Area Around Structures: Within 10 feet compact each fill or backfill layer to:

1. Maximum Dry Density: Minimum of 95 percent for ASTM D1557.
2. Moisture Content: At or near its optimum moisture content of plus/minus 2 percent.

D. Embankments, Lawn, or Unimproved Areas: Does not include embankments under roadways and earth dam structures. Compact each fill or backfill layer to:

1. Maximum Dry Density: Minimum of 95 percent for ASTM D1557.
2. Moisture Content: At or near its optimum moisture content of plus/minus 3 percent.

E. Sidewalks: Compact each fill layer to:

1. Maximum Dry Density: Minimum of 98 percent for ASTM D1557.

2. Moisture Content: At or near its optimum moisture content of plus/minus 2 percent.

F. Utility Pipelines: Compact each fill layer to:

1. Maximum Dry Density: As shown in Drawing.
2. Moisture Content: At or near its optimum moisture content of plus/minus 2 percent.

3.9 DISPOSAL OF UNSUITABLE, WASTE, AND SURPLUS EXCAVATED MATERIALS

A. Unsuitable soil, objectionable material, waste, and surplus excavated material shall be removed and disposed of off-site. Materials may be temporarily stockpiled in an area within the limits of construction that does not disrupt construction activities, create any nuisances or safety hazards, or otherwise restricts access to work site.

B. Topsoil or loam excavated under this Section may be salvaged for use as specified under Florida Department of Transportation (FDOT) Section 570, as approved by the Engineer.

3.10 GRADING

A. Perform grading to lines and grades shown on Drawings. Remove objectionable materials encountered within the limits indicated and disposed of off-site. Completely and continuously drained and dewatered subgrades throughout the grading process. Install temporary drains and drainage ditches to intercept or divert surface water that may affect the execution or condition of grading work.

B. If it is not possible at the time of grading to place material in its proper section of the Work, stockpile it in approved areas for later use. No additional compensation will be made for stockpiling or double handling of excavated materials.

C. In cut areas, remove loose or protruding rocks in slopes to line or finished grade of the slope. Uniformly dress, cut, and fill slopes to slope cross-section and alignment shown on Drawings, unless otherwise directed by the Engineer.

3.11 FIELD QUALITY CONTROL

A. Test and observe materials as described in this Article. Cooperate by allowing free access to work for selection of test materials and observations.

B. General Testing Requirements:

1. At Structures: Prior to placement of bedding material, concrete work mats, structural fill or structural concrete, coordinate with Engineer or Soils Testing Laboratory to verify suitability of existing subgrade soil.
2. Backfill and Fill: Prior to and during the placement of backfill and fill coordinate with Engineer or Soils Testing Laboratory to perform in-place soil density tests to verify that

backfill and fill material has been placed and compacted in accordance with specified compaction requirements.

a. Provide minimum 48 hours' notice prior to placement of backfill and fill.

3. Subgrade: Do not cover with fill without observation, testing, and approval by Engineer or Soils Testing Laboratory.

a. Earthwork activities performed without properly scheduled inspection are subject to removal and replacement or additional testing as directed by the Engineer without additional compensation.

C. Test materials by a certified independent laboratory, engaged by Contractor and acceptable to the Engineer, demonstrating conformance with project requirements. Deliver test reports and material certifications to the Engineer before using any material in the work.

D. If field test results are not in conformance with project requirements, costs involved in correcting deficiencies in compacted materials to satisfaction of the Engineer without additional compensation.

E. Earthwork activities performed without properly scheduled inspection are subject to removal and replacement or additional testing as directed by the Engineer without additional compensation.

F. Testing methods shall comply with latest ASTM or equivalent AASHTO Standards applicable during bidding.

G. During placement of bedding, backfill, and fill, perform in-place soil density testing to confirm that fill material has been compacted in accordance with project requirements. The Engineer may designate areas to be tested. Notify the Engineer at least 72 hours in advance of scheduled compaction testing. In place soil density tests on backfill and fill material shall be as required by authorities having jurisdiction, project geotechnical report, but in no instance, shall less than those listed:

1. Structures and Embankments: At least one density and moisture content test for each 2,500 square feet of surface area for each lift of fill at embankment, structure, and manhole locations.
2. Trench Excavations: At least one nuclear density and one moisture content test at a maximum of 150 feet intervals along pipelines, or as directed by the Engineer. A minimum of one test between manholes and valves is required for every other lift of fill placed regardless of the distance between manholes or valves.
3. The Engineer may designate supplemental areas to be tested at additional compensation.

H. Materials which have been previously tested may be subjected to further testing from time to time and may be rejected, if it is determined that results do not conform to project requirements. Immediately remove rejected materials when directed by the Engineer, notwithstanding results of previous testing.

I. The Engineer or Owner may conduct additional soil testing. Cooperate fully in allowing additional test to be made, including free access to the work.

3.12 PROTECTION

A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.

B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.

1. Scarify or remove and replace soil material to depth as directed by the Engineer; reshape and recompact.

C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.

1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

END OF SECTION

SECTION 02333

TRENCHING AND BACKFILLING

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. Section includes trench excavation, backfilling, and compaction for the Headworks Structure, new BTU No. 3 and associated yard piping.

B. Related Requirements:

1. Section 02060 “Soils and Aggregates for Earthwork” for materials used as backfill and for sheeting and bracing.
2. Section 02300 “Earthwork” for related earthwork activities.
3. Section 02240 "Dewatering" for dewatering and drainage.
4. Section 02370 “Erosion and Sedimentation Controls” to prevent erosion, sedimentation, and contamination of adjacent properties.

1.3 DEFINITIONS

A. Percent Compaction: Means at least the stated percentage of maximum density as determined by ASTM D 1557.

1.4 ACTION SUBMITTALS

A. Submit proposed method of backfilling and compaction prior to start of Work.

1.5 QUALITY ASSURANCE

A. Comply with following regulations:

1. Florida "State Safety Act" (CS/SB 2626).
2. Occupational Safety and Health Administration (OSHA): 29 CFR Part 1926 Subpart P.

B. Provide excavation, trenching, related sheeting, bracing, and related materials to comply with requirements of the Florida "State Safety Act" (CS/SB 2626) which incorporates, by reference, OSHA's excavation safety standards, 29 CFR 1926 Subpart P.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store excavated materials according to Section 02370 “Erosion and Sedimentation Control” to prevent erosion of soil type materials and contamination of adjacent water sources.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine that erosion and sedimentation controls are in place and comply with project requirements and authorities having jurisdiction.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Coordinate work of this Section with materials specified in other Sections of Division 2.

B. Identify required lines, levels, contours, and datum locations.

C. Protect features to remain-in-place including bench marks, existing structures, sidewalks, paving, curbs, etc. from excavating equipment and vehicular traffic.

D. Maintain and protect above and below grade utilities indicated to remain.

3.3 TRENCH EXCAVATION

A. Trench excavation includes material of every description and substance encountered.

B. Cut rigid and flexible pavement, existing structures, and concrete sidewalk with a saw, wheel, or pneumatic chisel along straight lines before excavating.

C. Strip and stockpile topsoil from grassed areas crossed by trenches.

1. At Contractor's option when required, topsoil may be disposed of and replaced with approved topsoil of equal quality.

D. While excavating and backfilling is in progress, maintain traffic and protect utilities and other property.

E. Excavate trenches to indicated depths and in widths sufficient and of practical minimum for pipe laying, bracing, and pumping and drainage facilities.

F. Accomplish excavation and dewatering by methods preserving undisturbed state of subgrade soils. Excavate trench by machinery to or just below designated subgrade, if material remaining in trench bottom is no more than slightly disturbed.

1. Remove subgrade soils that become soft, loose, quick, or otherwise unsatisfactory due to inadequate excavation, dewatering, or other construction methods and replace with screened gravel fill acceptable to the Engineer at Contractor's expense.

G. Use care when working in clay and organic silt soils, which are particularly susceptible to disturbance due to construction operations. When excavation is to end in such soils, use a smooth-edge bucket to excavate the last 12 inches of depth.

H. Where pipe is to be laid in screened gravel bedding, excavate trench by machinery to normal depth of pipe, provided material remaining in trench bottom is no more than slightly disturbed.

I. Where pipe is to be laid directly on trench bottom, manually perform final excavation, providing a flat-bottom, true to grade upon undisturbed material. Make bell holes required by project conditions.

3.4 DISPOSAL OF MATERIALS

A. Stack excavated material without excessive surcharge on trench bank or obstructing free access to hydrants and gate valves. Avoid inconvenience to traffic and abutters. Segregated excavated material for use in backfilling as specified below.

B. Do not remove excavated material from work site, except as directed by the Engineer. When removal of surplus materials is approved by the Engineer, dispose of such surplus material in approved designated areas.

C. Should conditions make it impracticable or unsafe to stack material adjacent to trench, haul and store material at a location provided. When required, re-handled and use it in backfilling trench.

3.5 SHEETING AND BRACING

A. Provide and maintain sheeting and bracing required by Federal, State, or local safety requirements to support sides of excavation and prevent loss of ground which could endanger personnel, damage, adjacent structures, or delay the work.

1. Engineer may order additional supports placed at Contractor’s expense if it is determined that at any point sufficient or proper supports have not been provided. Compliance with such order shall not relieve Contractor from their responsibility for sufficiency of such supports. Take care to prevent voids outside of sheeting; if voids are formed, immediately fill and ram them.

B. When moveable trench bracing such as trench boxes, moveable sheeting, shoring or plates are used to support trench sides, take care in placing and moving the boxes or supporting bracing to prevent pipe movement, disturbance of pipe bedding, or screened gravel backfill.

1. Rigid Pipe Installation (such as R.C., V.C., A.C.): Raise that portion of box extending below mid-diameter above this point prior to moving box ahead to install next pipe. Perform to prevent separation of installed pipe joints due to box movement.
2. Flexible Pipe Installation (such as D.I., PVC): Do not allow trench boxes, moveable sheeting, shoring, or plates to extend below mid-diameter of pipe. As trench boxes, moveable sheeting, shoring, or plates are moved, place screened gravel to fill voids created. Re-compact screened gravel and backfill to provide uniform side support for pipe.

C. Engineer may give permission to use steel sheeting in lieu of wood sheeting for entire job wherever sheeting use is necessary. Include cost for use of sheeting in bid items for pipe, including full compensation for driving, bracing, and later removal of sheeting.

D. Carefully remove sheeting and bracing in manner to not endanger construction of other structures, utilities, or property, whether public or private. Immediately refill voids left after withdrawal of sheeting using sand by ramming with tools especially adapted to that purpose and watering or otherwise directed by the Engineer.

E. No payment will be given for sheeting, bracing, or other support during progress of the work. No payment will be given for sheeting left in trench for Contractor's convenience.

F. Leave sheeting driven below mid-diameter of pipe in place from driven elevation to at least 12 inches above top of pipe.

3.6 TEST PITS

A. Excavation of test pits may be required for purpose of locating underground utilities or structures as an aid in establishing the precise location of new work.

B. Backfill test pits as soon as desired information has been obtained. Maintain backfilled surface appropriate for travel until resurfaced.

3.7 EXCAVATION BELOW GRADE AND REFILL

A. Drain trench completely and effectively be in-the-dry, whatever the nature of unstable material encountered or groundwater conditions.

B. If Contractor excavates below grade through error or for their own convenience, through failure to properly dewater the trench, or disturbs subgrade before dewatering is sufficiently complete, the Engineer may direct Contractor to excavate below grade as set forth in following Paragraph, where work shall be performed at its own expense.

C. If material at trench bottom consists of fine sand, sand and silt or soft earth which may work into the screened gravel, even with effective drainage, remove subgrade material to extent directed. Refill excavation with a 6-inch layer of coarse sand or a mixture graded from coarse sand to fine pea stone to form a filter layer preserving voids in pipe gravel bed. Composition and gradation of gravel shall be approved by the Engineer prior to placement. Place screened gravel in 6-inch layers thoroughly compacted up to normal grade of pipe. If directed by the Engineer, use bank-run gravel for refill of excavation below grade.

D. Subsurface Drainage Geotextile: Non-woven filter fabric may be substituted for filter layer, if approved by the Engineer. Filter fabric intended for use shall be submitted for Engineer's approval.

3.8 BACKFILLING

A. Begin backfilling as soon as practicable after laying and jointing pipe and continue expeditiously. Place bedding gravel of specified type for pipe installed up to 12 inches over the pipe.

B. Construct an impervious dam or bulkhead cutoff of clay or other impervious material in the trench, as directed by the Engineer, to interrupt unnatural flow of groundwater after construction is completed. Key dam into trench bottom and sidewalls. Provide at least one clay or other impervious material dam in pipe bedding between each manhole where directed or every 300 feet, whichever is less.

C. Where pipes are laid cross-country, fill remainder of trench with common fill material in layers not to exceed 12 inches and mounded 6 inches above existing grade or as directed by the Engineer. Where a loam or gravel surface exists prior to cross-country excavations, remove, conserve and replace it to full original depth as part of the work under pipe items. Where necessary, remove excess material during clean-up process, so that ground may be restored to its original level and condition.

D. To prevent longitudinal pipe movement, do not dump backfill material into trench and then spread, until selected material or screened gravel has been placed and compacted to a level at least 12 inches over the pipe.

E. Bring backfill up evenly on all sides. Thoroughly compact each layer of backfill material by rolling, tamping, or vibrating with mechanical compacting equipment or hand tamping to 95 percent compaction according to ASTM D 1557. If rolling, use a suitable roller or tractor being careful to compact fill throughout full width of trench.

F. Do not compact by puddling or water jetting.

G. Use hand or pneumatic ramming with tools weighing at least 20 pounds for compacting in confined areas. Spread and compact material in layers not exceeding 6 inches thick, an uncompacted loose measurement.

H. Use granular fill material as backfill around structures. Spread and compact specified backfill under and over pipes connected to structures.

I. Do not place bituminous paving in backfill. Do not use frozen material under any circumstances.

J. Broom and hose-clean road surfaces immediately after backfilling. Employ dust control measures throughout construction period.

3.9 RESTORING TRENCH SURFACE

A. Where trench occurs adjacent to paved streets, in shoulders, sidewalks, or in cross-country areas, thoroughly consolidate backfill and maintain surface as the work progresses. If settlement takes place, immediately deposit additional fill to restore ground level.

B. Restore surface of driveways or other areas which are disturbed by trench excavation to a condition at least equal to that existing before work began.

C. In areas where pipeline passes through grassed areas, remove and replace sod or loam and seed surface at Contractor's own expense.

END OF SECTION

SECTION 02370

EROSION AND SEDIMENTATION CONTROLS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Diversion Channels
2. Rock Barriers/Check Dams
3. Sediment Fences
4. Construction Entrances
5. Turbidity Curtains
6. Filter Bags
7. Erosion Control Blanket
8. Straw Wattle.

B. Related Sections:

1. Section 01320 “Construction Video and Photographs
2. Section 02060 “Soils and Aggregates for Earthwork”
3. Section 02200 “Site Clearing”
4. Section 02260 “Excavation Support and Protection”
5. Section 03100 “Concrete Forming and Accessories”
6. Section 03200 “Concrete Reinforcing”
7. Section 03300 “Cast-In-Place Concrete”
8. Section 03600 “Grouting”
9. Section 05502 “Metal Fabrications”

1.3 REFERENCE STANDARD

A. EPA document titled: “Stormwater Management for Construction Activities – Developing Pollution Prevention Plans and Best Management Practices” document number EPA 832-R-92-005, dated 1992, or most recent edition. State or appropriate Conservation Commission standards can be substituted for the EPA standard if the State or Conservation Commission standard is equal to, or more detailed than, the EPA standard.

1.4 ACTION SUBMITTALS

A. Section 01330 “Submittals”: Requirements for submittals.

1. Submit, within 10 days after award of Contract, technical product literature for all commercial products.

B. Product Data: Product Data: Submit data on geotextile.

C. Submit proposed mix design for review prior to commencement of Work.

D. Test Reports: Indicate certified tests results for granular backfill.

E. Manufacturer's Certificate: Certify Products meet or exceed specified requirements.

F. Certificate: Certified statement as specified in “Erosion Control Blanket” Article.

1.5 INFORMATIONAL SUBMITTALS

A. Stormwater Pollution Prevention Plan (SWPPP) as specified in “Quality Assurance” article.

B. Copy of EPA NPDES Notice of Intent to Discharge submitted to the EPA as specified in “Quality Assurance” article.

1.6 CLOSEOUT SUBMITTALS

A. Section 01701 “Project Closeout”: Requirements for submittals.

1.7 QUALITY ASSURANCE

A. Prepare and submit a Stormwater Pollution Prevention Plan (SWPPP) in accordance with the U.S. Environmental Protection Agency (EPA) National Pollution Discharge Elimination System (NPDES) General Permit applicable to this work) document number EPA 832-R-92-005, dated 1992, or most recent edition.

B. Prepare and submit the EPA NPDES Notice of Intent to Discharge to the applicable EPA office in accordance with EPA regulations.

C. Perform Work in accordance with requirements of Section 02060 “Soils and Aggregates for Earthwork”, Section 02200 “Site Clearing”, Section 03100 “Concrete Forming and Accessories”, Section 03200 “Concrete Reinforcing”, and Section 03300 “Cast-in-Place Concrete”.

D. Perform Work according to Clay County Utility Authority standards.

1.8 ENVIRONMENTAL REQUIREMENTS

A. Do not place grout when air temperature is below freezing.

PART 2 - PRODUCTS

2.1 ROCK AND GEOTEXTILE MATERIALS

A. Furnish materials according to State of Florida Department of Transportation standards.

B. Geotextile Fabric: Furnish according to State of Florida Department of Transportation standards.

2.2 BLOCK, STONE, AGGREGATE, AND SOIL MATERIALS

A. Stone: Furnish according to State of Florida Department of Transportation standards.

B. Coarse Aggregate: Furnish according to State of Florida Department of Transportation standards.

C. Soil Backfill: Soil Type as specified in Section 02060 “Soils and Aggregates for Earthwork”. Subsoil with no rocks over 6 inches in diameter, frozen earth or foreign matter.

2.3 SILT FENCE

A. Silt fence filter fabric shall be a woven, polypropylene, ultraviolent resistant material meeting minimum requirements below:

Fabric Properties	Minimum Acceptable Value	Test Method
Grab Tensile Strength (lbs)	110	ASTM D 4632/ D 4632M
Elongation at Failure (%)	20	ASTM D 4632/ D 4632M
Mullen Burst Strength	300 psi	ASTM D 3786/ D 3796M
Puncture Strength (lbs)	60	ASTM D 4833/ D 4833M
Minimum Trapezoidal Tear Strength (lbs)	50	ASTM D 4533/ D 4533M
Flow through Rate (gal/min/sf)	25	ASTM D 4491/ D 4491M
Equivalent Opening Size	40 – 80	US Std Sieve ASTM D 4751
Minimum UV Residual (%)	70	ASTM D 4355/ D 4355M

B. Products: Provide one of the following:

1. "Mirafi FW402," by TenCate Geosynthetics
2. "Carthage 15%," by Carthage Mills
3. "HSP2." by ACF Environmental, Inc.
4. Or equal.

C. Posts: As shown on the Drawings.

D. Tie wires for securing silt fence fabric to wire mesh shall be light gauge metal clips (hog rings), or 1/32 inch diameter soft aluminum wire.

2.4 TURBIDITY CURTAIN

A. Barrier Material: filter fabric.

B. Barrier height shall be 20 percent greater than the depth of water.

2.5 FILTER BAGS

A. Filter Bags: Sized with manufacturer recommendations based on pumped discharge rate.

B. Geotextile Material for Bags: Meet the following minimum requirements:

Minimum Grab Tensile Strength	200 lbs
Minimum Grab Tensile Elongation	50%
Minimum Trapezodial Tear Strength	80 lbs
Mullen Burst Strength	380 psi
Minimum Puncture Strength	130 lbs
Apparent Opening Size	40-80 US Sieve
Minimum Flow Through	70 gpm/square foot

C. Bag shall have opening large enough to accommodate 4 inch diameter discharge hose.

2.6 EROSION CONTROL BLANKET

A. Erosion control blankets: 100 percent agricultural straw fiber matrix, 0.5 lbs / sq yd, stitch bonded with degradable thread between two photodegradable polypropylene nettings.

1. Product: Provide Model S150 Double Net Short-Term Blanket (12 months) by North American Green, Evansville, IN), or equal.

B. Prior to start of work, provide a certified statement as to the number of pounds of materials to be used per 100 gallons of water. Specify the number of square feet of seeding that can be covered with the quantity of solution in the Contractor's hydroseeder.

2.7 STRAW WATTLE

A. Straw Wattle: Prefabricated commercial product with outside casing made up of organic hessin

1. Effective Height: 12 inches plus or minus 1 inch.
2. Effective Circumference: 3 38 inches.

B. Product: Provide products by Phase II Stormwater Products Wrentham MA or equal.

2.8 PLANTING MATERIALS

A. Seeding and Soil Supplements: as specified in Florida Department of Transportation (FDOT) Section 570.

B. Mulch: FDOT Standard Specifications for Road and Bridge Construction.

2.9 SOURCE QUALITY CONTROL (AND TESTS)

A. Section 01400 “Quality Control”: Testing, inspection and analysis requirements.

B. Perform tests on cement, aggregates, and mixes to ensure conformance with specified requirements.

C. Test samples in accordance with ACI 301.

D. Make rock available for inspection at producer's quarry prior to shipment. Notify Engineer at least seven days before inspection is allowed.

E. Allow witnessing of inspections and test at manufacturer's test facility. Notify Engineer at least seven days before inspections and tests are scheduled.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 01320 “Construction Video and Photographs”: Document existing conditions before starting work.

B. Verify compacted subgrade, granular base, or stabilized soil is acceptable and ready to support devices and imposed loads.

C. Verify gradients and elevations of base or foundation for other work are correct.

3.2 DIVERSION CHANNELS

A. Windrow excavated material on low side of channel.

B. Compact to 95 percent maximum density.

C. On entire channel area, apply soil supplements and sow seed as specified in FDOT Section 570.

D. Mulch seeded areas with hay as specified in FDOT Standard Specifications for Road and Bridge Construction.

3.3 ROCK BARRIER

A. Determine length required for ditch or depression slope and excavate, compact and foundation area to firm, even surface.

B. Produce an even distribution of rock pieces, with minimum voids to the indicated shape, height and slope.

C. Construct coarse aggregate filter blanket against upstream face of rock barrier to the indicated thickness.

3.4 SILT FENCE

A. Position sediment fences as indicated on the Drawings and to prevent off site movement of sediment produced by construction activities as directed by the Engineer. Areas beyond limits of silt fence shall be undisturbed or stabilized.

B. Dig trench approximately 6 inch wide and 6 inch deep along proposed fence lines.

C. Drive stakes, 10 feet on center (maximum) at back edge of trenches. Drive stakes 2 feet (minimum) into ground.

D. Hang filter fabric on posts carrying to bottom of trench with about 4 inches of fabric laid across bottom of trench. Stretch fabric fairly taut along fence length and maintain secure both ways.

E. Backfill trench with excavated material and tamp.

F. Install pre-fabricated silt fence according to manufacturer's instructions.

3.5 CONSTRUCTION ENTRANCE

A. Construct entrance with minimum of 6 inch of course aggregate at all points of ingress/egress.

B. Width: Minimum 20 feet, increased as needed for typical construction vehicles.

C. Minimum Length: 50 feet (15.2 m) (where soils are course grained).

D. Install filter fabric below aggregate.

E. Maintain entrance throughout construction, adding more aggregate or increasing length as needed.

3.6 TURBIDITY CURTAIN

A. Install turbidity curtain parallel to bank, extending beyond lateral limits of construction.

B. Install weights at 10 foot intervals, floats at 5 feet intervals.

C. Inspect turbidity curtain daily and repair/replace worn/torn areas as needed.

D. At end of construction, remove accumulated sediment by hand before removing the turbidity curtain.

3.7 FILTER BAG

A. Locate filter bag at least 50 feet from all wetlands, streams or other surface waters.

B. Install bag on a 4 inch (100 mm) thick straw mat to allow water to flow in all directions.

C. Bag is full when remaining flow area is reduced by 75%. Replace full bags with new bags.

3.8 EROSION CONTROL BLANKETS

A. Install erosion control blankets onto all exposed slopes to be loamed and seeded that are steeper than 4 (Horizontal) to 1 (Vertical) as shown on the Drawings. Erosion control blankets shall also be installed in all seeded drainage swales and ditches, and as directed by the Engineer in accordance with manufacturer's instructions.

B. The area to be covered shall be properly prepared, fertilized and seeded with permanent vegetation before the blanket is applied. When the blanket is unrolled, the netting shall be on top and the fibers in contact with the soil over the entire area. The blankets shall be applied in the direction of water flow and stapled.

C. Place blankets and stapled together in accordance with manufacturer's instructions. Side overlaps shall be 4-inch minimum. The staples shall be made of wire, 0.091 inch in diameter or greater, "U" shaped with legs 10-in in length and a 1-1/2-in crown. Commercial biodegradable stakes may also be used with prior approval by the Engineer. The staples shall be driven vertically into the ground, spaced approximately two linear feet apart, on each side, and one row in the center alternately spaced between each size. Upper and lower ends of the matting shall be buried to a depth of 4-in in a trench. In swales and ditches, erosion stops shall be created every 25-ft by making a fold in the fabric and carrying the fold into a silt trench across the full width of the blanket. The bottom of the fold shall be 4-in below the ground surface. Staple on both sides of fold. Where the matting must be cut or more than one roll length is required in the swale, turn down upper end of downstream roll into a slit trench to a depth of 4-in. Overlap lower end of upstream roll 4-in past edge of downstream roll and staple

D. To ensure full contact with soil surface, roll matting with a roller weighing 100 lbs/ft of width perpendicular to flow direction after seeding, placing matting and stapling. Thoroughly inspect channel after completion. Correct any areas where matting does not present a smooth surface in full contact with the soil below.

3.9 STRAW WATTLE

A. Position straw waddles as indicated on the Drawings and as necessary to prevent off site movement of sediment produced by construction activities as directed by the Engineer.

B. Drive wooden stakes, 5 feet on center (maximum) at back edge of waddle. Drive stakes 2 2 feet (minimum) into ground.

C. Install prefabricated straw waddle according to manufacturer’s instructions.

3.10 SITE STABILIZATION

A. Incorporate erosion control devices indicated on the Drawings into the Project at the earliest practicable time.

B. Construct, stabilize and activate erosion controls before site disturbance within tributary areas of those controls.

C. Stockpile and waste pile heights shall not exceed 35 feet. Slope stockpile sides at 2: 1 or flatter.

D. Stabilize any disturbed area of affected erosion control devices on which activity has ceased and which will remain exposed for more than 20 days.

1. During non-germinating periods, apply mulch at recommended rates.
2. Stabilize disturbed areas which are not at finished grade and which will be disturbed within one year.
3. Stabilize disturbed areas which are either at finished grade or will not be disturbed within one year in accordance with FDOT Section 570.

E. Stabilize diversion channels, sediment traps, and stockpiles immediately.

3.11 FIELD QUALITY CONTROL

A. Section 01400 “Quality Requirements”: Field inspecting, testing, adjusting, and balancing.

B. Inspect erosion control devices on a weekly basis and after each runoff event. Make necessary repairs to ensure erosion and sediment controls are in good working order.

C. Compaction Testing: In accordance with ASTM D1557.

D. When tests indicate Work does not meet specified requirements, remove Work, replace and re-test.

E. Frequency of Compaction Testing: Two for each lift.

3.12 CLEANING

A. Section 01701 “Project Closeout”: Requirements for cleaning.

B. When sediment accumulation in sedimentation structures has reached a point one-third depth of sediment structure or device, remove and dispose of sediment.

C. Do not damage structure or device during cleaning operations.

D. Do not permit sediment to erode into construction or site areas or natural waterways.

E. Clean channels when depth of sediment reaches approximately one-half channel depth.

3.13 PROTECTION

A. Immediately after placement, protect paving from premature drying, excessive hot or cold temperatures, and mechanical injury.

B. Do not permit construction traffic over paving until 75 percent design strength of concrete has been achieved.

C. Protect paving from elements, flowing water, or other disturbance until curing is completed.

END OF SECTION

SECTION 02561

DUCTILE-IRON UTILITY PIPE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. CCUA Standard Technical Specifications are included on Drawing G-2. Contractor shall conform to the latest standards from CCUA.

1.2 SUMMARY

A. Section Includes:

1. Materials, equipment and incidentals required to install and test ductile iron pipe and fittings for yard piping as shown on Drawings and as specified.

    a. The word "pipe" is used to refer to pipe, fittings, or appurtenances unless otherwise noted.

2. Yard Piping: Includes piping and fittings extending outward, upward and downward into the ground from the outside face of all buildings. Unless otherwise noted, non-buried pipe outside a building, including in utility tunnels, shall be specified in Division 15.
3. Locate piping as shown on the Drawings. The Engineer reserves the right to make modifications in locations as may be found desirable to avoid interference between pipes or for other reasons.

B. Related Requirements:

1. Section 02060, “Soils and Aggregates for Earthwork” for granular fill
2. Section 02333, “Trenching and Backfilling”
3. Section 02370, “Erosion and Sedimentation Controls”
4. Section 15108, “Common Requirements for Process Valves.”

1.3 ACTION SUBMITTALS

A. Section 01300, “Submittals” for submittals requirements.

B. Shop Drawings and Product Data:

1. Including piping layouts, design calculations, warranty information, test reports, in accordance with Section 01300 “Submittals” and the referenced standards.
2. Design calculations in accordance with the “Pipe Wall Thickness Analysis” Paragraph under Part 2 Products, below, signed by a Professional Engineer registered in Florida.
3. Name of the pipe and fitting suppliers and a list of materials to be furnished.
4. Warranties per Section 01740, “Warranties and Bonds.”
5. Anticipated production and delivery schedule.

1.4 DELEGATED DESIGN SUBMITTALS

A. Delegated Design Submittals: Submit signed and sealed Shop Drawings with design calculations and assumptions.

B. Tabulated Laying Schedule:

1. Reference stations and invert elevations as shown on the Drawings

   a. Include fittings, bends, outlets, restrained joints, tees, special deflection bells, adapters, solid sleeves and specials.

2. Manufacturer's drawings and specifications providing complete details of all items. Show on the laying schedule:

   a. Pipe class,
   b. Class coding,
   c. Station limits
   d. Transition stations
   e. Various pipe classes
   f. Submit to engineer for approval before manufacture and shipment.

3. Full length pipe may be supplied from inventory provided that all specification requirements are met. Shop drawings shall include but not be limited to:

   a. Complete and dimensional working drawings of pipe layouts, including pipe stationing, invert elevation at changes in grade or horizontal alignment, all elements of curves and bends both in horizontal alignment and vertical position.

4. The grade of material; size, wall thickness, of the pipe and fittings and appurtenances, type and location of fittings, specials, and valves; and the type and limits of the lining, lining reinforcing and coating systems of the pipe and fittings. Methods and procedures recommended by the coating manufacturer to also be documented.

5. Joint details; methods and locations of supports and complete information concerning type, size and location of all welds.

    a. Shop welds (no field welding will be allowed) will be clearly differentiated
    b. welds will be clearly detailed with preparation procedures for all pipe and parent material comprising each weld.
    c. Critical welding procedures will be identified along with methods for controlling welding stresses and distortions.
    d. Locations and proposed joint details will also be clearly identified.

6. Method of manufacture of pipe; joint details, fittings and any specials.
7. All other pertinent information for all items to be furnished; product data to show compliance of all couplings, supports, fittings, coatings and related items.

1.5 INFORMATIONAL SUBMITTALS

A. Prior to Pipe Shipment:

1. Certified copies of mill tests confirming the type of materials used in the pipe, and shop testing of pipe to show compliance with the requirements of the applicable standards, along with a sworn affidavit of compliance that the pipe complies with the referenced standards.
2. Certified affidavit of compliance from manufacturer stating that pipe, fittings, gaskets, linings and exterior coatings for project have been manufactured and tested in accordance with AWWA and ASTM standards and requirements specified herein.

B. Copies of shop tests, including hydrostatic tests.

C. Source Quality Control Submittals: Document results of factory tests and inspections.

D. Field Quality Control Submittals: Document results of required tests and inspections.

E. Qualifications Statements:

1. Qualifications for manufacturer, applicator, installer, and licensed professional.
2. Manufacturer's approval of applicator and installer.

1.6 CLOSEOUT SUBMITTALS

A. Section 01701, “Project Closeout” for closeout procedures requirements.

B. Project Record Documents: Actual locations of pipe and fittings.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Section 01701, “Project Closeout” for maintenance materials requirements.

B. Spare Parts: Submit one set of manufacturer's recommended spare parts.

C. Tools: Furnish special wrenches, gages, and other devices required for Owner to maintain pipe and fittings.

1.8 QUALITY ASSURANCE

A. Perform Work according to standards set by Clay County Utility Authority.

B. Designed and supplied by a single manufacturer. Pipe and Fitting Connections: Pipe to be supplied by a single manufacturer and fittings supplied by multiple manufacturers**.**

C. Hydrostatically tested at point of manufacture to 500 psi for a duration of 10 seconds per AWWA C151. Testing may be performed prior to machining bell and spigot.

1. Test Failure: Defined as any leak or rupture of pipe wall.
2. Certified test results furnished in duplicate to Engineer 5 days prior to shipment.

D. Pipe and Fittings:

1. Inspected and tested at foundry as required by specified referenced standards.
2. Certified test results furnished in duplicate to Engineer 5 days prior to shipment.

E. Inspection of Pipe and Fittings After Delivery: By Engineer or representative of the Owner.

1. Pipe and fittings subject to rejection if failing to meet specified requirements even though pipe may have been accepted as satisfactory at the place of manufacture.
2. Pipe rejected after delivery (including defects from manufacturing or delivery/transport) to be marked for identification and immediately removed from the job.

F. Manufacturer's Representative:

1. Made available to the Owner and owner's representative during the manufacturing furnishing, transporting, and unloading of the pipe, as well as during installation and testing of the pipe to assist in insuring that the pipe is properly fabricated, transported, unloaded, stored in the field, joined and tested.
2. Manufacturer's responsibilities relate only to the proper care and treatment of the pipe during these procedures and not the techniques or procedures used during installation and testing.
3. Available at any time the Owner may request. A minimum of 2 working days (time on site) during the project when requested by the Owner.
4. The cost for the services of the factory representative, including expenses, to be considered incidental to the project and will not be paid separately.

G. Pipe and fittings marked in accordance with all applicable AWWA standards. Legibly and permanently mark pipe, fittings, specials and appurtenances to be consistent with the laying schedule and marking drawings (if required) with the following information:

1. Manufacturer
2. Date of manufacture.
3. Size, type, class, or wall thickness.
4. AWWA Standard(s) produced to.
5. Pipe identified with sequential numbering consistent with the laying schedule and marking drawings and each marked pipe will appear on the marking drawings in the identified location for installation.
6. Special fittings, bends, and appurtenances requiring specific orientation will be appropriately marked with the words "TOP" in the correct position and in a consistent location.

1.9 QUALIFICATIONS

A. The manufacturer shall meet the following criteria and furnish the necessary project information, which demonstrates the required experience:

1. Experience that includes successful fabrication (followed by installation, acceptance and service) to AWWA C151 standards of at least 50,000 lineal feet of the largest specified diameter or larger ductile iron pipe with similar linings/coatings within the past 5 years.
2. Experience to include the successful fabrication of at least 50 fittings in compliance with AWWA C110 or C153 of the largest specified diameter or larger with similar lining/coatings within the past 5 years.
3. Experience that includes the successful fabrication (followed by installation, acceptance and service) of at least 10,000 lineal feet of the largest specified diameter or larger push-on style, boltless restrained joint for ductile iron pipe within the last 5 years.

B. Pipe Origin: Manufactured in the United States. Ductile iron pipe to be supplied by a single manufacturer.

C. Fittings Origin: Manufactured in or outside the United States but supplied by one of the named pipe fitting manufacturers in Part 2 or Engineer approved equal. Written certification fittings are compatible with the supplied brand of pipe.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Section 01600, “Material and Equipment” for transporting, handling, storing, and protecting products requirements.

B. Delivery: Per AWWA C600 and referenced AWWA Standards for shipping, handling and storage procedures.

1. Deliver materials in manufacturer's packaging including application instructions.

2. Handle to prevent injury to the pipe, pipe linings and pipe coatings.

    a. Examine pipe and fittings as noted in Division 1. Damage to linings or coatings discovered during examination to be repaired to the satisfaction of the Engineer before proceeding with the work.

3. Transport pipe to job site on padded bunks or oak timbers and secured with steel banding or nylon tie down straps adequately protecting the pipe and coating.

    a. Handle pipe using slings, hooks, pipe tongs or other devices acceptable to the Engineer.
    b. Do not use non-cushioned ropes, chairs, wedges, cables or levers when handling finished pipe, fittings or couplings.
    c. Do not drop pipe or fittings.
    d. Do not skid pipe or fittings against each other.
    e. Do not mar pipe or fitting coatings.
    f. Utilize padded wooden pipe cradles, or chocks suitable for protecting coatings between and beneath finished pipes when pipes are placed upon rough surfaces.

C. Storage:

1. Do not store pipe on bare ground unless soft sand berms are used to support the pipe and is approved by the Engineer.
2. Keep materials safe from damage if stored. The interior of pipe, fittings and other appurtenances to be kept free from dirt, excessive corrosion or foreign matter.
3. Do not stack pipe higher than the limits recommended by manufacturer. Keep the bottom tier off the ground using timbers, rails, or concrete. Stacking to conform to manufacturer's recommendations and/or AWWA C600.
4. Store gaskets for mechanical and push-on joints in a cool location out of direct sunlight; not in contact with petroleum products. Use gaskets on a first-in, first-out basis.

D. Protection:

1. Lined and coated pipe: Suitably protected from exposure and heating from the sun. Follow procedures recommended by the coating and lining system manufacturer.

    a. Exposure will not be allowed except for short periods such as installation, assembly and repairs.

2. Metal tools or heavy objects are not permitted to come in contact unnecessarily with the finished coating.

    a. Workers may walk on coated pipe only when necessary, and only when wearing footwear with rubber or composition soles and heels sufficiently free of dirt and mud so coating remains undamaged.

3. Prevent damage to linings and coatings caused by handling, onsite storage, and exposure to low temperatures (due to embrittlement), high temperatures, or direct sunlight.

E. Inspection: Inspect for damage.

1.11 EXISTING CONDITIONS

A. Field Measurements: Verify field locations and sizes of connections to existing piping and equipment prior to submitting pipe lay drawings.

1. Indicate field measurements on Shop Drawings.

PART 2 - PRODUCTS

2.1 SYSTEMS

A. Ensure compatibility between joints of all items supplied.

2.2 DUCTILE IRON PIPE

A. Manufacturers: Provide pipe and fittings supplied by:

1. American Ductile Iron Pipe Co.
2. U.S. Pipe and Foundry.
3. Griffin Pipe Products.
4. Clow Water Systems Co.

B. Fitting Certification: From fitting manufacturer; written certification that fittings are compatible with supplied brand of pipe.

C. Ductile Iron Pipe: Per AWWA C151. Provide in standard lengths as much as possible.

D. Thickness Design: Per AWWA C150, except as follows:

1. Piping 12 inches and Smaller: Minimum Class 350.
2. Piping 14 inches to 20 inches: Minimum Class 350.
3. Piping Larger than 24 inches: Minimum Class 250.

E. Gravity Sewer Piping: Per ASTM A746.

F. Pipe Wall Thickness Analysis:

1. Tensile strength: 60,000 psi
2. Yield strength of 42,000 psi (per AWWA M-41).
3. Design and analyze external and internal pressures separately. Use the larger of the two to determine the net design thickness.
4. Design additional allowances for service allowance and casting tolerance per AWWA C150.

5. Pipe Classes: The minimum pipe class specified in the Thickness design paragraph above.

6. Design the net thickness for external loading based on the greater of the following conditions:

   a. Cover: 30 inches with HS-20 wheel loads per AASHTO Standard Specifications for Highway Bridges, with an impact factor of 1.5.
   b. Depth from existing ground level or future proposed grade, whichever is greater, to top of pipe as shown on the Drawings, with truck load.
   c. Soil Density: 100 lbs per cu ft.
   d. Laying Conditions: Per AWWA C150, Type 2.

7. Design the net thickness based upon the following internal pressure conditions:

   a. Design Pressure: 150 psi.
   b. Surge Allowance: 100 psi.
   c. Safety Factor: 2.
   d. Total Internal Pressure Design: 250 psi.
   e. E': 300 psi.

8. Furnish to the Engineer for approval, copies of design calculations showing pipe meets the specified requirements during shop drawing review in accordance with Section 01300, “Submittals.”

2.3 END TREATMENTS/JOINTS

1. Restrained Pipe and Fitting Joints: Push-on rubber gasket, locking ring type joints per the manufacturer' standard described below, except where flange joints are shown on the Drawings.

2. Gasket materials: Per Table 5-1 of AWWA M-41.

   a. Rubber-Gasket Joints: Per AWWA C111. EPDM (Ethylene Propylene).

3. Restraints for push-on joint pipe and fittings to be positive locking, utilizing restraints independent of the joint gasket.

   a. Joint Test Pressure 150 psig
   b. Joint Fabrication: Heavy section ductile iron casting.
   c. Bolts and Nuts: Low carbon steel conforming to ASTM A193, Grade B7.
   d. Restraint for mechanical joint pipe shall use retainer glands for restraining joint.

4. Provide restrained push on joints from one of the following manufacturers or an Engineer approved equivalent.

   a. US Pipe and Foundry Company: "TR Flex."
   b. American Cast Iron Pipe Company: "Lok-Ring” or "Flex Ring (positive locking style)."

c. Griffin Pipe Products Company: "Snap Lok."
d. Clow Water Systems Company: "Superlok."

5. All joints shall be restrained.
6. Restrained pipe joints incorporating cut out sections in the pipe wall must have a minimum wall thickness at the cut out corresponding with the minimum specified wall thickness for the rest of the pipe.
7. Pipe manufacturer proprietary mechanical joint restraint systems that utilize a wedge-style gripping system or a gland/ring positive restraint system will be considered acceptable on a case by case basis as determined by the Engineer.

    a. The optional mechanical joint restraint shall be incorporated in the design of a follower gland. The gland shall be manufactured of ductile iron per ASTM A536. Dimensions of the gland must be such that it can be used with the standard mechanical joint bell and tee-headed bolts, as specified with the pipe.
    b. Restraint Mechanism:

        1) Individually activated gripping surfaces maximizing restraint capability.
        2) Wedges designed to spread the bearing surfaces on the pipe.
        3) Torque limiting twist-off nuts sized same as T bolts for mechanical joints. When the nut is sheared off, standard hex nut shall remain.

    c. Restraint Device for Ductile Iron Pipe: EBAA Iron Megalug Series 1100, or approved equivalent.

        1) Working Pressure: 250 psi and a safety factor of 2:1.

8. Threaded Ductile Iron Flanges

    a. Fabricated per AWWA C115 and sealed during installation with a special high pressure, full face gasket per AWWA C111.

    b. At pipe manufacturer's option, the use of 250 lbs. pattern flanges, faced and drilled in accordance with ANSI B16.1 may be substituted in order to match valves or other equipment or to meet the required working pressure requirements.

    c. Flanges:

        1) Rated for the same pressure as the adjacent pipe in all cases.
        2) Compatible with 250 lbs. class and higher special class AWWA valves.
        3) Pre-drilled and faced after being screwed onto the pipe,
        4) True to 90 degrees of the pipe axis and shall be flush with the end of the pipe.

    d. Gaskets: Full face rubber, 1/8 inch thick SBR material.

        1) American Torseal Gasket or approved equal.
        2) Special material ring gaskets such as those by Garlock or equivalent may be required if pressures exceed 250 psi for ANSI rated and custom flanges.

e. Flanged joints:

1) Supplied with bolts and nuts on one end.
2) Bolt studs with a nut at each end, or studs with nuts on one end where the flange is tapped.
3) Quantity and size of bolts to comply with the corresponding flange standard.
4) Bolts and Nuts: Per ASTM A193, grade B7.

f. Blind flanges shall mate with regular flanges.
g. Filler flanges and beveled flange fillers shall be furnished faced and drilled complete with extra length bolts.

9. Couplings and Adapters Sleeve Type Couplings: Dresser Style 38, 138 or equivalent by:

a. Ford Meter Box Co.
b. Mueller Company.
c. JMC
d. Romac Industries, Inc.

2.4 FITTINGS

A. Pipe Fittings: Ductile iron per AWWA C110 or AWWA C153 as applicable. Fittings to have the same pressure rating, as a minimum, of the connecting pipe.

1. Piping 24 inch and smaller: minimum pressure rating of 350 psi.
2. Piping 30 inch and larger: 350 psi.

B. Closures: Made with mechanical joint ductile iron solid sleeves. Locate in straight runs of pipe at minimum cover outside the limits of restrained joint sections; subject to approval of the Engineer.

C. Flexible Coupling:

1. Double Ball with flanged ends. Flange outlets conform to the dimensional requirements of ANSI/AWWA C110/A21.10 (class 150) with the addition of an O-ring gasket. Provide minimum of 8 inches of expansion capacity.
2. Rated for a minimum 150 psi and pressure tested prior to shipment.
3. Expansion/Contraction travel preset at 50/50 setting.
4. Ductile Iron per ASTM A536.
5. Up to 15° deflection per ball.
6. Interior coating 15 mils fusion bonded epoxy, NSF61certified. Exterior 6 mils fusion bonded epoxy.
7. Sealing gaskets of EPDM.
8. Tested in accordance with either AWWA C600 or ASTM D2774.
9. EBAA IRON FLEX-TEND, double ball flexible expansion joint, or approved equal.

2.5 LININGS, COATINGS & CORROSION PROTECTION

A. Interior Lining:

1. Ductile iron pipe and fittings shall have the same type of lining.

   a. Certified Test Reports: Furnish to the Engineer.

2. Pipe and Fittings: Lined with ceramic-filled amine-cured epoxy, Protecto 401 by Induron or approved equal.

   a. Lining thickness: 40 mils minimum.
   b. Application: By coating manufacturer approved applicator per manufacturer's instructions, under controlled conditions at applicator's shop or the pipe manufacturer's plant.
   c. Applicator: Certified affidavit of compliance with manufacturer's instructions and specified requirements submitted prior to performing Work.

B. Exterior Coating

1. Buried pipe installed with bituminous coating per AWWA C151 and C110 respectively.

2.6 SOURCE QUALITY CONTROL

A. Section 01400, “Quality Control” for testing, inspection, and analysis requirements.

B. Certificate of Compliance: When fabricator is approved by authorities having jurisdiction, submit certificate of compliance indicating Work performed at fabricator's facility conforms to Contract Documents.

C. Specified shop tests are not required for Work performed by approved fabricator.

PART 3 - EXECUTION

3.1 PREPARATION

A. Handle piping and fittings per “Delivery, Storage, and Handling” Article in Part 1 of this specification.

B. Examine pipe and fittings before laying. Repair any damage to the pipe, lining or coatings per manufacturer's recommendations prior to installation.

C. The interior of all pipe, fittings and other appurtenances shall be kept free from dirt, excessive corrosion or foreign matter at all times.

3.2 INSTALLATION

A. Installed per requirements of AWWA C600, unless otherwise specified.

1. Provide firm, even bearing the length of the pipe. Dig bell holes at each joint. Tamp backfill materials on pipe sides to the springline per details on the Drawings.
2. Blocking is not permitted.
3. Replace with sound pipe or fitting, defective pipe or fitting discovered after having been laid.
4. When laid, pipe and fittings shall perform to lines and grades required. When laying is not in progress, close open ends of the pipe with watertight plug or other approved means.
5. Place sufficient backfill to prevent flotation. Joint deflection not to exceed manufacturer's recommendation.
6. Pipe Laid Underground: 3 feet cover unless Drawings show otherwise or otherwise specified.
7. Lay pipe such that the invert elevations shown on Drawings are not exceeded.
8. Provide fittings, in addition to those shown on the Drawings, where required, in crossing utilities which may be encountered upon opening the trench. Install solid sleeve closures at locations approved by the Engineer.
9. Pipe Interior: Maintain dry and broom clean throughout construction period.
10. Field Cutting Pipe: When required, smooth cut by machine perpendicular to pipe axis. Bevel cut pipe ends per manufacturer's recommendations for the spigot end.

    a. Repair coating removed from cut per manufacturer's recommendation and/or the coating and lining paragraphs of Part 2 above (whichever method is more stringent in the opinion of the Engineer).
    b. Lining shall be undamaged.
    c. Cutting of restrained joint pipe will not be allowed, unless approved at specific joints in conjunction with the use of restrainer glands by EBAA Iron or field adaptable restrained joints.
    d. Where Field Cuts are Permitted" Pipe supplied by the factory as "gauged full length".

        1) Gauged Full Length Pipe is Unavailable: Pipe to be field gauged at the location of the new spigot using a measuring tape, or other means approved by the manufacturer, to verify that the diameter is within tolerances permitted in Table 1 of AWWA C151.

B. Jointing Ductile-Iron Pipe

1. Push-On Joints: Install per manufacturer's instructions, AWWA C600 and Appendix B of AWWA C111. If there is conflict, manufacturer's instructions take precedence.

    a. Lay pipe with bell ends looking ahead.
    b. Insert rubber gasket in the groove of bell end of pipe.
    c. Clean and lubricate joint surfaces
    d. Align the plain end of the pipe with the bell of the pipe to which it is to be joined and pushed home.
    e. Metal feeler shall be used to make certain that the rubber gasket is properly seated.

2. Mechanical Joints: Assembled per manufacturer's instructions, AWWA C600 and Appendix A of AWWA C111. If there is conflict, manufacturer's instructions take precedence.

    a. Lay pipe with bell ends looking ahead.
    b. Clean and lubricate joint surfaces and rubber gasket.
    c. Tighten bolts to the specified torques.
    d. Extension wrenches or pipe over handle of ordinary ratchet wrench are not allowed to secure greater leverage.
    e. Encapsulate bolts and nuts using wax sealing tape per AWWA Standard C217.
    f. Install polyethylene encasement as specified.

3. Bolts in Mechanical or Restrained Joints: Tightened alternately and evenly.
4. Restraint for Mechanical Joint Pipe:

    a. Retainer glands for restraining joint.
    b. Restrained mechanical joints to be suitable for the specified test pressure.
    c. Installed according to pipe manufacturer's instructions.

5. Flanged Joints: Assembled per manufacturer's instructions and Appendix C of AWWA C111. If there is conflict, manufacturer's instructions take precedence.

    a. Ensure there is no restraint on opposite ends of pipe or fitting, which would prevent uniform gasket compression, cause unnecessary stress, bending or torsional strains, or distortion of flanges or flanged fittings.
    b. Adjoining push-on joints are not to be assembled until flanged joints have been tightened.
    c. Tighten flange bolts for uniform gasket compression and sealing.

        1) Leave flange bolts with approximately 1/2 inch projection beyond the nut face after tightening.

    d. Encapsulate bolts and nuts using wax sealing tape per AWWA Standard C217,

6. Sleeve Couplings: Only installed for closure or as shown on the Drawings. Do not assemble couplings until adjoining joints have been assembled.

    a. Encapsulate bolts and nuts using wax sealing tape per AWWA Standard C217,
    b. Install protective wrap recommended by manufacturer or as required herein. Maintain insulating properties of insulating and dielectric couplings.

7. Blowoffs, outlets, valves, fittings and other appurtenances to be set and jointed as indicated on the Drawings and per manufacturer's instructions.

C. Polyethylene Encasement

1. Install polyethylene encasement around ductile iron pipe to limits shown on the Drawings and in accordance with pipe manufacturer's recommendations.

   a. Installed per ANSI/ AWWA C105/A21.5, Method 'A' in accordance with section 2.15 of DIPRA's Installation Guide for Ductile Iron Pipe.

2. Use a fabric type or padded sling when handling pipe to prevent damage to the encasement.
3. Seal seams with approved 2-inch wide plastic adhesive tape.
4. Repair encasement rips or tears with tape and film per ANSI/AWWA C105/A21.5.
5. When backfilling does not damage the polyethylene encasement.

3.3 CONNECTIONS TO STRUCTURES

A. Where pipe 3 inch diameter or larger horizontally passes from concrete to earth, install two flexible joints spaced 2 to 4 feet apart depending on pipe size within 2 feet of exterior wall face, whether shown on Drawings or not.

B. Utilize wall sleeves for pipes passing through walls designed to pass through the wall via restrained piping unless otherwise specified.

C. Encase piping underneath structures in reinforced concrete as shown in the Drawings.

3.4 FIELD QUALITY CONTROL

A. Section 01400, “Quality Control” for inspecting and testing requirements.

B. Replace with sound pipe or fitting, defective pipe or fitting discovered after having been laid.

C. Thoroughly clean pipe and fittings before laying. Keep clean until used in the Work.

D. Pipe and fittings, when installed or laid, shall conform to the lines and grades required.

E. Filling and Testing

1. After Installation: Test pipe shall for compliance as specified.

   a. Furnish necessary equipment and labor for hydrostatic pressure testing the pipelines.
   b. Submit detailed test procedures and methods per AWWA C600 for Engineer's review and approval at least 10 days prior to testing

2. Pressure Pipelines: Shall be pressure tested as specified on the Drawings.
3. Gravity Pipelines: Subjected to hydrostatic pressure test as specified in AWWA C600.
4. Valves and Valve Boxes: Properly located, installed, and operable prior to testing.

5. Provide bulkheads with a sufficient number of outlets for filling and draining the line and for venting air.

6. Hydrostatic Pressure Tests: As specified on the Drawings.

    a. Furnish gauges, meters, pressure pumps and other equipment required to slowly fill the line and perform the required tests.

7. Owner will supply a maximum quantity of water equal to 110 percent of the volume of the pipelines for testing. Additional water required will be provided at standard billing rates for the volume required.

    a. Slowly fill the line with water. Maintain the specified test pressure in the pipe for entire test period. Provide accurate means for measuring the quantity of makeup water required to maintain this pressure.

8. Pressure Test Duration: 2 hours.

    a. Repair leaks evident at the surface regardless of total leakage as shown by test.
    b. Repair lines failing to meet tests. Retest as necessary until test requirements are met.
    c. Defective materials, pipes, valves and accessories shall be removed and replaced.

3.5 CLEANING

A. Section 01701, “Project Closeout” for cleaning requirements.

B. At conclusion of the Work, thoroughly clean pipes by flushing with water or other means to remove dirt, stones, pieces of wood, or other material which may have entered during the construction period. Remove all debris from the pipeline. The lowest segment outlet shall be flushed last to assure debris removal.

C. After pipes have been cleaned and if groundwater level is above the pipes or water in the pipe trench is above the pipe following a heavy rain, the Engineer will examine the pipe for leaks.

    1. Repair and replace defective pipes, fittings or joints that are discovered.

END OF SECTION

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SECTION 02563

POLYVINYL CHLORIDE PIPE

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.

B. CCUA Standard Technical Specifications are included in Drawing G-2. Contractor shall conform to the latest standards from CCUA.

1.2 SUMMARY

A. Polyvinyl chloride (PVC) non-potable water, drains, in indicated locations, and odor control pipe and fittings, complete as shown on Drawings and as specified.

1. Pipe or Piping: Refers to all pipe, fittings, material and appurtenances required to construct PVC non-potable water and drain pipe complete, in place.
2. Equipment and materials specified are intended to be standard types used in transporting non-potable water, drain, and odor control pipes.

B. Related Requirements:

1. Section 02060 “Soils and Aggregates for Earthwork” for granular fill.
2. Section 02333 “Trenching and Backfilling.”
3. Section 15108 “Common Requirements for Process Valves”

1.3 ACTION SUBMITTALS

A. Section 01300, “Submittals” for submittals requirements.

B. Product Data: Name of pipe and fitting manufacturers, materials list furnished by each manufacturer and catalog information for each product.

C. Shop Drawings:

1. Piping layouts and schedules including dimensioning, fittings, types and locations of valves and appurtenances, and joint details.
2. Methods and location of supports, anchorage, gasket material, grade of material and all other pertinent technical information.
3. Indicate restrained joint locations.

1.4 INFORMATIONAL SUBMITTALS

A. Manufacturer’s Certificate: Submit certificates of compliance that the products meet or exceed specified requirements.

B. Manufacturer's Certificate: Certify the following products meet or exceed specified sustainable design requirements.

1.5 CLOSEOUT SUBMITTALS

A. Section 01720 “Record Documents” for submittals requirements.

B. Project Record Documents: Document actual locations of pipe and appurtenances.

1.6 QUALITY ASSURANCE

A. Perform Work according to Clay County Utility Authority standards.

B. PVC pipe shall be from a single manufacturer. Supplier is responsible for provisions of test requirements specified in ASTM D 3034 and NSF Standard No. 14 as applicable.

C. PVC pipe installed under this Contract may be inspected at the plant for compliance with this Section by an independent testing laboratory provided by the Owner.

1. Manufacturer's cooperation is required in these inspections.
2. The cost of plant inspection of pipe approved for this Contract, plus the cost of inspection of a reasonable amount of disapproved pipe, will be borne by the Owner.

D. Inspections of pipe may also be made by the Engineer or other representatives of the Owner after delivery.

1. Pipe is subject to rejection at any time due to failure to meet any of the requirements specified, even though sample pipes may have been accepted as satisfactory at the place of manufacture.
2. Mark rejected pipe for identification and removed from job at once.

1.7 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum three years' experience.

B. Installer: Company specializing in performing Work of this Section with minimum three years' experience and approved by manufacturer.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Section 01600, “Materials and Equipment” for transporting, handling, storing, and protecting products requirements.

B. Delivery:

1. Bundled or package items to provide adequate protection of ends during transportation to site. Pipe damaged in shipment will be replaced as directed by the Engineer.
2. Where applicable, deliver materials in manufacturer's packaging including application instructions.

C. Inspection: Accept materials on Site in manufacturer’s original packaging and inspect for damage.

1. Any gouges or scratches that extend 10 percent or more into the pipe wall shall be cause for rejection of that pipe.
2. The undamaged portion may cut off and used.
3. Clearly mark rejected materials as rejected. Segregate and remove from the site.

D. Storage: Per manufacturer's instructions, referenced standards and as specified

1. Adequately support stored pipe from below, at 3 feet maximum intervals to prevent deformation. Pipe stored in stacks no higher than that given in the following table or the manufacturer’s instructions whichever is more restrictive:

    a. Pipe Diameter 8 inches or Less: Maximum Number of Rows Stacked: 5
    b. Pipe Diameter 12 to 21: Maximum Number of Rows Stacked: 4
    c. Pipe Diameter 24 to 30: Maximum Number of Rows Stacked: 3
    d. Pipe Diameter 33 to 48: Maximum Number of Rows Stacked: 2

2. Do not store plastic manholes, pipe, and fittings in direct sunlight.
3. Store in a manner keeping materials at ambient outdoor temperatures.
4. No pipe or fitting is to be exposed to sunlight for more than 60 days.
5. Temporary shading as required to meet this requirement shall be provided.
6. Simple covering of the pipe and fittings which allows temperature buildup, or direct or indirect sunlight, will not be permitted.

E. Protection:

1. Pipe and fittings showing cracks, or which have received a blow that may have caused an incident fracture, even though no such fracture can be seen, are to be marked as rejected and removed at once from the work.
2. Thoroughly clean pipe and fittings before installation. Keep interior clean until testing
3. Store gaskets for mechanical and push-on joints in cool and dry location, out of direct sunlight, and not in contact with petroleum products.
4. Provide additional protection according to manufacturer instructions

1.9 EXISTING CONDITIONS

A. Field Measurements:

1. Verify field locations and sizes of connections to existing piping and equipment prior to submitting pipe lay drawings.
2. Document field measurements on Shop Drawings.

1.10 WARRANTY

A. Section 01740 “Warranties and Bonds” for warranty requirements.

B. Furnish two-year manufacturer's warranty for PVC pipe and fittings.

PART 2 - PRODUCTS

2.1 SYSTEMS

A. Contractor is responsible for compatibility between pipe materials, fittings and appurtenances.

2.2 POLYVINYL CHLORIDE (PVC) PIPE AND FITTINGS

A. Polyvinyl Chloride (PVC) Pipe:

1. PVC Pressure Pipe: 4 through 60 inch per AWWA C900 requirements.
2. Piping 12 inch and Less: Class 235 with a Dimension Ratio of 18.
3. Piping Materials: PVC compounds Class 12454 as defined in ASTM D 1784.

a. Mark pipe lengths with manufacturer's name or trademark, size, material code, pressure class, AWWA designation number and seal of test agency that verified pipe material for potable-water service.

B. Polyvinyl Chloride (PVC) Fitting:

1. Bell and Spigot Push-on Joints.

a. Bell: Consists of integral wall section with solid cross-section elastomeric gasket securely locked in place to prevent displacement during assembly.
b. Installation of elastomeric gasketed joints and joint performance: Per ASTM F477, ASTM D3139. Joint lubricants as recommended by manufacturer.

2. Fittings and Accessories for Waterlines and Sewers: Bell and/or spigot configurations compatible with the pipe.

3. Fittings for Water Mains: Cast or ductile iron per AWWA C110 for mechanical joints. Furnish Adaptors, fittings and transition gaskets necessary to connect cast or ductile iron fittings to PVC.
4. PVC Fittings: Per AWWA C900. Pressure rating the same as or higher than the pipeline.
5. Force Mains: Green in color.
6. Water Lines: Blue in color.
7. Reclaimed Water: Purple in color.
8. Restraining glands shall be installed on all joints and fittings. Restraining glands for PVC pipe shall conform to AWWA C111 and be:

    a. 6500 Bell Restraint Harness by EBAA Iron Sales Inc.,
    b. Uni-Flange Series 1300, 1350, or 1390 by Ford Meter Box Company, Inc.
    c. 1000 or 1100 Series by Star Pipe Products.
    d. PV-Lok, PVM & PVP Series by Sigma Corporation.
    e. Series 5606 PF/MJ or 6506 by Ebba Iron.
    f. Or approved equal.

2.3 ACCESSORIES

A. Provide Plastic ribbon tape for placement above direct buried utility in accordance with Section 15075, “Identification for Process Piping.”

2.4 SOURCE QUALITY CONTROL

A. Section 01400, “Quality Control” for testing, inspection, and analysis requirements.

B. Owner Witnessing: Allow witnessing of factory inspections and test at manufacturer's test facility.

1. Notify Owner at least seven days before inspections and tests are scheduled.

C. Certificate of Compliance: When fabricator is approved by authorities having jurisdiction, submit certificate of compliance indicating Work performed at fabricator's facility conforms to Contract Documents.

D. Specified shop tests are not required for Work performed by approved fabricator.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that trench cut is ready to receive Work.

B. Verify that excavations, dimensions, and elevations are as indicated on Drawings.

C. The centerline of the pipe shall not deviate from a straight line drawn between the centers of the openings at the ends of the pipe by more than 1/6 inch per foot of length.

3.2 PREPARATION

A. Pipe and Fittings: Thoroughly cleaned before installation and kept clean until they are used in the Work.

1. When laid, must conform to the lines and grades required.

3.3 INSTALLATION

A. As soon as excavation is complete to normal grade of bottom of trench:

1. Place bedding, compact and grade to provide firm, uniform and continuous support for the pipe.
2. Excavate bell holes so only the barrel of the pipe bears upon the bedding.
3. Lay pipe accurately to lines and grades indicated on Drawings.
4. Blocking under the pipe is not permitted.

B. Bedding Placement:

1. Place Bedding evenly on each side of pipe to mid-diameter.

   a. Use hand tools to force the bedding under the haunches of the pipe and into the bell holes to give firm continuous support for the pipe.

2. Place bedding to 12 inches above top of pipe.
3. Place the initial 36 inch of backfill above bedding in 12 inches layers and carefully compacted.
4. Compaction: Generally done evenly on each side of pipe.

   a. Compaction Equipment: Do not operate directly over pipe until sufficient backfill has been placed ensuring such compaction equipment will not damage the pipe.
   b. Equipment used in compacting the initial 36 inch of backfill shall be approved by the pipe manufacturer's representative prior to use.

C. Piping:

1. Install PVC pipe and fittings per requirements of manufacturer, ASTM D2321 and AWWA C605 or as otherwise specified.
2. Sound and clean before installation.
3. When installation is not in progress, including lunchtime, open ends of pipe must be closed by watertight plug or other approved means.
4. Preserve proper alignment during installation.
5. Joint Deflection: Not to exceed manufacturer recommendations.

6. Fittings: Provide in addition to those shown on Drawings, if required, in crossing utilities that may be encountered upon opening the trench.

D. Defective Pipe Discovered After Installation: Remove and replace with sound pipe in a satisfactory manner.

E. When Cutting Pipe: By machine, leaving a smooth cut at right angles to the pipe axis.

1. Cut Ends of Pipe Used with Bell: Bevel to conform to manufactured spigot end and a reference mark made at the same distance from the pipe end as measured from a factory marked end from the same manufacturer.
2. Engineer may examine each bell and spigot end to determine whether any preformed joint has been damaged prior to installation.

    a. Reject pipe having defective joint surfaces. Marked as defective and immediately remove from job site.

F. Pipe lengths must have the assembly mark aligned with the pipe previously laid and held securely until enough backfill has been placed to hold the pipe in place. Joints must not be subjected to any applied longitudinal or lateral stresses other than bedding compaction as specified.

G. Before Joint are Made: Inspect pipe to assure a close joint with the next adjoining pipe has been maintained and that inverts are matched and conform to the required grade. The pipe shall not be driven down to grade by striking it.

H. Precautions shall be taken to prevent flotation of the pipe in the trench.

I. Moveable Trench Bracing: Trench boxes, moveable sheeting, shoring or plates to support the sides of the trench.

1. Prevent movement of pipe, and disturbance of pipe bedding and backfill, when placing and moving the boxes or supporting bracing.
2. Do not allow Trench boxes, moveable sheeting, shoring or plates to extend below the top of the pipe.

J. Jointing

1. Restrained joints installed at all joints and fitting.

2. Jointing PVC Pipe (Push-on type):

    a. Installed in strict accordance with the manufacturer's instructions.
    b. Lay pipe with bell ends looking ahead.
    c. Be sure joint surfaces clean.
    d. Insert a rubber gasket in the groove of the bell end of the pipe.
    e. Lubricate with approved lubricant per manufacturer's recommendations.
    f. Insert the plain end of pipe to be installed into the bell of the pipe to which it is to be joined, and when in alignment pushed home with a come-along or by other means.
    g. Check that the reference mark on the spigot end is flush with the end of the bell.

3. Jointing Mechanical Joint Fittings:

a. PVC Sewer Pipe and Fittings: Jointed per recommendations of latest ASTM standards and manufacturer detailed instructions.
b. Install Suitable PVC to cast iron adaptors prior to installing fittings.
c. Cut PVC beveled spigot flush prior to insertion in mechanical joint pipe.
d. Field Assembled Joints: Thoroughly clean joint surfaces and rubber gaskets with soapy water before tightening bolts to specified torques.

1) Under no circumstances are extension wrenches or pipe over handle of ordinary ratchet wrench to be used to secure greater leverage.

K. Pipe Identification: Install Plastic ribbon tape above direct buried utility in accordance with Section 15075, "Identification for Process Piping."

3.4 TOLERANCES

A. Section 01400, "Quality Control" for tolerances requirements.

3.5 FIELD QUALITY CONTROL

A. Section 01400, "Quality Control" for inspecting and testing requirements.

B. After Installation: Test pipe for compliance as specified below. Furnish necessary equipment and labor for hydrostatic pressure test on pipelines.

C. Submit detailed test procedures and method for Engineer's review. In general, conduct testing per AWWA C605.

1. Hydrostatic pressure test methods and procedures must be approved by the Engineer.
2. Submit testing plan to Engineer 10 days before testing.

D. Hydrostatic Pressure Tests: As specified on the Drawings.
1. Provide suitable restrained bulkheads as required to complete the hydrostatic testing specified.

E. Contractor will make any taps and furnish necessary caps, plugs etc., as required in conjunction with performing the testing.

F. Gravity Pipelines: Hydrostatic pressure test as specified in AWWA C605.

G. Valves and Valve Boxes: Properly located and installed and operable prior to testing.

1. Provide bulkheads with sufficient number of outlets for filling and draining the line and for venting air.

H. Hydrostatic Pressure Tests: Per Section 7.3 of AWWA C605.

1. Furnish gauges, meters, pressure pumps and other equipment needed to fill the line slowly and perform the required hydrostatic pressure tests.

I. Owner will provide a source of supply from the existing treated water distribution system for Contractor's use in filling the lines. Maintain an air break at all times between the Owner's distribution system and the Contractor's equipment to prevent cross-connection.

1. Slowly fill lines with water and maintain specified test pressure in the pipe for the entire test period by means of a pump furnished by the Contractor.
2. Provide accurate means for measuring makeup water volume required to maintain pressure.
3. Pressure Test Duration: Not less than 2 hours.

    a. Leaks evident at the surface shall be repaired and leakage eliminated regardless of the total leakage as shown by test.
    b. Lines Failing to Meet Tests: Repaired and retested as necessary until test requirements are met.
    c. Remove and replace defective materials, pipes, valves and accessories.

3.6 CLEANING

A. Before Being Placed in Service and Hydrostatic Testing: Clean pipe.

1. Cleaning of drain and non-potable water pipe consist of removal and flushing of dirt and debris from the force main prior to placing in service. Disinfection is not required.

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SECTION 03015

MODIFICATIONS TO EXISTING CONCRETE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes:

1. Cutting, removing, or modifying parts of existing concrete structures or appurtenances.
2. Addressing existing steel reinforcing bars encountered.
3. Bonding new concrete or grout to existing concrete.

B. Related Requirements:

1. Section 01881, “Tightness Testing Performance Requirements” for tightness testing of liquid retaining structures.
2. Section 02222, “Selective Demolition” for selective demolition and modification procedures.
3. Section 03100, “Concrete Forming and Accessories” for formwork and related repair work.
4. Section 03200, “Concrete Reinforcing” for reinforcing and related repair work.
5. Section 03300, “Cast-In-Place Concrete” for concrete materials, and related work.
6. Section 03150, “Concrete Joints and Accessories” for related work.
7. Section 03350, “Concrete Finishing” for related work.
8. Section 03390, “Concrete Curing” for related work.
9. Section 03600, “Grouting” for grout and related accessories.
10. Section 05051, “Post-Installed Anchors” for anchors and related accessories.
11. Section 05502, “Miscellaneous Metals” for various metals and related fabrications.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Submit manufacturer's technical literature and installation instructions that include:

a. Current printed recommendations and product data sheets for products including performance criteria, product life, working time after mixing, surface preparation and application requirements and procedures, curing, volatile organic compound data, and safety requirements.
b. Storage requirements including temperature, humidity, and ventilation.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: Documentation of the qualifications for Contractor qualifications, Manufacturer's qualifications, and Contractor's supervisor as specified in Paragraph 1.8.

B. Material Certificates: For each material provided.

1.5 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Have a minimum of ten years' experience within last 10 years in manufacture and use of specified products and have an ongoing program of training, certifying, and technically supporting Contractor's personnel.

B. Contractor Qualifications: Complete a program of instruction in application of approved manufacturer's material and provide certification from manufacturer attesting to their training and status as an approved applicator.

C. Contractor's Supervisor: Have attended a training program sponsored by manufacturer supplying materials approved for this project.

D. Manufacturer's Representative: A representative of product manufacturer who will visit the site for first three days of installation to give instructions to installation crew. Make periodic site visits to ensure products being installed are in accordance with published instructions.

E. Do not shift, cut, remove, or otherwise altered existing structure or concrete until authorization is given by the Engineer.

F. When removing materials from or making openings in existing structures, take precautions and erect necessary barriers, shoring and bracing, and other protective devices. Prevent damage to structures beyond limits necessary for new work, protect personnel, control dust, and to prevent damage to structures or contents by falling or flying debris.

G. Unless otherwise permitted, shown, or specified, cut existing concrete by line drilling.

H. Construction Tolerances: Comply with requirements specified elsewhere in Division 03, except as modified herein, and elsewhere in Contract Documents.

I. Make locations and phases of the work available for access by the Engineer or other personnel designated by the Engineer. Provide ventilation and safe access to the work.

J. Be solely responsible for workmanship and quality of modification work. Inspections by the manufacturer, the Engineer, or others do not limit Contractor's responsibility for work quality.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Delivery: Deliver materials in original, new and unopened packages and containers clearly labeled with the following information:

1. Manufacturer's name.
2. Name or title of material, and other product identification.
3. Manufacturer's stock number and batch number.
4. Date of manufacture.
5. Instructions.
6. Expiration date.

B. Storage: Store products in accordance with manufacturers' published recommendations and the following supplementary requirements:

1. Store only approved materials on site and in locations as directed.
2. Keep area clean and accessible.
3. Comply with health and fire regulations including those of the Occupational Safety and Health Administration (OSHA).

C. Handling: Handle products carefully and in accordance with manufacturers' published recommendations and the following supplementary requirements:

1. Prevent inclusion of foreign materials.
2. Do not open containers or mix components until necessary preparatory work has been completed and application work will start immediately.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General: Comply with this Section and applicable state and local regulations.

B. Epoxy Bonding Agent:

1. Product: Two-component, solvent-free, asbestos-free moisture insensitive epoxy resin material used to bind plastic concrete to hardened concrete and complying with requirements of ASTM C 881, Type V, Grade 2, Class C.

C. Epoxy Paste Adhesive:

1. Product: Two-component, solvent-free, moisture insensitive epoxy resin material used as an adhesive for mating surfaces where the glue line is 1/8 inch or less and to bond fresh, plastic concrete to clean, sound hardened concrete and complying with requirements of ASTM C 881, Type IV, Grade 3, Class C.

D. Repair Mortar (Polymer-Modified Portland Cement Mortar):

1. Horizontal Surfaces:

a. Product: Two-component polymer-modified, portland cement based mortar used to repair horizontal surfaces with a migrating corrosion inhibitor and having a minimum compressive strength of 7,000 psi at 28 days tested in accordance with ASTM C 881 or ASTM C 109.

2. Vertical and Overhead Surfaces:

a. Product: Two-component polymer-modified, portland cement based, fast setting, non-sag mortar used to repair vertical and overhead surfaces with a migrating corrosion inhibitor and having a minimum compressive strength of 5,000 psi at 28 days tested in accordance with ASTM C 881 or ASTM C 109.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for maximum moisture content, installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION - GENERAL

A. Cut, remove, or otherwise modify parts of existing structures or appurtenances as indicated, specified, or as necessary to complete the work. Finishes, joints, reinforcements, sealants, and similar materials are specified in their respective Sections. Install work complying with requirements of this Section and as indicated.

B. Locations, details, and limits of modifications are indicated on Drawings. Comply with requirements of this Section and as indicated on Drawings.

C. Examine areas and conditions under which modification work is to be installed and notify Engineer in writing of conditions detrimental to proper and timely completion of work. Do not

proceed with work until unsatisfactory conditions have been corrected in a manner acceptable to Engineer.

D. Store, mix, apply, and cure materials in strict compliance with manufacturer's instructions.

E. Where concrete is to be modified near an expansion joint or control joint, preserve isolation between components on either side of the joint.

F. When drilling holes for dowels and bolts, stop drilling if reinforcing is encountered. Do not cut reinforcing without prior approval by the Engineer. Relocate hole to avoid reinforcing as approved by the Engineer.

1. Identify reinforcing locations prior to drilling using reinforcing bar locators so that drill hole locations may be adjusted to avoid reinforcing interference.

G. Saw-cut edges for modification areas vertically and horizontally straight. Make intersecting cuts perpendicular to each other.

H. Stop saw cutting if reinforcing is encountered. Do not cut reinforcing without prior approval by the Engineer. Identify reinforcing locations within 1 foot of saw cut locations in any direction prior to saw cutting using reinforcing bar locators.

I. Clean concrete surfaces of efflorescence, deteriorated concrete, dirt, laitance, and existing repair materials such as liners, adhesives, and epoxies. Remove foreign matter and deleterious films by sandblasting, oil-free air-blasting, scarifying, or other mechanical means to sound original concrete.

J. Consolidate modification materials, completely filling portions of the area to be filled.

K. Bring finished surfaces into alignment with adjacent existing surfaces to provide a uniform, flush, and even surface. Match repair surfaces to adjacent existing surfaces in texture including any coatings or surface treatments that had been provided for the existing structure.

L. Repair or replace concrete indicated or specified to be left in place that is damaged because of the work by approved means without additional compensation.

3.3 CONCRETE REMOVAL

A. Concrete designated to be removed to specific limits indicated or directed by the Engineer, perform saw cutting 1 inch deep at limits of removal followed by line drilling and chipping, sandblasting, or oil-free airblasting, as appropriate in the areas where concrete is to be taken out. Remove concrete such that surrounding concrete and existing reinforcing to be left in place and existing in place equipment are not damaged.

1. Perform full thickness saw-cutting at limits of concrete to be removed only if indicated, herein specified, or after obtaining written approval from the Engineer.

B. Where existing reinforcing is exposed due to saw cutting or line drilling and no new material is to be placed on cut surface, apply a 1/4 inch thick surface treatment of epoxy paste to entire cut surface.

C. Where joint between new concrete or grout and existing concrete will be exposed in finished work, remove concrete edge by making a 1 inch deep saw cut on each exposed surface of existing concrete or as indicated.

3.4 CONNECTION SURFACE PREPARATION

A. Concrete areas requiring patching, repairs, or modifications, prepare connection surfaces as specified, as indicated, or as directed by the Engineer.

B. Remove loose and deteriorated materials, efflorescence, existing repair materials, dirt, oil, grease, and other bond inhibiting materials from concrete surface by dry mechanical means such as sandblasting, chipping, wire brushing, or other mechanical means as approved by the Engineer.

1. Uniformly roughen concrete surface to approximately 1/4 inch amplitude with pointed chipping tools. Thoroughly clean surface of loose or weakened material by sandblasting or air-blasting.
2. Irregular voids or surface stones need not be removed if they are sound, free of laitance, and firmly embedded into parent concrete.

C. If reinforcing steel is exposed, mechanically clean to remove loose material, contaminants, and rust as approved by the Engineer. If half of reinforcing steel diameter is exposed, chip out behind the steel. Chip distance behind the steel to a minimum of 1 inch. Do not damage reinforcing to be incorporated in new concrete or repair mortar during removal operation.

D. Clean reinforcing from existing removed or deteriorated concrete that is shown to be incorporated in new concrete or repair mortar by mechanical means to remove loose material and products of corrosion before proceeding. Cut, bend, or lap to new reinforcing as indicated and provide with 1 inch minimum clear cover.

E. Use following specific concrete surface preparation Methods where indicated, specified, or as directed by the Engineer:

1. Method A:

a. Roughen and clean existing concrete surface at connection.
b. Thoroughly saturate surfaces with water; prevent standing water during application.
c. Scrub repair mortar into substrate filling concrete pores and voids.
d. While scrub coat is still plastic, force repair material against surface. Use epoxy bonding agent if area is too large.
e. Place new repair mortar as detailed.

2. Method B:

    a. Roughen and clean existing concrete surface at connection.
    b. Apply epoxy bonding agent at connection surfaces.
    c. Place new concrete or grout mixture to limits indicated within time constraints recommended by manufacturer to ensure bond.

3. Method C:

    a. Use adhesive anchoring system, as specified in Section 05051, “Post-Installed Anchors”, for installation of reinforcing steel dowels into existing concrete where indicated.
    b. Perform installation complying strictly with manufacturer's recommendations, including drill bit diameter, surface preparation, injection, and installation of dowels.
    c. Drill concrete to embedded deformed bars to indicated depths.
    d. Use oil-free compressed air to blast out loose particles and dust from drilled holes. Clean dowels to be free of dirt, oil, grease, ice, or other deleterious material that would reduce bond.
    e. Concrete in existing structures is considered to have a strength of 3,000 psi.

4. Method D:

    a. Combination of Method B & Method C.

3.5 GROUTING

A. Grout: As specified in Section 03600, “Grouting.”

3.6 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect completed installations.

1. Perform inspection with Contractor, material installer, and the Engineer present. Give minimum of 72 hours’ notice prior to time of inspection.
2. Repair modifications not in conformance with Contract Documents in accordance with manufacturer's instructions at no additional cost to Owner.
3. At completion of non-conforming repairs, Contractor, material installer, and the Engineer shall reinspect the repaired problem areas.
4. Prepare inspection reports, identifying acceptable work, type and locations of unacceptable work, and actions taken to correct unacceptable work.
5. Complete field quality control work without additional compensation.

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SECTION 03100

CONCRETE FORMING AND ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Formwork for cast-in-place concrete.
2. Shoring, bracing, and anchorage.
3. Form accessories.
4. Form stripping.

B. Related Requirements:

1. Section 03200 – "Concrete Reinforcing": Reinforcing steel and required supports for cast-in-place concrete.
2. Section 03300 – "Cast-in-Place Concrete": Cast-in-place concrete.
3. Section 03350 – "Concrete Finishing."
4. Section 05051 "Post-Installed Anchors and Reinforcing Bars" for testing of drilled in injection adhesive anchor system.
5. Section 05502 – "Metal Fabrications": Product requirements for metal fabrications for placement by this Section.
6. Various Sections in Divisions 16: Product requirements for electrical items for placement by this Section.
7. Section 02260 – "Excavation Support and Protection": Execution requirements for shoring and underpinning required by this Section.

1.3 COORDINATION

A. Coordinate Work of this Section with other Sections of Work in forming and placing openings, slots, reglets, recesses, sleeves, bolts, anchors, other inserts, and components of other Work.

1.4 ACTION SUBMITTALS

A. Section 01300 – "Submittals": Requirements for submittals.

B. Product Data: Submit manufacturer information on void form materials and installation requirements.

C. Shop Drawings:

1. Indicate:

a. Formwork, shoring, and reshoring.
b. Pertinent dimensions, openings, details of construction, types of connections, materials, joint arrangement and details, ties and shores, location of framing, studding and bracing, and temporary supports.
c. Means of leakage prevention for concrete exposed to view in finished construction.
d. Notes to formwork erector showing size and location of conduits and piping embedded in concrete according to ACI 318 or ACI 350.
e. Procedure and schedule for removal of shores and installation and removal of reshores.
f. Location and sequence of concrete placement.
g. Form release agent.
h. Form ties.
i. Bond breakers.

D. Review of submittals will be for appearance, performance, and strength of completed structure only. Approval by the Engineer will not relieve Contractor of responsibility for the strength, safety, or correctness of methods used, the adequacy of equipment, or from carrying out the work as shown on Contract Documents.

1.5 INFORMATIONAL SUBMITTALS

A. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

B. Delegated Design Submittals:

1. Submit signed and sealed Shop Drawings with design calculations and assumptions for formwork and shoring.
2. Indicate loads transferred to structure during process of concreting, shoring, and reshoring.
3. Include signed and sealed structural calculations to support design for project records. Calculations will not be reviewed.
4. Submit completed PE Certification Form for design of formwork in accordance with Section 01300, “Submittals.” Complete PE Certification Form and stamp by a professional engineer registered in the State where project work site exists.

C. Field Quality-Control Submittals: Indicate results of Contractor-furnished tests and inspections.

D. Qualifications Statement:

1. Submit qualifications for licensed professional.

E. Certify that form release agent complies with Federal, State and local VOC limitations.

1.6 QUALITY ASSURANCE

A. Perform Work according to ACI 301, 318, 347 and 350.

B. For wood products furnished for Work of this Section, comply with AF&PA.

1.7 SYSTEM DESCRIPTION

A. Delegated Design Structural Design Responsibility: Provide forms, shoring, and reshoring designed by a professional engineer registered in the State of Florida. Design formwork in accordance with the requirements of ACI 301, 318, 347 and 350. Comply with all applicable regulations and codes. Consider any special requirements due to the use of plasticized and/or retarded set concrete.

1.8 QUALIFICATIONS

A. Licensed Professional: Professional engineer experienced in design of specified Work and licensed in the State of Project location.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Section 01600 – "Product Requirements": Requirements for transporting, handling, storing, and protecting products.

B. Store materials off ground in ventilated and protected manner to prevent deterioration from moisture.

PART 2 - PRODUCTS

2.1 PERFORMANCE AND DESIGN CRITERIA

A. Design, engineer, and construct formwork, shoring, and bracing according to ACI 318, ACI 347, ACI 347.2R and ACI 350 conforming to Florida Building Code requirements to achieve concrete shapes, lines, and dimensions as indicated and required by project conditions.

2.2 FORMS, GENERAL

A. Make forms for cast-in-place concrete of wood, steel, or other approved materials. Design and construct all forms to provide a flat, uniform concrete surface requiring no grinding, repairs, or finishing except as specified in Section 03350, "Concrete Finishing."

1. Construct wood forms of sound lumber or plywood free from knotholes and loose knots.
2. Construct steel forms to produce surfaces equivalent in smoothness and appearance to those produced by new plywood panels.

B. Provide rigid forms that will not deflect, move, or leak. Design forms to withstand high hydraulic pressures resulting from rapid filling of forms and heavy high frequency vibration of the concrete. Limit deflection to 1/400 of each component span. Lay out form joints in a uniform pattern or as indicated on Drawings.

C. Dress and match boards. Sand plywood smooth and fit adjacent panels with tight joints. Tape, gasket, plug, or caulk joints and gaps in forms to provide watertight joints that will withstand placing pressures without exceeding specified deflection limit or creating surface patterns.

D. Provide 3/4 inch chamfer on form corners unless otherwise indicated.

2.3 FORMS FOR STRUCTURAL CONCRETE

A. Plywood Forms:

1. Make forms for exposed and non-submerged exterior and interior concrete of new and unused Plyform exterior grade plywood panels.
2. Species: Douglas fir.
3. Grade: B grader or better.
4. Edges: Clean and true.
5. Exposed Concrete:

    a. Comply with APA/EWA PS 1.
    b. Panels: Full size, 4 by 8 feet.
    c. Label each panel with grade trademark of APA/EWA

6. Surfaces to Receive Membrane Waterproofing:

    a. Minimum Thickness: 5/8 inch.
    b. Grade: APA/EWA "B-B Plyform Structural I Exterior."

7. "Smooth Finish" Indicated on Drawings:

    a. Minimum Thickness: 3/4 inch.
    b. Grade: APA/EWA "HD Overlay Plyform Structural I Exterior."

8. Design and construct forms to provide a flat, uniform concrete surface requiring no grinding, repairs, or finishing, except as specified in Section 03350, “Concrete Finishing.”

B. Preformed Steel Forms:

1. Description: Matched, tightly fitted, and stiffened to support weight of concrete without deflection detrimental to tolerances and appearance of finished surfaces.

2. Minimum Thickness: 16 gage.

C. FRP Forms: Matched, tightly fitted, and stiffened to support weight and pressure of concrete without deflection detrimental to tolerances and appearance of finished concrete surfaces.

D. Steel Forms: Description: Sheet steel, suitably reinforced.

E. Framing, Studding, and Bracing: Stud or No. 3 structural light-framing grade.

2.4 FORMWORK ACCESSORIES

A. Form Ties:

1. Type: Removable.
2. Material: Stainless-Steel.
3. Length: Adjustable.
4. Furnish waterproofing washer.
5. Back Break Dimension: 1 inch.
6. Free of defects capable of leaving holes larger than 1 inch in concrete surface.
7. Coil and Wire Ties: Provide ties manufactured so that after removal of projecting part, no metal remains within 1-1/2 inch of concrete face. The part of the tie to be removed shall be at least 1/2-in diameter or be provided with a plastic or wooden cone at least 1/2 inch1/2-in diameter and 1-1/2 inch long. Provide cone washer type form ties in concrete exposed to view.
8. Flat Bar Ties for Panel Forms: Provide ties that have plastic or rubber inserts with a minimum depth of 1-1/2 inch and manufactured to permit patching of the tie hole.
9. Provide ties for liquid retaining structures that have a steel waterstop tightly attached to each strut or that have a neoprene rubber washer on each strut.
10. Alternate form ties consisting of tapered through-bolts at least 1 inch in diameter at smallest end or through-bolts that utilize a removable tapered sleeve of same minimum size may be used. Install in forms so that large end is, where applicable, on liquid or backfilled side of the wall. Clean, fill, and seal form tie hole with rubber plug installed from the liquid or backfilled side and non-shrink cement grout to provide watertight form tie holes. Make repairs needed to make watertight.
11. Alternate form ties specified in Paragraph above may be used when forms are to be set against previously placed or existing concrete walls. Use in conjunction with cast-in threaded inserts or drilled-in threaded anchors so that no metal remains within expansion joint upon removal of tapered through bolt. Conform to requirements specified in above Paragraph.

B. Spreaders:

1. Description: Standard, non-corrosive, metal-form clamp assembly of type acting as spreaders and leaving no metal within 1 inch of concrete face.
2. Wire ties, wood spreaders, or through bolts are not permitted.

C. Form Release Agent:

1. Description: Colorless form coating that will not stain concrete or absorb moisture or impair natural bonding or color characteristics of coating intended for use on concrete.

2. Form Release Agent. Coat form surfaces in contact with concrete with an effective, non-staining, non-residual, water based, bond-breaking form coating, unless otherwise indicated or specified. Form release agent shall not impair the bond of paint, sealant, waterproofing, or other coatings.
3. For concrete surfaces which are to be painted, use forms with high density overlay or a similar material which does not require a form release agent unless Contractor can substantiate to satisfaction of the Engineer that form release agent will not remain on formed surface after it is stripped.

D. Bond Breaker:

1. Bond breakers for precast and tilt-up construction when cast against concrete shall be a non-staining, non-residual type, which will provide a positive bond prevention.
2. Acceptable Manufacturers: One of the following or equal:

   a. Dayton Superior Specialty Chemical Corporation: Sure-Lift (J-6).
   b. Universal Form Clamp Co: Super Clean and Tilt.
   c. Nox-Crete Products Group: Silcoseal Select.

E. Corners, Recesses for Joint Sealant, Rustications, and Drip Edges:

1. Type: Chamfer.
2. Provide rustications as indicated. Mill and plane smooth moldings for chamfers and rustications. Provide rustications and chamfer strips of nonabsorbent material, compatible with the form surface and fully sealed on all sides to prevent the loss of paste or water between the two surfaces.
3. Size: As indicated on drawings.
4. Lengths: Maximum possible.

F. Nails, Spikes, Lag Bolts, Anchorages: Size, strength, and character to maintain formwork in place while placing concrete.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify lines, levels, and centers before proceeding with formwork.

B. Verify that dimensions agree with Drawings and Shop Drawings.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Earth Forms: Not permitted.

B. Formwork:

1. Provide top form for sloped surfaces steeper than 1.5 horizontal to 1 vertical to hold shape of concrete during placement, unless it can be demonstrated that top forms can be omitted.
2. Construct forms to correct shape and dimensions, mortar-tight, braced, and of sufficient strength to maintain shape and position under imposed loads from construction operations.
3. Camber forms where necessary to produce level finished soffits unless indicated otherwise on Drawings.
4. Positioning:

    a. Carefully verify horizontal and vertical positions of forms.
    b. Correct misaligned or misplaced forms before placing concrete.

5. Complete wedging and bracing before placing concrete.
6. Erect formwork, shoring, and bracing according to ACI 301, 318, 347 and 350.
7. Obtain approval of Engineer before framing openings in structural members not indicated on Drawings.
8. Install chamfer strips for corners, recesses for sealant, rustications, and drip edges on exposed corners of beams and walls.
9. Form Release Agent:

    a. Apply according to manufacturer instructions.
    b. Apply prior to placement of reinforcing steel, anchoring devices, and embedded items.
    c. Do not apply form release agent if concrete surfaces are indicated to receive special finishes orapplied coverings that may be affected by agent.
    d. Soak inside surfaces of untreated forms with clean water, and keep surfaces coated prior to placement of concrete.
    e. Apply form coatings before placing reinforcing steel.

10. Leave forms in place for minimum number of days according to ACI 347.
11. Do not remove forms or bracing until concrete has gained sufficient strength to carry its own weight and imposed loads and until the concrete has attained a strength of at least 70 percent of its specified design strength for beams and slabs and at least 30 percent of its specified design strength for walls and vertical surfaces.
12. Do not remove shores until concrete has attained at least 70 percent of its specified design strength and also sufficient to support safely its own weight and the construction live load on it.
13. Loosen forms carefully; do not wedge pry bars, hammers, or tools against finish concrete surfaces scheduled for exposure to view.

14. Stripping:

    a. Arrange and assemble formwork to permit dismantling and stripping.
    b. Do not damage concrete during stripping.
    c. Permit removal of remaining principal shores.

15. Be responsible for damage resulting from removal of forms and make repairs at no additional compensation. Leave in place forms and shoring for horizontal structural members in accordance with ACI 301 and ACI 347. Conform to requirements for form removal specified in Section 03300, "Cast-in-Place Concrete."
16. Store removed forms in manner that surfaces to be in contact with fresh concrete will not be damaged.
17. Discard damaged forms.

18. Reuse and Coating of Forms:

    a. Thoroughly clean forms and reapply form coating before each reuse.
    b. For exposed Work, do not reuse forms with damaged faces or edges.
    c. Apply form coating to forms according to manufacturer instructions.
    d. Do not coat forms for concrete indicated to receive "scored finish."

19. Do not patch formwork.

20. Form Cleaning:

    a. Clean forms as erection proceeds to remove foreign matter within forms.
    b. Clean formed cavities of debris prior to placing concrete.
    c. Flush with water or use compressed air to remove remaining foreign matter.
    d. Ensure that water and debris drain to exterior through cleanout ports.
    e. Cold Weather:

        1) During cold weather, remove ice and snow from within forms.
        2) Do not use de-icing salts.
        3) Do not use water to clean out forms, unless formwork and concrete construction proceed within heated enclosure; use compressed air or other dry method to remove foreign matter.

C. Forms for Smooth Finish Concrete:

1. Use steel, plywood, or lined-board forms.
2. Use clean and smooth plywood and smooth sheet form liners, uniform in size, and free from surface and edge damage capable of affecting resulting concrete finish.
3. Install smooth sheet form lining with close-fitting square joints between separate sheets without springing into place.
4. Use full-sized sheets of smooth sheet form liners and plywood wherever possible.
5. Tape joints to prevent protrusions in concrete.
6. Apply forming and strip wood forms in a manner to protect corners and edges.
7. Level and continue horizontal joints.

D. Forms for Surfaces to Receive Membrane Waterproofing:

1. Use plywood or steel forms.
2. After erection of forms, tape form joints to prevent protrusions in concrete.

E. Framing, Studding, and Bracing:

1. Framing, Studding, and Bracing: Stud or No. 3 structural light-framing grade.

2. Maximum Spacing of Studs:

   a. Boards: Maximum 16 inches o.c.
   b. Plywood: 12 inches o.c.

3. Size framing, bracing, centering, and supporting members for sufficient strength to maintain shape and position under imposed loads from construction operations.
4. Construct beam soffits of material minimum 2 inches thick.
5. Distribute bracing loads over base area on which bracing is erected.
6. When placed on ground, protect against undermining, settlement, and accidental impact.

F. Form Anchors and Hangers:

1. Do not use anchors and hangers leaving exposed metal at concrete surface.
2. Symmetrically arrange hangers supporting forms from structural-steel members to minimize twisting or rotation of member.
3. Penetration of structural-steel members is not permitted.

G. Inserts, Embedded Parts, and Openings:

1. Make provisions for pipes, sleeves, anchors, inserts, reglets, anchor slots, nailers, waterstops, and other features.
2. Do not embed wood or uncoated aluminum in concrete.
3. Obtain installation and setting information for embedded items furnished under other Sections.
4. Securely anchor embedded items in correct location and alignment prior to placing concrete.
5. Ensure that conduits and pipes, including those made of coated aluminum, meet requirements of ACI 318 and 350 regarding size and location limitations.
6. Install formed openings for items to be embedded in or passing through concrete Work.
7. Locate and set in place items required to be cast directly into concrete.
8. Install accessories straight, level, and plumb, and ensure that items are not disturbed during concrete placement.
9. Frame openings in concrete where indicated on Drawings.
10. Establish exact locations, sizes, and other conditions required for openings and attachment of Work specified under other Sections.
11. Coordinate Work to avoid cutting and patching of concrete after placement.

12. Temporary Openings:

    a. Provide temporary ports or openings in formwork as required to facilitate cleaning
    b. Provide removable cleanout sections or access panels at bottoms of forms to permit inspection and effective cleaning of loose dirt, debris, and waste material.
    c. Locate openings at bottom of forms to allow flushing water to drain.
    d. Remove chips, sawdust, and other debris.
    e. Thoroughly blow out forms with compressed air just before concrete is placed and inspection.
    f. Clean forms and surfaces against which concrete is to be placed.
    g. Close temporary openings with tight-fitting panels, flush with inside face of forms, and neatly fitted such that joints will not be apparent in exposed concrete surfaces.

H. Form Ties:

1. Provide sufficient strength and quantity to prevent spreading of forms.
2. Place ties at least 1 inch away from edge of concrete.
3. Leave inner rods in concrete when forms are stripped.
4. Space form ties equidistant, symmetrical, and aligned vertically and horizontally unless indicated otherwise on Drawings.

I. Arrange formwork to allow proper erection sequence and to permit form removal without damage to concrete.

J. Construction Joints:

1. Install surfaced pouring strip where construction joints intersect on exposed surfaces to provide straight line at joints.
2. Just prior to subsequent concrete placement, remove strip, and tighten forms to conceal shrinkage.
3. Appearance:

    a. Show no overlapping of construction joints.
    b. Construct joints to present same appearance as butted plywood joints.

4. Arrange joints in continuous line straight, true, and sharp.

K. Embedded Items:

1. Make provisions for pipes, sleeves, anchors, inserts, reglets, anchor slots, nailers, waterstops, and other features.
2. Do not embed wood or uncoated aluminum in concrete.
3. Obtain installation and setting information for embedded items furnished under other Sections.
4. Securely anchor embedded items in correct location and alignment prior to placing concrete.
5. Ensure that conduits and pipes, including those made of coated aluminum, meet requirements of ACI 318 regarding size and location limitations.

L. Screeds:

1. Set screeds and establish levels for tops of and finish on concrete slabs.
2. Slope slabs to drain where required or as indicated on Drawings.
3. Before depositing concrete, remove debris from space to be occupied by concrete, thoroughly wet forms, and remove freestanding water.

M. Screed Supports:

1. For concrete over waterproof membranes and vapor retarder membranes, use cradle-, pad-, or base-type screed supports that will not puncture membrane.
2. Staking through membrane is not permitted.

N. Cleanouts and Access Panels:

1. Provide removable cleanout sections or access panels at bottoms of forms to permit inspection and effective cleaning of loose dirt, debris, and waste material.
2. Clean forms and surfaces against which concrete is to be placed.
3. Remove chips, sawdust, and other debris.
4. Thoroughly blow out forms with compressed air just before concrete is placed.

3.3 TOLERANCES

A. Construct formwork to maintain tolerances according to ACI 301 and 117.

B. Camber:

1. According to ACI 301.

C. Formed Surface Including Mass Concrete, Pipe Encasement, Electrical Raceway Encasement and Other Similar Installations: No minimum requirements for surface irregularities and surface alignment. The overall dimensions of the concrete shall be plus or minus 1 inch from the intended surface indicated.

D. Rustications Exposed to View: Straight, plumb and true with a variation of no more than 1/8 inch in 10 feet measured in any direction.

E. Formed Surfaces to be Painted: Surface irregularities limited to 1/16 inch at any point. Variation in alignment not to exceed 1/16 inch per 4 feet. Do not allow maximum deviation of finish surface at any point to exceed 1/4 inch from intended surface indicated.

3.4 FIELD QUALITY CONTROL

A. Section 01400 – “Quality Control”: Requirements for inspecting and testing.

B. Inspection:

1. Inspect erected formwork, shoring, and bracing to ensure that Work complies with formwork design and that supports, fastenings, wedges, ties, and items are secure.
2. Notify Engineer after placement of reinforcing steel in forms at least six working hours prior to proposed concrete placement.
3. Schedule concrete placement to permit formwork inspection before placing concrete.
4. Failure of forms to comply with specified requirements or to produce concrete complying with requirements specified shall be grounds for rejection of that portion of concrete work. Repair or replace rejected work as directed by the Engineer at no additional compensation. Make required repair or replacement subject to requirements of these Specifications and approval of the Engineer.

3.5 SCHEDULE

A. Concrete Not Exposed to View: Site-fabricated plywood coated with form oil.

B. Concrete Exposed to View: New and unused Plyform exterior grade plywood panels or steel forms.

C. Supported Floor Slabs: steel forms.

END OF SECTION

SECTION 03150

CONCRETE JOINTS AND ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes construction of durable, watertight joints in concrete structures.

B. Related Requirements:

1. Section 01881 “Tightness Testing Performance Requirements” for watertightness test of water containing structures.
2. Section 03100 “Concrete Forming and Accessories” for formwork.
3. Section 03200 “Concrete Reinforcing” for reinforcing.
4. Section 03300 “Cast-In-Place Concrete” for cement, and related concrete products.
5. Section 03350 “Concrete Finishing” for concrete finish related work.
6. Section 03600 “Grouting” for grout related work.
7. Section 03015 “Modifications to Existing Concrete”.
8. Section 05502 “Metal Fabrications” for various metal fabrications.

1.3 ACTION SUBMITTALS

A. Plastic Waterstops: Product data including sample, catalogue cut, dimensions, technical data, storage requirements, splicing methods, conformity to CRD standards, details and samples of factory fabrications.

B. Special Waterstops: Product data including location of use, sample, catalogue cut, technical data, storage requirements, splicing methods, installation instructions, and conformity to CRD, ASTM or FS standards, as applicable.

C. Premolded Joint Fillers: Product data including location of use, sample, catalogue cut, technical data, storage requirements, and conformity to ASTM standards.

D. Preformed Expansion Joint Material: Product data including location of use, catalogue cut, dimensions, technical data, storage requirements, installation instructions, and conformity to ASTM standards.

E. Bond Breaker: Product data including location of use, catalogue cut, technical data, storage requirements, and application instructions.

F. Expansion Joint Dowels: Product data on the complete assembly including dowel material, sizes and dimensions, coatings, expansion dowel caps, installation instructions and conformity to ASTM standards.

G. Sealant: Product data including location of use, catalogue cut, technical data, storage requirements, mixing and application instructions, and conformity to ASTM standards.

1.4 INFORMATIONAL SUBMITTALS

A. System and Material Certificates:

1. Certify that materials used within joint system are compatible with each other.
2. Certify that sealant is made for use in continuous immersion in contact with wastewater.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Fabricator of products.

B. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS

A. Use materials in a given joint that are compatible with one another. Coordinate selection of suppliers and products to provide compatibility. Do not use asphaltic bond breakers or asphaltic joint fillers in joints receiving sealant.

B. Product Experience: Provide plastic waterstops adhesive waterstops products specifically manufactured for intended purpose and have five years' successfully experience in similar applications.

2.2 MATERIALS - STANDARD WATERSTOPS

A. Plastic Waterstops: Conform to CRD C572, fabricate by extruding elastomeric plastic compound with virgin polyvinylchloride as basic resins and with compound containing no reprocessed materials. Incorporate an integral fastening system or provide with grommets or prepunched holes between outermost ribs at a spacing of 12 inches on center.

1. Waterstops For Non-Expansion Joints and Joints Indicated:

    a. Type: Ribbed type waterstops.
    b. Minimum Tensile Strength: 1,750 psi per ASTM D 638.
    c. Size: 6 inches by 3/8 inch.
    d. Acceptable Manufacturers: Provide products manufactured by one of the following or equal:

        1) Greenstreak Plastic Products: Style 679.
        2) Paul Murphy Plastics Co.: Style FR-6380.
        3) Vinylex Corp.: Style R6-38.

2. Factory Fabrications:

    a. Provide factory fabrications for waterstop changes of direction, transitions, and intersections:

        1) Intersections: Vertical ells, flat ells, vertical tees, flat tees, vertical crosses, flat crosses, and special, unusual, or complicated intersections including waterstop intersections of different sizes or configurations, and intersections due to joint offsets.

    b. Make and inspect factory fabrications by waterstop manufacturer.
    c. Provide stub ends of sufficient length to leave only straight butt joints for field splicing.

2.3 MATERIALS - SPECIAL WATERSTOPS

A. Expansive Waterstops for Construction Joints Where Indicated:

1. Type B - Preformed Hydrophilic Rubber Strips:

    a. Installation Adhesives: Use with expansive waterstops as recommended by waterstop manufacturer.
    b. Acceptable Manufacturers: Provide products manufactured by one of the following or equal:

        1) Greenstreak Plastic Products: Hydrotite CJ-1020-2K.
        2) Mitsubishi: Adeka Ultraseal MC-201MN-N.
        3) W.R. Grace: Adcor ES.

2.4 MATERIALS - ACCESSORIES

A. Premolded Joint Filler - Structures: ASTM D 1752, Type III, self-expanding cork.

1. Thickness: 1 inch, unless otherwise indicated.

B. Bond Breaker:

1. Bond Breaker Tape: Adhesive-backed glazed butyl or polyethylene tape that adheres to premolded joint filler or concrete surface. Provide tape of same width as the joint.
2. Bond breaker for concrete other than where tape is indicated or specified: Either bond breaker tape or a non-staining type bond prevention coating.

    a. Acceptable Coating Manufacturers: Provide products manufactured by one of the following or equal:

        1) Cresset Chemical Company: Crete-Lease Bond Breaker for Tilt-Up.
        2) Dayton Superior: Sure-Lift J-6 WB.
        3) Nox-Crete: Silcoseal Select.

C. Preformed Expansion Joint Material: Non-extrudable watertight strip material used to fill expansion joints between structures meeting following criteria:

1. Compressibility: Capable of being compressed at least 40 percent for 70 hours at 68 degrees F and subsequently recovering at least 20 percent of its original thickness in first 30 minutes after unloading.
2. Basis-of-Design: Provide products as manufactured by Chase Construction Products, or equal:

    a. Phyzite 380.

D. Grout: Non-metallic, non-shrinking as specified in Section 03600 “Grouting.”

2.5 MATERIALS - SEALANTS

A. Sealant:

1. Comply with ASTM C 920 for following conditions:

    a. Sealant for Joints in Horizontal Surfaces: Type S or M, Grade P or NS, Class 25.
    b. Sealant for Joints in Sloping and Vertical Surfaces: Type S or M, Grade NS, Class 25.
    c. Sealant in Pedestrian and Vehicular Traffic Areas: Use T_1.
    d. Sealant in Non-Traffic Areas: Type S or M, Grade P, Use NT.

2. Provide sealants made for use in continuous immersion in contact with wastewater. Provide gray colored sealants unless otherwise indicated, specified, or approved.

PART 3 - EXECUTION

3.1 INSTALLATION - WATERSTOPS, GENERAL

A. Install waterstops for joints indicated and according to manufacturer’s published installation instructions and approved submittals.

B. Include waterstops continuous around corners and intersections to provide a continuous seal.

C. Provide a minimum number of connections or splices. Replace connections or splices that do not meet specified requirements at no additional cost to Owner.

D. Secure waterstops in joints before concrete is placed.

E. Install plastic waterstops so that half of width is embedded on each side of joint. Install waterstops with a center bulb in expansion joints so center bulb is within the joint width. Provide waterstops completely embedded in void-free concrete.

F. Terminate waterstops 2 inch below exposed top of walls.

G. Protect waterstops from damage in intervals between placing waterstops and subsequent placing of concrete. Replace damaged or punctured waterstops at no additional cost to Owner.

H. Protect plastic waterstops from sunlight when exposed more than 30 days between concrete placements.

I. Provide waterstops free from form release agent, bond breaker, dirt, concrete splatter, ice, mortar, paint, or other deleterious material that could reduce or destroy bond between waterstop and adjacent concrete.

3.2 INSTALLATION - PLASTIC WATERSTOPS

A. Field Splices: Make only straight butt joints. Fabricate splices on a bench.

1. Use a power saw and guide to cut straight ends to be spliced.
2. Heat fuse weld splices using a Teflon coated thermostatically controlled waterstop splicing iron following manufacturer's recommendations.
3. Provide finished splices having a cross-section that is dense and free of porosity. Engineer may conduct destructive tests of splices by cutting along one-half of splice length and by cutting perpendicular to splice at several locations on remaining half of splice length.
4. Completed Splices: Exhibit a continuous and uniform bead of excess melted material with welded material looking similar to parent material.
5. Show no misalignment of center bulbs or ribs greater than 1/16 inch, lack of fusion, porosity, pinholes, cracks, charred or burnt material, bubbles, or separation of cooled splice when bent by hand. If a splice displays any of these defects, reject the splice, recut back at least 1 inch from rejected splice on each side, and reweld.

B. Secure waterstops in wall joints before concrete is placed. If waterstop does not incorporate an integral fastening system, grommets, or prepunched holes, drill holes in waterstops between outermost ribs at each edge. Center waterstop in the joint. Tie both edges of waterstop to reinforcing steel with tie wire as specified for tying reinforcing steel. Secure waterstop centered on and perpendicular to joint and to maintain its position during concrete placement.

C. Space waterstop ties to match spacing of adjacent reinforcing, but ties need not be spaced closer than 12 inches on center.

D. Clamp horizontal waterstops in slabs in position with form bulkhead, unless previously set in concrete. Lift waterstop edge while placing concrete below the waterstop. Manually force waterstop against and into placed concrete and cover with fresh concrete, to provide complete encasement of waterstop in concrete.

3.3 INSTALLATION - SPECIAL WATERSTOPS

A. Install special waterstops at joints only where specifically indicated on Drawings. Provide waterstops continuous around corners and intersections to provide a continuous seal.

B. Use waterstops of maximum practicable length to provide a minimum number of joints, connections, or splices. Make joints, connections, and splices conforming to manufacturer's recommended.

C. Terminate waterstops 2 inches below exposed top of walls.

D. Expansive Type and Preformed Adhesive Waterstops:

1. Clean and prepare joint surfaces, install primers or adhesives, and install Type B expansive waterstops on dry surfaces in accordance with manufacturer's instructions, including concrete cure, temperature conditions, and splices.
2. Use mechanical fasteners to secure, Type B expansive waterstops to previously placed vertical and overhead concrete surfaces and other locations, as recommended by manufacturer. Protect installed waterstops from moisture and keep dry until subsequent placement of concrete.

3.4 INSTALLATION - CONSTRUCTION JOINTS

A. Make construction joints only at locations indicated or as approved by the Engineer. Submit additional or relocation of construction joints proposed by Contractor to the Engineer for written approval. Do not eliminate construction joints.

B. Locate additional or relocated joints where they least impair member strength. In general, locate joints within middle third of spans of slabs, beams, and girders.

1. If a beam intersects a girder at joint, offset joint a distance equal to twice the width of member being connected.

2. Locate joints in walls and columns at underside of floors, slabs, beams, or girders and at tops of footings or floor slabs.
3. Do not locate joints between beams, girders, column capitals, or drop panels and the slabs above them. Do not locate joints between brackets or haunches and walls or columns supporting them.

C. Unless otherwise indicated, provide joints perpendicular to main reinforcement. Continue reinforcing steel through joint as indicated.

D. Provide waterstops in wall and slab construction joints in liquid retaining structures and at other locations indicated.

E. Roughened Construction Joints:

1. At construction joints and at concrete joints indicated, uniformly roughen concrete surface with chipping tools to expose a fresh face 1/4 inch of a full amplitude, distance between high and low points and side to side.
2. Thoroughly clean joint surfaces of loose or weakened materials by waterblasting or sandblasting and prepare for bonding.
3. At least two hours before and again shortly before new concrete is deposited, saturate joints with water.
4. After glistening water disappears, coat joints with neat cement slurry mixed to consistency of very heavy paste. Apply a coating to surfaces at least 1/8 inch, scrubbed-in by means of stiff bristle brushes. Deposit new concrete before neat cement dries.

3.5 INSTALLATION - SEALANTS

A. Install sealants in clean dry recesses free of frost, oil, grease, form release agent, loose material, laitance, dirt, dust, and other deleterious materials that will impair bond.

B. Apply sealant conforming to manufacturer's recommendations including concrete cure, temperature, moisture, mixing, primer, primer cure time, joint and recess preparation, tooling, and curing.

C. Apply masking tape to each side of joint prior to sealant installation. Remove masking tape afterwards, along with any spillage to leave a sealant installation with neat straight edges.

3.6 INSTALLATION - PREFORMED EXPANSION JOINT MATERIAL

A. Install preformed expansion joint material in conformance with manufacturer's recommendations; including surface preparation, adhesive installation, heat welding, and set time.

3.7 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect system components verifying that installation conforms to manufacturer’s installation instructions.,

1. Prepare test and inspection reports.

3.8 CLEANING AND PROTECTION

A. Clean adjacent surfaces removing excess spills.

B. Protect installed products until subsequent work is installed. For exposed materials, protect from damage until Substantial Completion.

END OF SECTION

SECTION 03200

CONCRETE REINFORCING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Reinforcing bars.
2. Reinforcement accessories.

B. Related Requirements:

1. Section 03100 – "Concrete Forming and Accessories": Form materials, and accessories required to form cast-in-place concrete.
2. Section 03300 – "Cast-in-Place Concrete": Cast-in-place concrete.
3. Section 03350 – "Concrete Finishing": Reinforcement for concrete floor toppings.

1.3 COORDINATION

A. Coordinate Work of this Section with placement of formwork, formed openings, masonry dowels, and other Work.

1.4 SUBMITTALS

A. Section 01300 – "Submittals": Requirements for submittals.

B. Shop Drawings:

1. Indicate bar sizes, spacings, locations, splice locations, and quantities of reinforcing steel.
2. Indicate bending and cutting schedules.
3. Indicate supporting and spacing devices.
4. Placement Drawings:

a. Walls: Show elevations from outside, looking towards the structure, at a minimum scale of 1/4 inch to one foot.

b. Slabs: Show top and bottom reinforcement on separate plan views, as needed for clarity.
c. Beams and Columns: Show schedules with sections, elevations, and stirrup/tie spacing.
d. Show additional reinforcement around openings, at corners and at other locations indicated, diagrams of bent bars, arrangements and assemblies, all as required for the fabrication and placement of concrete reinforcement.
e. Reference bars to same identification marks shown on bar bending details. Identify bars to have special coatings or to be of special steel or special yield strength.

1.5 INFORMATIONAL SUBMITTALS

A. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

B. Submit certified copies of mill test report of reinforcement materials analysis.

C. Certified copy of test reports for each foreign manufactured steel proposed for use. Provide tests specifically made for this project by a domestic independent testing laboratory certified to perform the tests. Test for conformity to applicable ASTM Standard.

D. Source Quality-Control Submittals: Indicate results of shop tests and inspections.

E. Field Quality-Control Submittals: Indicate results of Contractor-furnished tests and inspections.

1.6 QUALITY ASSURANCE

A. Perform Work according to ACI 318.

B. Prepare Shop Drawings according to ACI SP-66.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Section 01600, “Material and Equipment”: Requirements for transporting, handling, storing, and protecting products.

B. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.

C. Ship and store reinforcement with bars of same size and shape fastened in bundles with durable tags, marked in a legible manner with waterproof markings showing same "mark" designations as those shown on submitted placement drawings. Indicate that reinforcing is weldable on tags for ASTM A 706 reinforcing and for ASTM A 615 reinforcing meeting specified requirements in PART 2.

D. Store materials according to manufacturer instructions.

E. Protection:

1. Protect materials from moisture by storing off ground, in clean, and dry location.
2. Provide additional protection according to manufacturer instructions.

1.8 EXISTING CONDITIONS

A. Field Measurements:

1. Verify field measurements prior to fabrication.
2. Indicate field measurements on Shop Drawings.

PART 2 - PRODUCTS

2.1 REINFORCEMENT

A. Reinforcing Steel:

1. Comply with ASTM A 615.
2. Yield Strength: 60 ksi.
3. Billet Bars: Deformed.
4. Finish: Uncoated.

2.2 FABRICATION

A. Fabricate concrete reinforcement according to ACI 318.

B. Form standard hooks for 180-degree bends, 90-degree bends, stirrups and tie hooks as indicated.

C. Form reinforcement bends with minimum diameters according to ACI 318.

D. Bend bars cold. Do not straighten or rebend bars.

E. Bend bars around a revolving collar having a diameter not less than that recommended by the CRSI or ACI 318.

F. Saw cut bar ends that are to be butt spliced, placed through limited diameter holes in metal, or threaded. Terminate saw cut ends in flat surfaces within 1-1/2 degrees of a right angle to the axis of the bar.

G. Form ties and stirrups as indicated

2.3 ACCESSORY MATERIALS

A. Tie Wire:

1. Minimum 16 gage, annealed type. Use black wire to tie uncoated reinforcing.

B. Reinforcing Steel Accessories:

1. Plastic Protected Wire Bar Supports: CRSI Bar Supports, Class 1 - Maximum Protection.
2. Stainless Steel Protected Wire Bar Supports: CRSI Bar Supports, Class 2 - Moderate Protection with legs made wholly from stainless steel wire.
3. Precast Concrete Bar Supports: CRSI Bar Supports, Precast Concrete Bar Supports. Precast concrete blocks that have equal or greater strength than the surrounding concrete.

C. Reinforcing Splicing Devices:

D. Type: Mechanical threaded, set screw, swaged; full tension and compression.

1. Use only where indicated. Meet all ACI 318 requirements. Provide threaded type with cap on female end to exclude dirt, debris and wet concrete. Torque couplers to manufacturer's recommended value.
2. Unless otherwise indicated, mechanical reinforcing splicing devices shall produce a splice strength in tension or compression of not less than 125 percent of ASTM specified minimum yield strength of reinforcing bar. Base yield strength on Grade 60 reinforcing unless otherwise indicated or specified.
3. Compression type mechanical splices shall provide concentric bearing from one bar to other bar.
4. Size: To fit joined reinforcing.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with CRSI 10-MSP for surface condition, bending, spacing and tolerances of placement for reinforcement. Provide the amount of reinforcing indicated at the spacing and clearances indicated on the Drawings.

B. Coat uncoated reinforcement which will be exposed for more than 60 days after placement with a heavy coat of neat cement slurry.

C. Do not weld reinforcing steel bars either during fabrication or erection unless indicated or as specified herein, or unless prior written approval has been obtained from the Engineer. Remove immediately all bars that have been welded, including tack welds, without such approval. Comply with AWS D1.4 when welding of reinforcement is indicated, specified, or approved.

D. Reinforcing steel interfering with the location of other reinforcing steel, piping, conduits or embedded items may be moved within the specified tolerances or one bar diameter, whichever

is greater. Obtain the approval of the Engineer if greater displacement of bars to avoid interference is needed. Do not cut reinforcement to install inserts, conduits, mechanical openings or other items without the prior approval of the Engineer.

E. Place, support, and secure reinforcement against displacement. Secure dowels in place before placing concrete.

F. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.

G. Do not deviate from required position beyond specified tolerance.

H. Do not field bend reinforcing unless indicated or specifically authorized in writing by the Engineer. Cold-bend bars indicated or authorized to be field bent around the standard diameter spool specified in the CRSI. Do not heat bars. Closely inspect the reinforcing steel for breaks. Replace, repair by cutting out damaged bars and splicing new bars using exothermic welding type reinforcing splicing devices, or otherwise repair damaged reinforcing bars as directed by the Engineer at no additional cost to Owner. Do not bend reinforcement after it is embedded in concrete unless indicated.

I. Chairs, Bolsters, Bar Supports, and Spacers:

1. Size and Shape: To support reinforcement and prevent displacement of reinforcing during concrete placement conditions.
2. Use precast concrete blocks where reinforcing steel is to be supported over soil.
3. Use plastic protected bar supports or steel supports with plastic tips where reinforcing steel is to be supported on forms for a concrete surface that will be exposed to weather, high humidity, or liquid (including bottom of slabs over liquid containing areas). Use stainless-steel protected bar supports in walls, beams and elevated slabs. Use stainless-steel supports or plastic tipped metal supports in all other locations unless otherwise noted on the Drawings or specified herein.
4. Provide #5 minimum size support bars. Do not reposition upper bars in a bar mat for use as support bars.
5. Alternate methods of supporting top steel in slabs, such as steel channels supported on the bottom steel or vertical reinforcing steel fastened to the bottom and top mats, may be used if approved by the Engineer.

J. Spacing:

1. Space reinforcement bars with minimum clear spacing according to ACI 350.
2. If bars are indicated in multiple layers, place upper bars directly above lower bars.

K. Determine clear concrete cover based on exposure to the environment. Provide the following minimum clear concrete cover over reinforcement, unless indicated otherwise:

1. Concrete cast against and permanently exposed to earth: 3 inches.
2. Concrete exposed to soil, water, sewage, sludge and/or weather:

    a. Slabs (top and bottom cover), walls: 2 inches.
    b. Beams and columns (ties, spirals and stirrups): 2 inches.

3. Concrete not exposed to soil, water, sewage, sludge and/or weather:

    a. Slabs (top and bottom cover), walls, joists, shells and folded plate members: 1 inches.
    b. Beams and columns (ties, spirals and stirrups): 1-1/2 inches.

L. Splicing:

1. Tension Members: Avoid splicing of reinforcing steel in concrete elements indicated as "tension members." However, if splices are required for constructability, splices in the reinforcement subject to direct tension shall be butted and joined with complete penetration welds to develop, in tension, at least 125 percent of the specified yield strength of the bar. Offset splices in adjacent bars the distance of a Class B splice or 30 inches, whichever is greater.
2. Welded Wire Fabric: Provide lap splices in accordance with the requirements of ACI 318 but not less than 12 inches. Tie the spliced fabrics together with wire ties spaced not more than 24 inches on center and lace with wire of the same diameter as the welded wire fabric. Offset splices in adjacent widths to prevent continuous splices.
3. Reinforcing Splicing Devices: Use only where indicated. Offset splices in adjacent bars by at least 30 bar diameters. Use only for special splice and dowel conditions indicated or approved by the Engineer.
4. After installation of mechanical reinforcing steel coupling system, on reinforcement, repair coating damage in accordance with applicable ASTM standard. Coat all parts of mechanical connectors used on coated bars including steel splice sleeves, bolts, and nuts with same material used for repair of damaged coating.
5. Locate reinforcement splices at point of minimum stress, unless indicated otherwise.
6. Obtain approval of splice locations from Engineer.

3.2 TOLERANCES

A. Section 01400 - Quality Control: Requirements for tolerances.

B. Install reinforcement within following tolerances for flexural members, walls, and compression members:

1. Reinforcement Depth Greater Than 8 Inches:

    a. Depth Tolerance: Plus or Minus 3/8 inch
    b. Concrete Cover Tolerance: Plus or Minus 3/8 inch.

2. Reinforcement Depth Less Than or Equal to 8 Inches:

    a. Depth Tolerance: Plus or Minus 1/2 inch
    b. Concrete Cover Tolerance: Plus or Minus 1/2 inch.

3.3 FIELD QUALITY CONTROL

A. Inspection by Engineer: When reinforcing is complete and ready for inspection, notify Engineer at least six working hours prior to proposed concrete placement.

B. Do not cover reinforcing steel with concrete until reinforcement, including the size, spacing and position has been inspected by the Engineer and the Engineer's release to proceed with concreting has been obtained. Keep forms open until the Engineer has completed inspection of the reinforcement.

END OF SECTION

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SECTION 03300

CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes: Cast-in-Place Concrete for various items indicated in Contract Documents.

B. Furnish, as required to establish concrete mixes, all sampling and laboratory testing of products and materials performed by an independent testing laboratory engaged by and at the expense of the Contractor. Field sampling, testing, inspection and related laboratory tests will be provided by the Owner.

C. Related Requirements:

1. Section 03100 - Concrete Forming and Accessories: .
2. Section 031500 - Concrete Joints and Accessories.
3. Section 03200 - Concrete Reinforcing: Requirements for reinforcing steel and supports.
4. Section 03350 - Concrete Finishing: Finishing of concrete floor and wall surfaces.
5. Section 03390 - Concrete Curing: Curing of concrete surfaces.
6. Various Sections in Division 11: Mechanical items for casting into concrete.
7. Various Sections in Division 16: Electrical items for casting into concrete.

1.3 COORDINATION

A. Coordinate placement of joint devices with erection of concrete formwork and placement of form accessories.

1.4 ACTION SUBMITTALS

A. Submit, in accordance with Section 01300 “Submittals”, product data for:

1. Sources of cement, fly ash or ground granulated blast furnace slag, aggregates, and batched concrete. Indicate name and address of mill, quarry, or plant.
2. Air entrainment admixture. Product data including catalogue cut, technical data, storage requirements, product life, recommended dosage, temperature considerations and conformity to ASTM standards.

3. Water reducing admixture. Product data including catalogue cut, technical data, storage requirements, product life, recommended dosage, temperature considerations and conformity to ASTM standards.
4. Cold weather and hot weather concreting plans demonstrating how concrete will meet the requirements of this Section including but not limited to concrete mixes, placement, curing and protection.

B. Concrete Mixes: For each formulation of concrete proposed for use, submit constituent quantities per cubic yard, water cementitious ratio, air content, concrete slump, type and manufacturer of cement and type and manufacturer of fly ash or ground granulated blast furnace slag. Provide either subparagraph 1. or 2., below, for each mix proposed.

1. Standard deviation data for each proposed concrete mix based on statistical records. Provide the following for each strength data point used in the calculation of the standard deviation for determination of the minimum required average strength:

   a. Date of sampling and name of testing laboratory.
   b. Name of concrete batch plant.
   c. Water cementitious ratio.
   d. Slump of batch.
   e. Air content of batch.
   f. Compressive strengths of all cylinders tested at that age in that batch.
   g. If available, temperature and unit weight of batch.
   h. Provide data from projects not more strictly controlled than outlined in these specifications. Provide summary sheet showing all pertinent data and the computation of the standard deviation.

2. Water cementitious ratio curve for concrete mixes based on laboratory tests. Provide average cylinder strength test results at 7, 14, and 28 days for laboratory concrete mix designs.

C. High-range water-reducing admixture (plasticizer). Product data including catalogue cut, technical data, storage requirements, product life, recommended dosage, temperature considerations, retarding effect, slump range and conformity to ASTM standards. Identify proposed locations of use.

D. Samples: Fine and coarse aggregates, if requested for examination by the Engineer.

1.5 INFORMATIONAL SUBMITTALS

A. Test Reports:

1. Aggregates: Conformance to ASTM standards, including sieve analysis, mechanical properties, deleterious substance content, and mortar bar expansion test results.
2. Cement and fly ash or ground granulated blast furnace slag: Conformance to ASTM standards, including chemical analysis and physical tests.

B. Certifications:

1. Certify that admixtures used in the same concrete mix are compatible with each other and the aggregates.
2. Certify that Contractor is not associated with independent testing laboratory proposed for use by Contractor nor does Contractor or its officers have a beneficial interest in the laboratory.
3. Certificate of conformance for concrete production facilities from the NRMCA.

C. Qualifications:

1. Independent Testing Laboratory:

a. Name and address
b. Names and positions of principal officers and the name, position, and qualifications of the responsible registered professional engineer in charge.
c. Listing of technical services to be provided. Indicate external technical services to be provided by other organizations.
d. Names and qualifications of the supervising laboratory technicians.
e. Statement of conformance provided by evaluation authority defined in ASTM C 1077. Provide report prepared by evaluation authority when requested by the Engineer.
f. Submit as required above for other organizations that will provide external technical services.

1.6 CLOSEOUT SUBMITTALS

A. Section 01701 “Project Closeout”: Requirements for submittals.

B. Project Record Documents: Record actual locations of embedded utilities and components concealed from view in finished construction.

1.7 QUALITY ASSURANCE

A. Comply with ACI 318 and ACI 350 and other stated specifications, codes and standards. Apply the most stringent requirements of other stated specifications, codes, standards, and this Section when conflicts exist.

B. Independent Testing Laboratory: Meet requirements of ASTM E 329 and ASTM C 1077. Do not use laboratories affiliated and having a beneficial interest with Contractor or its officers.

C. Provide concrete uniform in color and appearance.

D. Preconstruction Meeting: At least 10 working days before first concrete placement, hold a meeting to review concrete placement requirements, waterstop placement, jointing, concrete curing, hot and cold weather concreting, and finishing. Review, with the attendance of the plasticizer manufacturer, the properties and techniques of batching and placing concrete

containing high-range water-reducing admixture. Notify all parties involved, including the Engineer, of the meeting at least 10 working days prior to its scheduled date. Prepare an agenda for the meeting. Take meeting minutes and distribute to meeting attendees.

E. If during work progress, it is impossible to secure concrete of the specified workability and strength with the materials being furnished, the Engineer may order such changes in proportions or materials, or both, as may be necessary to secure the specified properties. Make ordered changes without additional compensation.

F. If during work progress, materials from the sources originally accepted change in characteristics, make new acceptance tests of materials and establish new concrete mixes with assistance of an independent testing laboratory, without additional compensation.

G. Provide field testing and inspection services and related laboratory tests. Perform testing methods conforming to latest applicable ASTM methods. Test following items to verify conformity with this Section:

1. Concrete Placements: Compressive strength (cylinders), temperature, slump, and air content.
2. Other materials that may require field testing.

H. Concrete Placement: Compressive strength (cylinders), temperature, slump, and air content.

I. Samples of constituents and as-placed concrete will be subjected to laboratory tests by Owner. Materials incorporated in the work shall conform to accepted samples.

J. Perform Work according to ACI 301, 318 and 350.

K. Comply with ACI 305R when placing concrete during hot weather.

L. Comply with ACI 306.1 when placing concrete during cold weather.

M. Acquire cement and aggregate from one source for Work.

1.8 AMBIENT CONDITIONS

A. Section 01500 Construction Facilities: Requirements for ambient condition control facilities for product storage and installation.

B. Maintain concrete temperature after installation at minimum 50 degrees F for minimum seven days.

C. Maintain high-early strength concrete temperature after installation at minimum 50 degrees F for minimum three days.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Materials shall comply with this Section and any applicable State or local requirements.

B. Cement: Domestic portland cement conforming to ASTM C 150. Do not use air entraining cements. Do not use cement produced by a manufacturer that uses hazardous waste derived fuel as an energy source for its kilns. Cement brand must be approved by the Engineer and one brand shall be used throughout the work.

1. Comply with ASTM C150, Type II - Moderate Sulfate Resistant.
2. Type: Portland.

C. Aggregates:

1. Fine Aggregate: Washed inert natural sand conforming to ASTM C 33.
2. Coarse Aggregate: Well-graded crushed stone or washed gravel conforming to ASTM C 33. Grading requirements are listed in ASTM C 33, Table 3 for the specified coarse aggregate size number listed in Table 1. Limits of deleterious substances and physical property requirements are listed in ASTM C 33, Table 4 for severe weathering regions. Do not use coarse aggregates known to be deleteriously reactive with alkalis in cement.
3. Fine and coarse aggregates used shall not cause expansion of mortar bars greater than 0.1 percent in 16 days when tested in accordance with ASTM C 1260 and using project proposed cement. If aggregates proposed do not meet this requirement, then satisfy subparagraph a. below.

    a. Total equivalent alkali content of the cement: Do not exceed 0.60 percent as provided in the Optional Chemical Requirements of ASTM C 150.

D. Water:

1. Comply with ACI 318 and ACI 350 (350M).
2. Potable, without deleterious amounts of chloride ions.

E. Admixtures: Use admixtures free of chlorides and alkalis, except for those attributable to drinking water. Provide admixtures from same manufacturer when it is required to use more than one admixture in the same concrete mix. Use admixtures compatible with concrete mix including other admixtures. Do not use admixtures causing retarded or accelerated setting of concrete without written approval from the Engineer. Use retarding or accelerating water reducing admixtures when so approved.

1. Air Entrainment: Comply with ASTM C260.
2. Chemical:

    a. Comply with ASTM C 494.
    b. Type A - Water Reducing.

c. Type F - Water Reducing, High Range.

3. Plasticizing:

a. Comply with ASTM C 1017/.
b. Type I, plasticizing.

F. Supplementary Cementitious Materials:

1. Fly Ash: Class F fly ash complying with ASTM C 618, including the requirements of Table 1 but with the Loss on Ignition (LOI) limited to 3 percent maximum and the optional physical requirements of Table 3. Test in compliance with ASTM C311 with a minimum of one sample weighing four pounds taken from each 200 tons of fly ash supplied for the project.
2. Ground Granulated Blast Furnace Slag: Grade 100 or Grade 120 ground granulated blast furnace slag complying with ASTM C 989. Provide ground granulated blast furnace slag from a single source and uniform in color. Mill test reports submitted must be within 6 months of submittal date.
3. Silica Fume: Comply with ASTM C 1240.

2.2 CONCRETE MIX

A. Engage an independent testing laboratory to establish concrete mixes and perform sampling and laboratory testing of products and materials.

B. Select proportions of ingredients to meet the design strength and materials limits specified in Table 1 and to produce placeable, durable concrete conforming to these specifications. Proportion ingredients to produce a homogenous mixture which will readily work into corners and angles of forms and around reinforcement without permitting materials to segregate or allowing free water to collect on the surface.

C. Base concrete mixes on standard deviation data of prior mixes with essentially the same proportions of the same constituents or, if not available, develop concrete mixes by laboratory tests using the materials proposed for the work.

1. For concrete mixes based on standard deviation data of prior mixes, submit standard deviation data of prior mixes with essentially the same proportions of the same constituents in accordance with ACI 318, ACI 350 and based on the modification factors for standard deviation tests contained in ACI 318 and ACI 350.
2. For concrete mixes developed by laboratory testing, base cementitious content of the concrete on curves showing the relation between water cementitious ratio and 7, 14 and 28-day compressive strengths of concrete made using the proposed materials. Determine curves by four or more points, each representing an average value of at least three test specimens and one water-cementitious ratio at each age. Provide curves with a range of values sufficient to yield the desired data, including the compressive strengths specified, without extrapolation. Cementitious content of the concrete mixes to be used, as determined from the curve, shall correspond to the required average compressive strength in Table 5.3.2.2 of ACI 318. Resulting mix shall not conflict with the limiting values for

maximum water cementitious ratio and net minimum cementitious content specified in Table 1.

D. Test fly ash or ground granulated blast furnace slag and concrete mixture to provide test data confirming that materials in combination with the cement meet strength requirements and are compatible with other concrete additives.

E. Test aggregates for potential alkali reactivity in accordance with ASTM C 1260. If initial testing indicates aggregates are not potentially reactive repeat test at 3 month intervals.

F. Compression Tests: Provide testing of the proposed concrete mixes to demonstrate compliance with compression strength requirements in conformity with the provisions of ACI 318.

G. Entrained Air: Measure by ASTM C 231 as shown in Table 1.

1. If proposed air entrainment admixture requires testing methods other than ASTM C 231 to accurately determine air content, make special note of this requirement in admixture submittal specified under Paragraph 1.4, A.

H. Concrete Slump: Measure by ASTM C 143 as shown in Table 1. If a high-range water-reducing admixture (plasticizer) is used, the slump indicated shall be that measured before plasticizer is added. Plasticized concrete shall have a slump ranging from 7 inches to 10 inches.

I. Proportion admixtures according to the manufacturer's recommendations. Two or more admixtures specified may be used in the same mix provided that the admixtures in combination retain full efficiency and have no deleterious effect on the concrete or on the properties of the other admixture(s).

J. Where Type III cement is approved, use concrete conforming to Table 1, except attain design strength at 7 days.

TABLE 1

Class	Design Strength 1	Cement 2	Fine Aggregate 3	Coarse Aggregate 3	Cementitious Content 4
A	2500	Type II	Sand	57 (9)	440
B	3000	Type II	Sand	57	480
E2	4500	Type II	Sand	57	580
E3	4500	Type II	Sand	67	610

Class	W/C Ratio 5	SCM 6	AE Range 7	WR 8	HRWR 10	Slump Range Inches
A	0.62 max.	Yes	3.5 to 5	Yes	No	1-4
B	0.54 max.	Yes	3.5 to 5	Yes	No	1-3
E2	0.42 max.	Yes	3.5 to 5	Yes	No	3-5
E3	0.42 max.	Yes	3.5 to 5	Yes	No	3-5

TABLE NOTES:

1. Minimum compressive strength in psi at 28 days.
2. ASTM designation in ASTM C 150.
3. Size Number in ASTM C 33.
4. Minimum cementitious content in lbs per cubic yard where fly ash or ground granulated blast furnace slag is used cementitious content is defined as cement content plus fly ash or ground granulated blast furnace slag content.
5. W/C is Maximum Water Cementitious ratio by weight.
6. Supplementary Cementitious Material (SCM) fly ash content in the range of 20-25 percent of the total cement content plus fly ash content, by weight. If ground granulated blast furnace slag is used in lieu of fly ash, the content of ground granulated blast furnace slag shall be in the range of 25-45 percent of the total cement plus ground granulated blast furnace slag content, by weight.
7. AE is percent air entrainment.
8. WR is water reducing admixture.
9. HRWR is high-range water-reducing admixture.

K. Admixtures:

1. Include admixture types approved by Engineer and their quantities in concrete mix designs.
2. Cold Weather:

    a. ASTM C 494 Type E admixture may be used in cold weather, if approved by the Engineer.
    b. Use of admixtures will not relax cold-weather placement requirements.

3. Hot Weather:

    a. ASTM C 494 Type D admixture may be used in hot weather, if approved by the Engineer.
    b. Use of admixtures will not relax hot-weather placement requirements.

4. Do not use calcium chloride or admixtures containing calcium chloride.
5. Add air entrainment admixture to all concrete.
6. Add water reducing admixture to all concrete.

L. Ready-Mixed Concrete: Mix and deliver concrete according to ASTM C 94.

PART 3 - EXECUTION

3.1 MEASURING MATERIALS

A. Provide concrete composed of portland cement, fly ash or ground granulated blast furnace slag, fine aggregate, coarse aggregate, water and admixtures as specified and produced by a plant complying with ACI 318 and ASTM C 94. Batch all constituents, including admixtures, at the plant. High-range water reducing admixtures may be added in the field.

B. Measure materials for batching concrete by weighing in conformity with and within tolerances given in ASTM C 94 except as otherwise specified. Use scales last certified by the local Sealer of Weights and Measures within one year of use.

C. Weigh cement and fly ash or ground granulated blast furnace slag in individual weigh batchers that are separate and distinct from weigh batchers used for other materials. When cement and fly ash or ground granulated blast furnace slag are weighed in a cumulative weigh batcher, the cement shall be weighed first.

D. Measure the amount of free water in fine aggregates within 0.5 percent with a moisture meter. Compensate for varying moisture contents of fine aggregates. Record number of gallons of water as-batched on printed batch tickets.

E. Dispense admixtures either manually using calibrated containers or measuring tanks or by means of an automatic dispenser approved by the manufacturer of the specific admixture.

1. Charge air entrainment and chemical admixtures into the mixer as a solution using an automatic dispenser or similar metering device.
2. Inject multiple admixtures separately during the batching sequence.

3.2 MIXING AND TRANSPORTING

A. Provide ready-mixed concrete produced by equipment complying with ACI 318 and ASTM C 94 and produced by a plant certified by the NRMCA. Do not hand-mix. Use truck mixers carrying a rating plate conforming to TMMB 100. Clean each transit mix truck drum and reverse drum rotation before truck proceeds under the batching plant. Equip each transit-mix truck with a continuous, nonreversible, revolution counter showing the number of revolutions at mixing speeds.

B. Transport ready-mix concrete to the site in watertight agitator or mixer trucks loaded not in excess of their rated capacities as stated on the name plate.

C. Keep water tank valve on each transit truck locked at all times. Any addition of water must be directed by the Engineer. Incorporate water directed to be added by additional mixing of at least 50 revolutions at mixing speed after the addition of all water. Meter all added water and show the amount of water added on each delivery ticket.

D. Comply with ACI 318 and ASTM C 94 for central plant and rolling stock equipment and methods.

E. Select equipment of size and design to provide continuous flow of concrete at the delivery end. Use metal or metal-lined non-aluminum discharge chutes with slopes not exceeding one vertical to two horizontal and not less than one vertical to three horizontal. Chutes more than 20 feet long and chutes not meeting slope requirements may be used if concrete is discharged into a hopper before distribution.

F. Do not retemper (mix with or without additional cement, aggregate, or water) concrete or mortar which has partially hardened.

G. Handle concrete from mixer to placement providing concrete of specified quality in the placement area and not exceeding the maximum time interval specified in Paragraph 3.2 N.4. Dispatch trucks from the batching plant so they arrive at the work site just before the concrete is required to avoid excessive mixing of concrete while waiting or delays in placing successive layers of concrete in the forms. Remix for a minimum of 5 minutes prior to discharge or testing.

H. Furnish a delivery ticket for ready mixed concrete to the Engineer as each truck arrives. Provide a printed record of the weight of cement and each aggregate as batched individually on each ticket. Use the type of indicator that returns for zero punch or returns to zero after a batch is discharged. Indicate for each batch the weight of fine and coarse aggregate, cement, fly ash or ground granulated blast furnace slag, and water, moisture content of fine and coarse aggregate at time of batching, and types, brand and quantity of each admixture, the quantity of concrete delivered, the time any water is added and the amount, and the numerical sequence of the delivery. Show the time of day batched and time of discharge from the truck. Indicate the number of revolutions of transit mix truck.

I. Temperature and Mixing Time Control:

1. In cold weather (see Paragraph 3.8, C) maintain the as-mixed temperature of the concrete and concrete temperatures at the time of placement in the forms as indicated in Table 3.
2. If water or aggregate has been heated, combine water with aggregate in the mixer before cement is added. Do not add cement to mixtures of water and aggregate when the temperature of the mixture is greater than 90 degrees F.
3. In hot weather (see Paragraph 3.8, D), cool ingredients before mixing to maintain temperature of the concrete below the maximum placing temperature of 90 degrees F. Well-crushed ice may be substituted for all or part of the mixing water.

4. Maximum time interval between the addition of mixing water and/or cement to the batch and the final placing of concrete in the forms shall not exceed the values shown in the following Table 2:

TABLE 2

AIR OR CONCRETE TEMPERATURE (WHICHEVER IS HIGHER)	MAXIMUM TIME
(27 Degree C) 80 Degree F to 90 Degree F (32 Degree C)	45 minutes
(21 Degree C) 70 Degree F to 79 Degree F (26 Degree C)	60 minutes
(5 Degree C) 40 Degree F to 69 Degree F (20 Degree C)	90 minutes

5. If an approved high-range water-reducing admixture (plasticizer) is used to produce plasticized concrete, the maximum time interval between the addition of mixing water and/or cement to the batch and the final placing of concrete in the forms shall not exceed 90 minutes.

3.3 EXAMINATION

A. Section 01665 “Equipment Testing and Start-Up”: Requirements for installation examination.

B. Verify requirements for concrete cover over reinforcement.

C. Verify that anchors, seats, plates, reinforcement, piping, electrical conduits and other items to be cast into concrete are accurately placed, positioned securely, and will not interfere with placing concrete.

D. At all times batch, mix, transport, place, and cure concrete to the inspection of the Engineer. Advise the Engineer of readiness to proceed at least 24 hours prior to each concrete placement. The Engineer will inspect the preparations for concreting, including preparation of previously placed concrete, reinforcing and alignment, cleanliness, and tightness of formwork. Do not place concrete without the inspection and acceptance of the Engineer.

3.4 EMBEDDED ITEMS

A. Secure to forms as required or set for embedment as required, miscellaneous metal items, sleeves, reglets, anchor bolts, anchors, inserts and other items furnished under other Sections and required to be embedded into concrete. Set and secure such items in the locations and alignments needed so they are not displaced by concrete placement.

B. Clean embedded items free of rust, mud, dirt, grease, oil, ice, or other contaminants which would reduce or prevent bonding with concrete.

C. Coat or isolate all aluminum embedments to prevent aluminum-concrete reaction or electrolytic action between aluminum and steel.

D. Do not embed piping in concrete unless indicated on Drawings.

E. Do not embed electrical conduits in concrete unless indicated on Drawings.

F. Fabricate piping and conduit such that cutting, bending, or relocation of reinforcing steel is not required. Satisfy the following for pipes and conduits embedded within a slab or wall (other than those merely passing through), unless otherwise indicated on Drawings or approved:

1. Maximum outside dimension of pipe or conduit: Be not greater than one third the overall thickness of slab or wall.
2. Spacing of pipes or conduits: Be greater than or equal to three diameters or widths on center.

G. Close open ends of piping, conduits, and sleeves embedded in concrete with caps or plugs prior to placing concrete.

H. Ensure specified tests and inspections on embedded piping are completed and satisfactory before starting concrete placement. Ensure mechanical or electrical tests and inspections are completed and satisfactory prior to starting concrete placement. Do not place concrete until unsatisfactory items and conditions have been corrected.

I. Position embedded anchor bolts using templates.

J. Correct embedded items not installed in the location or alignment needed or displaced by concrete placement without additional compensation.

3.5 PREPARATION

A. Section 01665 “Equipment Testing and Start-Up”: Requirements for installation preparation.

B. Previously Placed Concrete:

1. Prepare joints as specified in Section 03150 - Concrete Joints and Accessories.

C. Remove debris and ice from formwork, reinforcement, and concrete substrates.

D. Remove water from areas receiving concrete before concrete is placed.

3.6 CONCRETE APPEARANCE

A. Remix concrete showing either poor cohesion or poor coating of the coarse aggregate with paste. Reject remixed concrete showing either poor cohesion or poor coating of the coarse aggregate with paste. Make, at no additional cost to the Owner, changes in the concrete mix design for future deliveries only by adjusting one or more of the following if the slump is within the allowable limit, but excessive bleeding, poor workability, or poor finish ability are observed:

1. Gradation of aggregate.
2. Proportion of fine and coarse aggregate.
3. Percentage of entrained air, within the allowable limits.

B. Provide concrete having a homogeneous structure which, when hardened, will have the specified strength, durability and appearance. Provide mixtures and workmanship such that concrete surfaces, when exposed, will require no finishing except as specified in Section 03350 “Concrete Finishing”.

3.7 INSTALLATION

A. Placing Concrete:

1. Place concrete according to ACI 301, 318 and 350.
2. Notify testing laboratory and Engineer minimum 24 hours prior to commencement of operations.
3. Ensure that reinforcement, inserts, embedded parts, formed expansion and contraction joints, are not disturbed during concrete placement.
4. Verify that formwork completely encloses concrete to be placed and is securely braced prior to concrete placement. Remove ice, standing water, dirt, debris, and other foreign materials from forms and exposed joint surfaces. Confirm that reinforcement and other embedded items are securely in place. Have a worker at the location of the placement who can check that reinforcement and embedded items remain in designated locations and alignments while concrete is being placed. Sprinkle semi-porous subgrades or forms to eliminate suction of water from the mix. Do not place concrete on frozen subgrade, snow, or ice.
5. Deposit concrete as near its final position as possible to prevent segregation due to rehandling or flowing. Place concrete continuously at a rate that allows the concrete previously placed to be integrated with fresh plastic concrete. Do not deposit concrete which has partially hardened or has been contaminated by foreign materials or on concrete which has hardened sufficiently to cause formation of seams or planes of weakness within the section. If the section cannot be placed continuously, place construction joints as specified or as approved.
6. Pumping of concrete will be permitted. Use a mix design and aggregate sizes chosen for pumping and submit for approval. Do not use pipelines made of aluminum or aluminum alloy. When concrete is pumped, determine slump at point of truck discharge and determine air content at point of placement.
7. Remove temporary spreaders from forms when the spreader is no longer needed. Temporary spreaders may remain embedded in concrete only when made of galvanized steel or concrete and if prior approval has been obtained.
8. Do not place concrete for supported elements until concrete previously placed in the supporting element has attained design strength.
9. Where surface mortar is to form the base of a finish, especially surfaces designated to be painted, work coarse aggregate back from forms to bring the full surface of the mortar against the form. Prevent the formation of surface voids.

10. Slabs:

    a. After bulkheads, screeds and jointing materials have been positioned, place concrete continuously between joints beginning at a bulkhead, edgeform, or corner. Place each batch into the edge of the previously placed concrete to avoid stone pockets and segregation.
    b. Avoid delays in placement. If there is a delay in placement, spade and consolidate concrete placed after the delay at the edge of previously placed concrete to avoid cold joints. Bring concrete to correct level and strike off with a straightedge. Use bullfloats or darbies to smooth the surface, leaving it free of humps or hollows.
    c. Where slabs are to be placed integrally with the walls below them, place the walls and compact as specified. Allow one hour to pass between placement of the wall

and the overlying slab to permit consolidation of the wall concrete. Keep top surface of the wall moist to prevent cold joints.

11. Formed Concrete:

    a. Place concrete in forms using tremie tubes taking care to prevent segregation. Maintain bottom of tremie tubes near the surface of concrete already placed. Do not permit concrete to drop freely more than 4 feet. Place concrete for walls in 12 inch to 24 inch lifts, keeping the surface horizontal. If a high-range water-reducing admixture is used do not permit concrete to drop freely more than 15 feet; maximum lift thickness not to exceed 7 feet.

12. Maintain records of concrete placement, including date, location, quantity, air temperature, and test samples taken.

B. Compacting:

1. Consolidate concrete by vibration and puddling, spading, rodding, or forking so that concrete is completely worked around reinforcement, embedded items and openings and into corners of forms. Continuously perform puddling, spading, rodding, and forking along with vibration of the placement to eliminate air or stone pockets which may cause honeycombing, pitting, or planes of weakness.
2. Compact concrete with mechanical vibrators. Do not order concrete until vibrators (including standby units in working order) are on the job.
3. Use mechanical vibrators having a minimum frequency of 8000 vibrations per minute. Insert vibrators and withdraw at points from 18 inches to 30 inches apart. Vibrate sufficiently at each insertion to consolidate concrete, generally from 5 to 15 seconds. Do not over vibrate so as to segregate. Keep standby vibrators on the site during concrete placing operations.
4. Concrete Slabs: Vibrate concrete slabs less than 8 inch thick by vibrating screeds. Vibrate concrete slabs 8 inches and thicker by internal vibrators and (optionally) with vibrating screeds. Place vibrators into concrete vertically. Do not lay vibrators horizontally or lay over.
5. Walls and Columns: Use internal vibrators rather than form vibrators, unless otherwise approved by the Engineer. General: for each vibrator needed to level the batch at the point of discharge, use one or more additional vibrators to densify, homogenize, and perfect the surface. Insert vibrators vertically at regular intervals, through fresh concrete and slightly into the previous lift, if any.

6. Amount of Vibration: Use vibrators to consolidate properly placed concrete. Do not use vibrators to move or transport concrete in the forms. Continue vibration until:

    a. Frequency of vibrator returns to normal.
    b. Surface appears liquefied, flattened and glistening.
    c. Trapped air ceases to rise.
    d. Coarse aggregate has blended into surface but has not disappeared.

3.8 PROTECTION

A. Protect all concrete work against injury from the elements and defacements of any nature during construction operations.

B. Protect finished surfaces and slabs whenever ambient conditions of humidity, temperature, sunlight and wind may result in the rapid evaporation of water from the concrete, to prevent checking and crazing, until the beginning of curing.

C. Cold Weather Concreting:

1. For this Specification, 'cold weather' is defined as a period when for more than three successive days, the average daily outdoor temperature drops below 40 degrees F. Calculate average daily temperature as the average of highest and lowest temperature during the period from midnight to midnight.
2. Batch, deliver, place, cure, and protect concrete during cold weather in compliance with the recommendations of ACI 306R and the additional requirements of this Section.
3. Review cold weather concreting plan at preconstruction meeting. Include methods and procedures for use during cold weather including the production, transportation, placement, protection, curing, and temperature monitoring of concrete and procedures to be implemented upon abrupt changes in weather conditions or equipment failures.
4. Maintain minimum temperature of concrete immediately after placement and during the protection period as indicated in Table 3. The temperature of the concrete in place and during the protection period shall not exceed these values by more than 20 degrees F. Prevent overheating and non-uniform heating of the concrete.

TABLE 3

Minimum Concrete
Temperatures For
Section Dimensions

Minimum Concrete Temperature:	< 12 inches	12 - 36 inches
	55 degrees F	50 degrees F

5. Protect concrete during periods of cold weather to provide continuous warm, moist curing (with supplementary heat when required by weather conditions) for a total of at least 350 degree-days of curing.

   a. Degree-days are defined as the total number of 24 hour periods multiplied by the weighted average daily air temperature at the surface of the concrete, where 7 days at an average 50 degrees F equals 350 degree-days.
   b. To calculate the weighted average daily air temperature, sum hourly measurements of air temperature in the shade at concrete surface taking any measurement less than 50 degrees F as 0 degrees F. Divide the sum thus calculated by 24 to obtain the weighted average temperature for that day.

6. Do not use salt, manure or other chemicals for protection.

7. At the end of the protection period, allow the concrete to cool gradually to the ambient temperature. If water curing has been used, do not expose concrete to temperatures below those shown in Table 3 until at least 24 hours after water curing has been terminated and air-dry concrete for at least 3 days prior to first exposure to freezing temperatures.
8. During periods not defined as cold weather, but when freezing temperatures are expected or occur, protect concrete surfaces from freezing for the first 24 hours after placing.

D. Hot Weather Concreting:

1. For this Specification, 'hot weather' is defined as any combination of high air temperatures, low relative humidity, and wind velocity which produces a rate of evaporation as estimated in ACI 305R, approaching or exceeding 0.2 pounds per square foot per hour.
2. Batch, deliver, place, cure, and protect concrete during hot weather in compliance with the recommendations of ACI 305R and the additional requirements of this Section.

    a. Temperature of concrete being placed shall not exceed 90 degrees F. Maintain a uniform concrete mix temperature below this level. The temperature of the concrete shall not cause loss of slump, flash set or cold joints.
    b. Promptly deliver concrete to the site and promptly place the concrete upon its arrival at the site, not exceeding the maximum time interval specified in Paragraph 3.2 N.4. Provide vibration immediately after placement.
    c. The Engineer may direct the Contractor to immediately cover concrete with sheet curing material.

3. Review hot weather concreting plan at preconstruction meeting. Include methods and procedures for use during hot weather, including production, placement, and curing.

3.9 REMOVAL OF FORMS

A. Do not remove forms before concrete has attained a strength of at least 70 percent of its specified design strength for beams and slabs and at least 30 percent of its specified design strength for walls and vertical surfaces, nor before reaching the following number of day-degrees of curing, whichever is longer.

TABLE 4

Forms for	Degree Days
Beams and slabs	500
Walls and vertical surfaces	100

(See definition of degree-days in Paragraph 3.8C).

B. Do not remove shores until concrete has attained at least 70 percent of its specified design strength and also sufficient strength to support safely its own weight and construction live loads.

C. In cold weather when temperature of concrete exceeds ambient air temperature by 20 degrees F at the end of the protection period, loosen forms and leave in place for at least 24 hours to allow concrete to cool gradually to ambient air temperature.

3.10 FIELD QUALITY CONTROL

A. Section 01400 - Quality Control: Requirements for inspecting and testing.

B. Section 01665 “Equipment Testing and Start-Up”: Requirements for testing, adjusting, and balancing.

C. Perform inspection and testing according to ACI 318 and Florida Building Code.

D. Provide unrestricted access to Work and cooperate with appointed testing and inspection firm.

E. Submit proposed mix design of each class of concrete to inspection and testing firm for review and approval prior to commencement of Work.

F. Concrete Inspections:

1. Continuous Placement Inspection: Inspect for proper installation procedures.
2. Periodic Curing Inspection: Inspect for specified curing temperature and procedures.

G. Strength Test Samples:

1. Sampling Procedures: Comply with ASTM C 172.
2. Cylinder Molding and Curing Procedures:

    a. Comply with ASTM C 31.
    b. Cylinder Specimens: Standard cured.

3. Sample concrete and make one set of five cylinders for every 100 cu. yd. or less of each class of concrete placed each day, and for every 5,000 sq. ft. of surface area for slabs and walls. Form specimens in 6 inch diameter by 12 inch long non-absorbent cylindrical molds.
4. If volume of concrete for a class of concrete would provide less than five sets of cylinders, take samples from five randomly selected batches, or from every batch, if less than five batches are used.
5. Make one additional cylinder during cold weather concreting and field cure.

H. Field Testing:

1. Slump Test Method: Comply with ASTM C 143.
2. Air Content Test Method: Comply with ASTM C 173.
3. Temperature Test Method: Comply with ASTM C 1064.

4. Compressive Strength Concrete:

    a. Measure slump and temperature for each sample. When concrete is pumped, slump will be determined at point of truck discharge. If the slump is outside the specified range, the concrete will be rejected.
    b. Measure air content in air-entrained concrete for each sample. Air content for concrete made of ordinary aggregates having low absorption shall be made in compliance with either the pressure method complying with ASTM C 231 or by the volumetric method complying with ASTM C 173. If aggregates with high absorptions are used, use the latter test method. When concrete is pumped, air content will be determined at point of placement.

I. Cooperate in the making of tests by allowing free access to the work for the selection of samples. Provide four firmly braced, insulated, heated, closed wooden curing boxes, each sized to hold ten specimens, complete with cold weather temperature and hot weather temperature control thermostat for initial curing and storage from time of fabrication until shipment to the testing lab. Protect the specimens against injury or loss through construction operations. Furnish material and labor required for purpose of taking concrete cylinder samples. Owner will pay for shipping of specimens.

J. Cylinder Compressive Strength Testing:

1. Test Method: Comply with ASTM C 39.
2. Test Acceptance: According to ACI 318.
3. Test one cylinder at seven days.
4. Test one cylinder at fourteen days.
5. Test two cylinders at 28 days.
6. Retain one cylinder for 56 days for testing when requested by Engineer.
7. Dispose of remaining cylinders if testing is not required.
8. When the average 28 day compressive strength of the cylinders in any set falls below the required compressive strength or below proportional minimum seven-day or 14-day strengths (where proper relation between seven, 14 and 28 day strengths have been established by tests), change proportions, cementitious content, or temperature conditions to achieve the required strengths without additional compensation.

K. Core Compressive Strength Testing:

1. The Engineer may have cores taken from any questionable area in the concrete work such as construction joints and other locations as required for determination of concrete quality. Use results of tests on such cores as basis for acceptance, rejection, or determining the continuation of concrete work. The right of the Engineer to take such cores shall not be construed as creating any obligation to take such cores, and not exercising this right to do so shall not relieve Contractor from meeting specification requirements. Cooperate in obtaining cores by allowing free access to the work and permitting the use of ladders, scaffolding, and such incidental equipment as may be required. Repair core holes with non-shrink grout as specified in Section 03600 - Grouting. Work of cutting, testing, and repairing the cores will be at the expense of Contractor if defective work is uncovered. If no defective work is found, such cost will be at the expense of Owner.

2. Sampling and Testing Procedures: Comply with ASTM C 42.
3. Test Acceptance: According to ACI 318.
4. Drill three cores for each failed strength test from failed concrete.

L. Patching:

1. Allow Engineer to inspect concrete surfaces immediately upon removal of forms.
2. It is the intent of these Specifications to require quality work including forming, mixing, and placement of concrete and curing so completed concrete surfaces will require no patching or repairs.
3. As soon as forms have been stripped and concrete surfaces exposed: remove fins and other projections; fill recesses left by the removal of form ties; and repair surface defects which do not impair structural strength. Clean exposed concrete surfaces and adjoining work stained by leakage of concrete.
4. Immediately after removal of forms, remove tie cones and metal portions of ties as specified in Section 03100 - Concrete Forming and Accessories. Fill holes promptly upon stripping as follows: Moisten the hole with water, followed by a 1/16 inchbrush coat of neat cement slurry mixed to consistency of a heavy paste. Immediately plug hole with a 1 to 1.5 mixture of cement and concrete sand mixed slightly damp to the touch (just short of "balling"). Hammer grout into the hole until dense, and an excess of paste appears on the surface in the form of a spider web. Trowel smooth with heavy pressure. Avoid burnishing.
5. When filling tie cone holes and patching or repairing exposed surfaces use the same source of cement and sand as used in the parent concrete. Adjust color to match by addition of white cement. Rub lightly with a fine carborundum stone at an age of one to five days as necessary to bring surface down with parent concrete. Do not damage or stain virgin skin of surrounding parent concrete. Wash thoroughly to remove rubbed matter.
6. For very heavy (generally formed) patches, the Engineer may order the addition of pea gravel to the mixture and the proportions modified as follows:

Material	Volumes	Weights
Cement	1.0	1.0
Sand	1.0	1.0
Pea Gravel	1.5	1.5

7. Patch imperfections as directed by Engineer according to ACI 318.
8. Defective concrete and honeycombed areas: Chip down square and at least 1 inch 1-in deep to sound concrete with hand chisels or pneumatic chipping hammers. Irregular voids or surface stones need not be removed if they are sound, free of laitance, and firmly embedded in the parent concrete. If honeycomb exists around reinforcement, chip to provide a clear space at least 3/8 inch wide around the steel. For areas less than 1-1/2 inches deep, the patch may be made in the same manner as described above for filling form tie holes, care being exercised to use adequately dry (non-trowelable) mixtures and to avoid sagging. Thicker repairs will require build-up in successive 1-1/2 inch layers on successive days, each layer being applied with slurry as described above.

M. Defective Concrete:

1. Description: Concrete not conforming to required lines, details, dimensions, tolerances, or specified requirements.
2. Repair or replacement of defective concrete will be determined by Engineer.
3. Do not patch, fill, touch up, repair, or replace exposed concrete except upon express direction of Engineer for each individual area.

3.11 FAILURE TO MEET REQUIREMENTS

A. Should the strengths shown by the test specimens made and tested in compliance with the previous provisions fall below the values given in Table 1, the Engineer may require changes in proportions or materials, or both, to apply to the remainder of the work in accordance with Paragraph 1.7E. Furthermore, the Engineer may require additional curing on those portions of the structure represented by the test specimens which fall below the values given in Table 1. The cost of such additional curing shall be at no additional cost to the Owner. In the event that such additional curing does not give the strength required, as evidenced by core and/or load tests, the Engineer may require strengthening or replacement of those portions of the structure which fail to develop the required strength. Coring and testing and/or load tests and any strengthening or concrete replacement required because strengths of test specimens are below that specified, without additional compensation. In such cases of failure to meet strength requirements, Contractor and Owner shall confer to determine what adjustment, if any, can be made in compliance with Sections titled "Strength" and "Failure to Meet Strength Requirements" of ASTM C 94. The "purchaser" referred to in ASTM C 94 is the Contractor.

B. When the tests on control specimens of concrete fall below the required strength, the Engineer will permit check tests for strengths to be made by means of typical cores drilled from the structure in compliance with ASTM C 42 and C 39. In cases where tests of cores fall below the values given in Table 1, the Engineer, in addition to other recourses, may require load tests on any one of the slabs, walls, beams, and columns in which such concrete was used. Test need not be made until concrete has aged 60 days. The Engineer may require strengthening or replacement of those portions of the structure which fail to develop the required strength. Perform coring and testing, load tests, and any strengthening or concrete replacement required because strengths of test specimens are below that specified, without additional compensation.

C. Should the strength of test cylinders fall below 60 percent of required minimum 28 day strength, concrete shall be rejected, removed, and replaced without additional compensation.

3.12 SCHEDULE

A. Following Table 5 are general applications for various concrete classes and design strengths:

TABLE 5

Class	Design Strength (psi)	Description
A	2,500	Concrete fill, electrical raceway encasement and pipe encasement.
B	3,000	Where specified or noted.
E2	4,500	Structural concrete greater than 10 inches in thickness including walls, slabs on grade, elevated slab and beam systems, and all other structural concrete greater than 10 inches in thickness.
E3	4,500	Structural concrete 10 inches or less in thickness including walls, slabs on grade, elevated slab and beam systems, and all other structural concrete 10 inches or less in thickness.

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SECTION 03350

CONCRETE FINISHING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Finishing of concrete.
2. Floor surface treatment.

B. Related Requirements:

1. Section 03100 - Concrete Forming and Accessories: Cast-in-place concrete formwork, form ties and form release agent.
2. Section 03150 - Concrete Joints and Accessories: Waterstops, premolded joint filler, sealant and neoprene bearing pads.
3. Section 03300 - Cast-in-Place Concrete: Cast-in-place concrete.
4. Section 03390 - Concrete Curing: Procedures for curing horizontal and vertical concrete surfaces.

1.3 COORDINATION

A. Coordinate Work of this Section with concrete placement and concrete curing.

1.4 ACTION SUBMITTALS

A. Section 01330 - Submittal Procedures: Requirements for submittals.

B. Product Data: Submit manufacturer information on curing compounds, compatibilities, and limitations.

1.5 INFORMATIONAL SUBMITTALS

A. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

B. Field Quality-Control Submittals: Indicate results of Contractor-furnished tests and inspections.

C. Qualifications Statements:

1. Submit qualifications for manufacturer and applicator.
2. Submit manufacturer's approval of installer.

1.6 CLOSEOUT SUBMITTALS

A. Section 01770 “Closeout Procedures.”

B. Operation and Maintenance Data: Submit information on maintenance renewal of applied coatings.

1.7 QUALITY ASSURANCE

A. Perform Work according to ACI 301 and 302.1.

1.8 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum three years' documented experience.

B. Applicator: Company specializing in performing Work of this Section with minimum three years' documented experience and approved by manufacturer.

1.9 RESPONSIBILITY FOR CHANGING FINISHES

A. The surface finishes specified for concrete to receive coatings or other finish materials are those required for the proper application of the products specified under other Sections. Where products different from those specified are approved for use, determine if changes in finishes are required and provide the proper finishes to receive these products.

B. Perform changes in finishes made to accommodate products different from those specified at no additional compensation. Submit proposed new finishes to the Engineer for approval.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Section 01600 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.

B. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.

C. Store materials according to manufacturer instructions.

D. Protection:

1. Protect materials from moisture and dust by storing in clean, dry location remote from construction operations areas.
2. Provide additional protection according to manufacturer instructions.

1.11 AMBIENT CONDITIONS

A. Section 01500 - Temporary Facilities and Controls: Requirements for ambient condition control facilities for product storage and installation.

B. Temporary Heat: Maintain minimum ambient temperature of 50 deg. F.

C. Ventilation: Sufficient to prevent injurious gases from temporary heat or other sources from affecting personnel or concrete.

PART 2 - PRODUCTS

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that floor surfaces are acceptable to receive Work of this Section.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 FORMED SURFACES

A. Form Removal: Conform to Sections 03100 and 03300.

B. Clean exposed concrete surfaces and adjoining work stained by leakage of concrete.

C. Off-Form Finish:

1. Remove fins and other projections and fill tie cones and defects as specified in Section 03100 “Concrete Forming and Accessories”.

D. Rubbed Finish:

1. Immediately upon stripping forms and before concrete changes color, carefully remove fins with a hammer. While surface is still damp apply a thin coat of medium consistency neat cement slurry using bristle brushes to provide a bonding coat within pits, air holes or blemishes in parent concrete. Do not coat large areas of the surface with this slurry.
2. Before slurry dries or changes color, apply a dry (almost crumbly) grout consisting of one volume cement to 1-1/2 volumes of clean masonry sand having a fineness modulus of

approximately 2.25 and complying with gradation requirements of ASTM C 144. Apply grout uniformly using damp (neither dripping wet nor dry) pads of coarse burlap approximately 6 inch square used as a float. Scrub grout into pits and air holes to provide a dense mortar in concrete imperfections to be patched.

3. Allow mortar to partially harden for one or two hours depending upon weather. If the air is hot and dry, keep surface damp during this period using a fine, fog spray. When grout has hardened sufficiently so it can be scraped from the surface with perpendicular edge of a steel trowel without damaging the grout in small pits or holes, cut off grout that can be removed with a trowel. Grout allowed to remain on surface too long will get too hard and will be difficult to remove.
4. Allow the surface to dry and rub it vigorously with clean dry burlap to completely remove dried grout. No visible film of grout should remain after this rubbing. Entire cleaning operation for any area must be completed the day it is started. Do not leave grout on surfaces overnight. Allow grout to dry after it has been cut off with trowel so it can be wiped off clean with the burlap.
5. On the day following repair of pits, air holes, and blemishes, wipe surfaces clean with dry, used pieces of burlap containing old hardened mortar, which will act as a mild abrasive. After this treatment, there should be no built-up film remaining on the parent surface; if however a built-up film remains, use a fine abrasive stone to remove such material without breaking through original concrete surface film. Scrub lightly to remove excess material without working up a lather or mortar or changing concrete texture.
6. Follow final bagging or stoning operation with a thorough wash-down with stiff bristle brushes to remove extraneous materials from the surface. Spray surface with a fine fog spray periodically to maintain a continually damp condition for at least 3 days after repair grout application.
7. Rubbed Finish application may be deleted by the Engineer if unfinished concrete surface is of superior quality and without surface voids.

3.3 FLOORS AND SLABS

A. Consider the potential for longer setting time in concrete containing fly ash or ground granulated blast furnace slag.

B. Compact with internal vibrators as specified in Section 03300 “Cast-In-Place Concrete” and screed to established grades.

C. Following screeding as specified above, float slabs as approved by the Engineer. Continue floating operation until sufficient mortar is brought to surface to fill voids. Test surfaces with a straightedge to detect and eliminate high and low spots. Do not overwork concrete as evidenced by excess water and fine material on its surface.

D. Do not use "jitterbugs" or other special tools designed for the purpose of forcing the coarse aggregate away from the surface and allowing a layer of mortar to accumulate on any slab finish. Do not dust surfaces with dry materials. Round off edges of slabs and tops of walls with a steel edging tool. Use steel edging tool with radius of 1/4 inchfor slabs subject to wheeled traffic.

E. Measure floor flatness the day after a concrete floor is finished and before the shoring is removed, in order to eliminate any effects of shrinkage, curling, and deflection.

F. Finish Descriptions:

1. Steel Trowel Finish:

   a. Finish by screeding and floating with straightedges to bring the surfaces to indicated elevations. While concrete is still green, but sufficiently hardened to bear a person's weight without deep imprint, wood float surface to a true and even plane with no coarse aggregate visible.
   b. Apply sufficient pressure on wood floats to bring moisture to the surface. After surface moisture has disappeared, hand steel trowel to produce a smooth, impervious surface, free from trowel marks.
   c. Trowel the surface again for the purpose of burnishing. Final troweling shall produce a ringing sound from the trowel.
   d. Do not use dry cement or additional water in troweling.

2. Wood Float Finish:

   a. Finish by screeding with straightedges to bring the surfaces to indicated elevations.
   b. Use a wood float to compact and seal surface. Remove laitance and leave a clean surface.

3. Light Broomed Finish:

   a. Steel trowel finish, as specified above, but omit final troweling and finish by drawing a fine-hair broom lightly across concrete surface.
   b. Broom in direction and parallel to expansion joints, or in the case of inclined slabs, perpendicular to slope or as directed otherwise.

4. Broomed Finish:

   a. Steel trowel finish, as specified above, but omit the final troweling
   b. While the concrete is still soft enough, finish the surface with a stiff coarse fiber broom to produce the pattern and depth of scoring as approved by the Engineer.

5. Power Machine Finish:

   a. In lieu of hand steel trowel finishing, use an approved power machine for finishing concrete floors and slabs in accordance with directions of machine manufacturer and as approved by the Engineer.
   b. Do not use a power machine until the concrete has attained necessary set to allow finishing without introducing high and low spots in the slab.
   c. Hand steel trowel those areas of slabs not accessible to power equipment. Provide a final steel troweling done by hand over all areas.

3.4 TOLERANCES

A. Section 01400 - Quality Requirements: Requirements for tolerances.

B. Measure for FF and FL tolerances for floors and slabs according to ASTM E 1155, within 48 hours after slab installation.

3.5 FIELD QUALITY CONTROL

A. Section 01400 - Quality Requirements: Requirements for inspecting and testing.

B. Acceptance:

1. Areas requiring corrective Work will be identified by Engineer.
2. Correct defects in defined floor or slab by grinding or removal and replacement of defective Work.
3. Remeasure corrected areas by procedure as specified in TOLERANCES Article.

3.6 SCHEDULE OF FINISHES

A. Finish concrete in various specified manners either to remain as natural concrete or to receive an additional applied finish or material under another Section. Where products different from those specified are approved for use, comply with requirements of PART 1 Article entitled "Responsibility for Changing Finishes."

B. Finish base concrete for following grouped conditions as scheduled in following Paragraphs and as further specified in this Section.

C. Exposed Exterior Concrete:

1. Concrete for exterior on stairs and other horizontal areas: Broomed finish, non-slip.
2. Tops of curbs and pads: Steel trowel finish.

D. Exposed Interior Concrete:

1. Exposed interior concrete including underside slabs, beams, walls, columns and stairs and sides of openings, beams and stairs: Rubbed finish.
2. Concrete for interior walking surfaces, excluding stairs: Wood float finish.
3. Concrete for interior stairs and metal pan stairs: Light broomed finish, non-slip.

E. Concrete Associated with Structures:

1. Exposed exterior concrete excluding slabs and walking surfaces: Rubbed finish. Rub open tank walls above and to 1 foot below normal water line.
2. Walls of open topped tanks: Rubbed finish above and to 1 foot below normal water line. Off-form finish from 1 foot below normal water line to base of wall.

3. Concrete stairs, landings and platforms below normal water level in liquid retaining structures: Broomed finish, non-slip.
4. Concrete on which liquids flow or are contained: Steel troweled finish.
5. Concrete tank bottoms to be covered with grout: Broom finish as approved. Refer to Section 03600 “Grouting” for additional requirements.

F. Concrete to Receive Additional Finishes or Coatings:

1. Concrete to receive paint: Rubbed finish.

G. Miscellaneous Concrete:

1. Concrete not exposed in finished work and not scheduled to receive an additional applied finish or material: Off-form finish at vertical surfaces, consolidate and screed to grade at horizontal surfaces.

END OF SECTION

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SECTION 03390

CONCRETE CURING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes: Initial and final curing of horizontal and vertical concrete surfaces.

B. Related Requirements:

1. Section 03300 - Cast-in-Place Concrete: Coordinate Work of this Section with concrete placement, including Hot and Cold Weather and other environmental factors affecting concreting procedures.
2. Section 03350 - Concrete Finishing: Surface finishing of concrete slabs and walls.

1.3 ACTION SUBMITTALS

A. Section 01300 “Submittals”: Requirements for submittals.

B. Product Data: Submit manufacturer's information on curing compounds, mats, paper, sheets, and film, including compatibilities and limitations.

1.4 INFORMATIONAL SUBMITTALS

A. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

B. Manufacturer Instructions: Submit detailed instructions on installation requirements, including storage and handling procedures.

C. Qualifications Statement:

1. Submit qualifications for manufacturer.

1.5 QUALITY ASSURANCE

A. Perform Work according to ACI 350.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum three years' documented experience.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Section 01600 “Material and Equipment”: Requirements for transporting, handling, storing, and protecting products.

B. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.

C. Store materials according to manufacturer instructions.

D. Protection:

1. Protect materials from moisture and dust by storing in clean, dry location.
2. Provide additional protection according to manufacturer instructions.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Membrane-Curing Compound, Type A:

1. Comply with ASTM C 309, Type 1D, Class A, containing no wax, paraffin or oil and be non-yellowing.
2. Comply with Federal, State and local VOC limits.

B. Water: Potable; not detrimental to concrete.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 01665 “Equipment Testing and Start-Up”: Requirements for application examination.

B. Verify that substrate surfaces are ready to be cured.

3.2 APPLICATION

A. Curing Methods for Concrete Surfaces: Cure concrete to retain moisture and maintain a temperature of at least 50 degrees Fat concrete surface for a minimum of seven days after placement. Use the following curing methods as specified:

1. Water Curing: Keep entire concrete surface wet by ponding, continuous sprinkling, or covered with saturated burlap. Begin water curing as soon as concrete attains an initial set and maintain water curing 24 hours a day. Do not permit concrete surface to dry out at any time during curing period. Provide temperature of curing water within 20 degrees Fof concrete temperature.
2. Sheet Material Curing: Cover entire surface with sheet material. Anchor sheeting to prevent wind and air from lifting the sheeting or entrapping air under the sheet. Place and secure sheet as soon as initial concrete set occurs.
3. Membrane Curing: Apply over entire concrete surface except as follows.

    a. Do not apply curing compound on any concrete surface where additional concrete or grout is to be placed, where concrete sealers or surface coatings are to be used, or where concrete finish requires an integral floor product.
    b. Apply curing compound as soon as free water on the surface has disappeared and no water sheen is visible.
    c. Do not apply after the concrete is dry or when curing compound can be absorbed into the concrete. Apply in compliance with manufacturer's recommendations.

B. Specified Applications of Curing Methods:

1. Slabs for Liquid Retaining Structures: Water cure only.
2. Slabs on Grade and Footings (not used to retain liquids): Water cure or sheet material cure or membrane cure.
3. Structural Slabs (other than Liquid Retaining Structures): Water cure or membrane cure.
4. Horizontal Surfaces which will Receive Additional Concrete, Coatings, Grout or Other Material that Requires Bond to the substrate: Water cure.
5. Formed Surfaces:

    a. No curing, if nonabsorbent forms are left in place seven days.
    b. Water cure if absorbent forms are used.
    c. Water cure if forms are removed prior to seven days.
    d. Sheet cure or membrane cure if forms are removed prior to seven days.
    e. Water cure exposed horizontal surfaces of formed walls or columns for seven days or until next placement of concrete is made.

6. Surfaces of Concrete Joints: Water cure or sheet material cure.

C. Protect finished surfaces and slabs whenever ambient conditions of humidity, temperature, sunlight and wind may result in the rapid evaporation of water from the concrete, to prevent checking and crazing, until the beginning of curing.

3.3 PROTECTION

A. Section 01600 “Material and Equipment”: Requirements for protecting finished Work.

B. Do not permit traffic over unprotected surfaces.

C. Reference Section 03300 “Cast-In-Place Concrete” for additional protection requirements.

END OF SECTION

SECTION 03600

GROUTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Nonshrink cementitious grout.

B. Related Requirements:

1. Section 02222 “Selective Demolition”: Demolition and removals.
2. Section 03100 “Concrete Forming and Accessories.”
3. Section 03300 “Cast-in-Place Concrete.”
4. Section 03320 “Concrete Reinforcing.”
5. Section 05502 “Metal Fabrications: Grout related to miscellaneous metals.”

1.3 ACTION SUBMITTALS

A. Section 01300 “Submittals”: Requirements for submittals.

B. Product Data: Submit manufacturer information regarding grout and surface preparation, mixing and installation.

1. Commercially manufactured nonshrink cementitious grout. Include catalog cuts, technical data, storage requirements, product life, working time after mixing, temperature considerations, and conformity to the specified ASTM standards.

1.4 INFORMATIONAL SUBMITTALS

A. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

B. Manufacturer Instructions: Submit instructions for mixing, handling, surface preparation, and placing epoxy-type and nonshrink grouts.

C. Field Quality-Control Submittals: Indicate results of Contractor-furnished tests and inspections.

D. Qualifications Statement:

1. Submit qualifications for manufacturer.

1.5 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum ten years' experience in production and use of provided grouts.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Section 01600 “Material and Equipment”: Requirements for transporting, handling, storing, and protecting products.

B. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.

C. Store materials according to manufacturer instructions. Limit total storage time from date of manufacture to date of installation to six months or the manufacturer’s recommended storage time, whichever is less.

D. Remove immediately from the site material which becomes damp, contains lumps, or is hardened and replace with acceptable material.

E. Protection:

1. Protect materials from moisture and dust by storing in clean, dry location.
2. Provide additional protection according to manufacturer instructions.

1.7 AMBIENT CONDITIONS

A. Section 01500 “Construction Facilities”: Requirements for ambient condition control facilities for product storage and installation.

B. Maximum Conditions: Do not perform grouting if temperatures exceed 90 degrees F.

C. Minimum Conditions: Do not perform grouting if the minimum temperature of base plates, supporting concrete and grout are less than 40 degrees F. Maintain minimum temperature of 40 degrees F before, during, and after grouting, until grout has set.

PART 2 - PRODUCTS

2.1 NONSHRINK CEMENTITIOUS GROUT

A. Description:

1. Pre-mixed and ready-for-use formulation requiring only addition of water.
2. Nonshrink, non-corrosive, nonmetallic, non-gas forming, not containing expansive cement and no chlorides.
3. No shrinkage when tested in conformity with ASTM C 827/C 827M.

B. Performance and Design Criteria:

1. Certified to maintain initial placement volume or expand after set, and to meet following minimum properties when tested according to ASTM C 1107/C 1107M for Grades B, C, D and CRD-C621 nonshrink grout:

a. Setting Time:

1) Initial: Approximately two hours.
2) Final: Approximately three hours.
3) Comply with ASTM C 191.

b. Maximum Expansion: 0.10 to 0.40 percent.
c. Minimum Compressive Strength:

1) One-Day: 4,000 psi.
2) Seven-Day: 7,000 psi.
3) 28-Day: 10,000 to 10,800 psi.
4) Comply with CRD-C621.

2.2 FORMWORK

A. As specified in this Section and in Section 03100 “Concrete Forming and Accessories”.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 01665 “Equipment Testing and Start-Up”: Requirements for installation examination.

B. Verify areas to receive grout.

3.2 PREPARATION

A. Section 01665 “Equipment Testing and Start-Up”: Requirements for installation preparation.

B. Place grout where indicated or specified over existing concrete and cured concrete which has attained its specified design strength unless otherwise approved by the Engineer.

C. Remove defective concrete, ice, laitance, dirt, oil, grease, form release agents, paints and other foreign material from concrete surfaces, which may affect the bond or performance of the grout by brushing, hammering, chipping, sand blasting or other similar dry mechanical means until sound and clean concrete surface is achieved. Irregular voids or projecting coarse aggregate need not be removed if they are sound, free of laitance and firmly embedded into the parent concrete.

1. Air compressors used to clean surfaces in contact with grout shall be the oil-less type or equipped with an oil trap in the airline to prevent oil from being blown onto the surface.

D. Roughen concrete lightly, but not to interfere with placement of grout.

E. Remove foreign materials from metal surfaces in contact with grout.

F. Align, level, and maintain final positioning of components to be grouted.

G. Wash concrete surfaces clean and then keep moist for at least 24 hours prior to the placement of nonshrink cementitious or cement grout. Saturation may be achieved by covering the concrete with saturated burlap bags, use of a soaker hose, or flooding the surface or other method acceptable to the Engineer. Upon completion of the 24 hour period, remove visible water from the surface prior to grouting.

H. Support equipment during alignment and installation of grout by shims, wedges, blocks or other approved means. Prevent bond of shims, wedges and blocking devices by bond breaking coatings and remove after grouting unless otherwise approved by the Engineer. Grout voids created by the removal of shims, wedges, and blocks.

3.3 INSTALLATION - GENERAL

A. Formwork:

1. Construct leakproof forms anchored and shored to withstand grout pressures.
2. Install formwork with clearances to permit proper placement of grout.
3. As specified in Section 03100 “Concrete Forming and Accessories”.

B. Placing of Grout:

1. Place grout material quickly and continuously.
2. Do not use pneumatic-pressure or dry-packing methods.
3. Apply grout from one side only to avoid entrapping air.

4. Do not vibrate placed grout mixture or permit placement if area is being vibrated by nearby equipment.
5. Thoroughly compact final installation and eliminate air pockets.
6. Do not remove leveling shims for at least 48 hours after grout has been placed.

C. Curing:

1. Prevent rapid loss of water from grout during first 48 hours by use of approved membrane curing compound or by using wet burlap bags, soaker hoses or ponding.
2. Immediately after placement, protect grout from premature drying, excessively hot or cold temperatures, and mechanical injury.
3. After grout has attained its initial set, keep damp for minimum three days.

D. Reflect all existing underlying expansion joints, partial contraction joints, and construction joints through the grout.

E. Remove debris and clean the surface by sweeping and vacuuming of all dirt and other foreign materials. Pressure wash the surface. Do not flush debris into tank drain lines.

F. Saturate the concrete surface for at least 24 hours prior to placement of the concrete grout by use of saturated burlap bags, soaker hoses or ponding. Remove excess water just prior to placement of the concrete grout. Place a cement slurry immediately ahead of the concrete grout so that the slurry is moist when the grout is placed. Work the slurry over the surface with a broom until it is coated with approximately 1/16 to 1/8-in thick cement paste.

G. Steel trowel finish as specified in Section 03350 “Concrete Finishing.” Cure the concrete grout as specified for cast-in-place concrete in Section 03300 “Cast-In-Place Concrete.”

3.4 SCHEDULE

A. Use particular types of grout as follows:

1. General Purpose Nonshrink Cementitious Grout (CRD-C621 Grade D): Use at locations where nonshrink grout is indicated, except for base plates greater in area than 3-feet wide by 3-feet long.
2. Flowable (precision) Nonshrink Cementitious Grout (CRD-C621 Grade B or C): Use under base plates greater in area than 3-feet wide by 3-feet long. Use at locations indicated to receive flowable (precision) nonshrink grout. Flowable (precision), nonshrink, cementitious grout may be substituted for general purpose nonshrink cementitious grout.

END OF SECTION

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SECTION 05051

POST-INSTALLED ANCHORS AND REINFORCING BARS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Post-installed adhesive and expansion anchors for concrete substrates.
2. Post-installed reinforcing bar dowels using adhesive anchoring system.

B. Related Requirements:

1. Section 03300 “Cast-In-Place Concrete” and related Sections for concrete, reinforcement, and accessories.
2. Various Sections in Divisions 2 and 15 related to facility utilities.
3. Various Sections in Division 11 related to process mechanical equipment.

1.3 ACTION SUBMITTALS

A. Submit in accordance with Section 01300 “Submittals”.

B. Post-Installed Expansion Anchors:

1. Design Data: Submit manufacturer’s specifications and data including recommended design values and physical characteristics for expansion anchors.
2. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, materials and finishes for post-installed expansion anchors installed into cracked concrete.
3. Installation Procedures: Submit procedures stating product proposed for use, and complete installation method.

C. Post-Installed Adhesive Anchoring System:

1. Design Data: Submit manufacturer’s specifications and data including recommended design values and physical characteristics, including temperature, humidity, and moisture limitations for adhesive anchoring system.

2. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, materials and finishes for post-installed adhesive anchoring system installed into cracked concrete.
3. Installation Procedures: Submit procedures stating method of drilling, product proposed for use, and complete installation method.

1.4 INFORMATIONAL SUBMITTALS

A. Installation procedure: Submit installation procedure for post-installed adhesive anchoring system; including method of drilling.

B. Certificates:

1. Submit current International Code Council (ICC) Evaluation Service Reports (ESR) for expansion anchors and adhesive anchoring system, for installation into cracked concrete, as applicable, indicating conformance with current ICC Evaluation Service (ICC-ES) Acceptance Criteria.

1.5 QUALITY ASSURANCE

A. General: Coordinate with the work of other Sections, field verifying dimensions and work of other trades adjoining items of work before installing items specified in this Section.

1.6 DELIVERY, STORAGE AND HANDLING

A. Deliver items to be incorporated into the work of other trades in sufficient time to be checked prior to installation.

B. Handle materials with cranes or derricks. Do not dump material off transportation vehicles or handle in ways that will cause damage.

C. Store materials elevated above grade and block up so they will not become bent or otherwise damaged.

D. Repair items that have become damage or corroded to satisfaction of the Engineer prior to incorporating them into the work.

PART 2 - PRODUCTS

2.1 EXPANSION ANCHORS

A. Fastening to Concrete Substrate: Zinc plated carbon steel wedge type anchors, complete with zinc plated nuts and washers, unless otherwise noted.

B. Submerged or Weather Exposed Substrates: ASTM A276 Type 316 stainless steel wedge type anchors, complete with Type 316 stainless steel nuts and washers, unless otherwise noted.

C. Meet ICC ES AC01 or ICC ES AC193.

D. Length: When length or anchor embedment is not indicated, provide length sufficient to place the wedge and expansion cone portion of the anchor at least 1 inch behind concrete reinforcing steel.

E. Basis-of-Design:

1. Anchorage designs indicated are based on Hilti, Kwik-Bolt TZ, unless otherwise noted.
2. Acceptable Anchors: Hilti Kwik-Bolt TZ; Simpson Strong-Tie Strong Bolt 2 Wedge Anchor; DeWalt Power-Stud+ SD1 (DeWalt Power-Stud+ SD6 for stainless steel); or equal.

2.2 ADHESIVE ANCHORING SYSTEM

A. Fastening to Concrete Substrate: Manufactured system consisting of post installed threaded rods, nuts, washers, other anchoring hardware, and chemical dispenser for installation in hammer drilled holes.

1. Anchors: Meet ICC ES AC308.
2. Injection Adhesive: Two-component epoxy system consisting of a hardener and a resin, furnished in pre-measured side-by-side cartridges which keep both components separate.
3. Adhesive Cartridge: Side-by-side design to accept a static mixing nozzle which thoroughly blends both components and allows injection directly into a drilled hole.
4. Anchor: or Type 316 stainless steel as indicated consisting of an all-thread anchor rod with nut and washer, of matching material to anchor rod.

a. Basis-of-Design:

1) Anchorage designs indicated are based on Hilti HIT- HY 200, unless otherwise noted.
2) Acceptable Manufacturers: Hilti HIT- HY 200; Simpson Strong Tie SET-XP; ITW Ramset Red Head Epcon G5+; or equal.

5. Reinforcing Bar Dowels: Reinforcing bar, per Section 03200 “Concrete Reinforcing”.

a. Basis-of-Design:

1) Anchorage designs indicated are based on Hilti HIT- HY 200, unless otherwise noted.
2) Acceptable Manufacturers: Hilti HIT- HY 200; Simpson Strong Tie SET-XP; ITW Ramset Red Head Epcon G5+; or equal.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General:

1. Install anchoring system in strict compliance with manufacturer's published installation instructions and approved Shop Drawings. Comply with recommended surface preparation, temperature, and moisture of substrate and ambient conditions.
2. Coordinate installation with Special Inspector.
3. Use drill bit of correct diameter and drill to required depth using rotary impact type hammer drills with carbide-tipped bits.
4. Drill holes perpendicular to concrete surface, unless otherwise indicated.
5. Use oil free compressed air to blast out loose particles and dust from drilled holes.

B. Expansion anchors:

1. Check expansion anchors for tightness a minimum of 24 hours after initial installation.

C. Adhesive anchoring system:

1. Inject adhesive and install anchors and reinforcing bar dowels that are clean and free of dirt, oil, grease, ice or other deleterious material which would reduce bond.

3.2 REPAIRS

A. Repair in accordance with provisions of Section 03015 “Modifications to Existing Concrete”, including but not limited to:

1. Saw cutting and removal of damaged, loose, or unsound concrete.
2. Removal of damaged anchors and reinforcing bar dowels.
3. Cleaning and preparing concrete surface and reinforcing bar dowels.
4. Place new repair material.
5. Install new anchors and reinforcing bar dowels to replace anchors and reinforcing bar dowels that are found to be unacceptable or deficient.
6. Perform repairs at no additional cost to Owner.

END OF SECTION

SECTION 05502

METAL FABRICATIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Steel framing and supports for mechanical and electrical equipment.
2. Miscellaneous items fabricated from aluminum or stainless steel.
3. Aluminum grates.
4. Castings.
5. Loose bearing and leveling plates for applications where they are not specified in other Sections.

B. Products furnished, but not installed, under this Section include the following:

1. Anchor bolts, steel pipe sleeves, slotted-channel inserts, and wedge-type inserts indicated to be cast into concrete.

C. Related Requirements:

1. Section 03300 "Cast-in-Place Concrete" for installing anchor bolts, steel pipe sleeves, slotted-channel inserts, wedge-type inserts, and other items cast into concrete.
2. Section 03600 “Grouting” for non-shrink grout.
3. Section 05051 “Post-Installed Anchors and Reinforcing Bars” for anchors in various substrates.
4. Section 05531 “Bar Gratings” for various types of bar grating assemblies.
5. Various Sections in Division 11 for process mechanical work scopes.

1.3 COORDINATION

A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.

B. Coordinate installation of metal fabrications that are anchored to or that receive other work. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

1.4 ACTION SUBMITTALS

A. Shop Drawings: Show fabrication and installation details. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items. Provide Shop Drawings for the following:

1. Steel framing and supports for mechanical and electrical equipment.
2. Steel framing and supports for applications where framing and supports are not specified in other Sections.
3. Miscellaneous aluminum items.
4. Miscellaneous stainless steel items.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For professional engineer.

B. Mill Certificates: Signed by aluminum, steel and stainless steel manufacturers, certifying that products furnished comply with requirements.

C. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.

1.6 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
2. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."
3. AWS D1.6/D1.6M, "Structural Welding Code - Stainless steel."

C. Evaluation Reports: Post-installed concrete anchors, from ICC-ES for expansion anchors and adhesive anchor system, for installation into cracked concrete, as applicable, indicating conformance with current ICC ES Acceptance Criteria.

1.7 FIELD CONDITIONS

A. Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication.

PART 2 - PRODUCTS

2.1 METALS

A. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.

B. Steel Wide Flange Shapes: ASTM A992.

C. Steel Other Shapes, Plates, Shapes, and Bars: ASTM A 36/A 36M.

D. Stainless steel Sheet, Strip, and Plate: ASTM A 240/A 240M or ASTM A 666, Type 316 (Type 316L for welded components).

E. Stainless steel Bars and Shapes: ASTM A 276, Type 316 (Type 316L for welded components).

F. Cast Iron: Either gray iron, ASTM A 48/A 48M, or malleable iron, ASTM A 47/A 47M, unless otherwise indicated.

G. Aluminum Extruded Pipe: ASTM B429, Alloy 6063 T6 and Alloy 6061 T6 as indicated.

H. Aluminum Plate and Sheet: ASTM B 209, Alloy 6061-T6.

I. Aluminum Extrusions: ASTM B 221, Alloy 6061 T6.

J. Aluminum-Alloy Rolled Tread Plate: ASTM B 632/B 632M, Alloy 6061-T6.

K. Aluminum Castings: ASTM B 26/B 26M, Alloy 443.0-F.

L. Stainless steel Bolts: ASTM F593, Type 316.

M. Stainless steel Nuts: ASTM F594, Type 316.

N. Carbon Steel Bolts and Studs: ASTM A307, Grade A (hot dip galvanized nuts and washers where noted)

O. High Strength Steel Bolts, Nuts and washers: ASTM F3125, Grade A325 (mechanically galvanized per ASTM B695, Class 50, where noted).

1. Elevated Temperature Exposure: Type I.
2. General Application: Type I or Type II.

P. Galvanizing: ASTM A123, Zn w/0.05 percent minimum Ni.

Q. Galvanizing, hardware: ASTM A153, Zn w/0.05 percent minimum Ni.

R. Galvanizing, anchor bolts: ASTM F2329, Zn w/0.05 percent minimum Ni.

S. Welding electrodes, steel: AWS A5.1 E70xx.

2.2 FASTENERS

A. Unless otherwise noted, provide steel machine bolts for the connection of carbon steel or iron; galvanized steel or stainless-steel machine bolts for the connection of galvanized steel or iron; and stainless steel machine bolts for the connection of aluminum or stainless-steel.

B. General: Unless otherwise indicated, provide Type 316 stainless steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633 or ASTM F 1941, Class Fe/Zn 5, at exterior walls. Select fasteners for type, grade, and class required.

1. Provide stainless steel fasteners for fastening aluminum.
2. Provide stainless steel fasteners for fastening stainless steel.

C. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A 307, Grade A; with hex nuts, ASTM A 563; and, where indicated, flat washers.

D. Mechanically Galvanized Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM F 3125, Grade A325, Type 3; with hex nuts, ASTM A 563, Grade C3; and, where indicated, flat washers.

E. Stainless steel Bolts and Nuts: Regular hexagon-head annealed stainless steel bolts, ASTM F 593; with hex nuts, ASTM F 594; and, where indicated, flat washers; Alloy Group 2.

F. Machine bolts and nuts conforming to Federal Specification FF-B-575C. Bolts and nuts shall be hexagon type. Bolts, nuts, screws, washers and related appurtenances shall be Type 316 stainless steel.

G. Toggle Bolts: shall be Hilti, Toggler Bolt or equal.

2.3 MISCELLANEOUS ALUMINUM

A. Miscellaneous Aluminum: Formed true to detail, with clean, straight, sharply defined profiles and smooth surfaces of uniform color and texture and free from defects impairing strength or durability. Drill or punch holes. Smooth edges without burrs. Fabricate supplementary pieces necessary to complete each item though such pieces are not definitely shown or specified.

B. Connections and Accessories: Sufficient strength to safely withstand the stresses and strains to which they will be subjected. Close fitting exposed joints and jointed where least conspicuous. Conceal threads on threaded connections where practical. Provide continuous welds or

intermittent welds on welded connections as specified or shown. Dress face of welds flush and smooth. Weld on unexposed side as much as possible in order to prevent pitting or discoloration of the aluminum exposed surface. Provide holes for temporary field connections and for attachment of the work of other trades.

C. Miscellaneous Aluminum Items: Beams, angles, closure angles, grates, floor plates, stop plates, stair nosings, and other miscellaneous aluminum indicated and not otherwise specified.

D. Angle Frames for Roof Hatches, Beams, Grates, and Similar Items: Complete with welded strap anchors attached.

E. Aluminum Finishes:

1. Anodized Finish: Give an anodic oxide treatment in accordance with AA M31C22A41 for the following items: .
2. Mill Finish: Have a cleaned and degreased mill finish on other aluminum items.

2.4 MISCELLANEOUS STEEL

A. Miscellaneous Steel Work: Formed true to detail, with clean, straight, sharply defined profiles and smooth surfaces of uniform color and texture and free from defects impairing strength or durability. Drill or punch holes. Smooth edges without burrs. Fabricate supplementary pieces necessary to complete each item though such pieces are not definitely shown or specified.

B. Connections and Accessories: Sufficient strength to safely withstand the stresses and strains to which they will be subjected. Close fitting exposed joints and jointed where least conspicuous. Conceal thread on threaded connections where practical. Provide continuous welds or intermittent welds on welded connections as specified or shown. Dress face of welds flush and smooth. Provide holes for temporary field connections and for attachment of the work of other trades.

C. Miscellaneous Steel Items: Beams, angles, lintels, metal stairs detailed on the Drawings, support brackets, base plates for other than structural steel or equipment, closure angles, bridge crane rails, monorail hoist beams, hold-down straps and lugs, door frames, splice plates, subframing at roof openings and any other miscellaneous steel indicated and not otherwise specified.

D. Steel Finish Work: Thoroughly cleaned, by effective means, of loose mill scale, rust and foreign matter. Provide one shop coat of primer compatible with finish coat after fabrication but before shipment. Omit paint within 3 inches of proposed field welds. Apply paint to dry surfaces and be thoroughly and evenly spread and well worked into joints and other open spaces.

E. Galvanizing, where required: Use hot-dip zinc process after fabrication, coating not less than 2 oz/sq.ft. of surface.

2.5 MISCELLANEOUS STAINLESS-STEEL

A. Miscellaneous Stainless-Steel Work: Formed true to detail, with clean, straight, sharply defined profiles and smooth surfaces of uniform color and texture and free from defects impairing strength or durability. Drill or punch holes. Smooth edges without burrs. Fabricate supplementary pieces necessary to complete each item though such pieces are not definitely shown or specified.

B. Connections and accessories: Sufficient strength to safely withstand the stresses and strains to which they will be subjected. Close fitting exposed joints, jointed where least conspicuous. Conceal threads on threaded connections where practical. Provide continuous welds or intermittent welds on welded connections as specified or shown. Dress face of welds flush and smooth. Provide holes for temporary field connections and for attachment of the work of other trades.

C. Beams, angles, bar racks, and other miscellaneous stainless steel.

2.6 MISCELLANEOUS MATERIALS

A. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79 and compatible with topcoat.

1. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.

B. Water-Based Primer: Emulsion type, anticorrosive primer for mildly corrosive environments that is resistant to flash rusting when applied to cleaned steel, complying with MPI#107 and compatible with topcoat.

C. Epoxy Zinc-Rich Primer: Complying with MPI#20 and compatible with topcoat.

D. Shop Primer for Galvanized Steel: Primer formulated for exterior use over zinc-coated metal and compatible with finish paint systems indicated.

E. Galvanizing Repair Paint: High-zinc-dust-content paint complying with ASTM A 780 and compatible with paints specified to be used over it.

F. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

2.7 CASTINGS:

A. General: Good quality, strong, tough, even-grained, smooth, free from scale, lumps, blisters, sand holes, and other defects. Thoroughly clean castings to remove foreign matter, and deleterious films. Castings will be subjected to a hammer inspection in the field by the Engineer. Damaged castings may be rejected and replaced at no cost to the Owner.

B. Matching Surfaces: Machine to a true plane surface allowing contact surfaces to seat without rocking. Provide allowances in patterns so specified thickness is not reduced to obtain finished

surfaces. Castings will not be acceptable if actual weight is less than 95 percent of theoretical weight computed from dimensions. Provide facilities for weighing castings in the presence of the Engineer.

2.8 FABRICATION, GENERAL

A. Shop Assembly: Preassemble items in the shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.

B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

C. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

D. Form exposed work with accurate angles and surfaces and straight edges.

E. Weld corners and seams continuously to comply with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

F. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners or welds where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) fasteners unless otherwise indicated. Locate joints where least conspicuous.

G. Fabricate seams and other connections that are exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

H. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.

I. Provide for anchorage of type indicated; coordinate with supporting structure. Space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.

J. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors, 1/4 by 1 inch, with a minimum 6 inch embedment and 1 1/2-inch hook, not less than 8 inches from ends and corners of units and 24 inches o.c., unless otherwise indicated.

2.9 MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Provide steel framing and supports not specified in other Sections as needed to complete the Work.

B. Fabricate units from steel shapes, plates, and bars of welded construction unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction.

1. Fabricate units from slotted channel framing where indicated.
2. Furnish inserts for units installed after concrete is placed.

C. Galvanize miscellaneous framing and supports where indicated.

D. Prime miscellaneous framing and supports with zinc-rich primer where indicated.

2.10 LOOSE BEARING AND LEVELING PLATES

A. Provide loose bearing and leveling plates for steel items bearing on masonry or concrete construction. Drill plates to receive anchor bolts and for grouting.

B. Galvanize plates.

2.11 FINISHES, GENERAL

A. Finish metal fabrications after assembly.

B. Finish exposed surfaces to remove tool and die marks and stretch lines, and to blend into surrounding surface.

2.12 STEEL AND IRON FINISHES

A. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A 153/A 153M for steel and iron hardware and with ASTM A 123/A 123M for other steel and iron products. Limit maximum nickel (Ni) content of galvanizing zinc to 0.05%.

1. Do not quench or apply post galvanizing treatments that might interfere with paint adhesion.

B. Preparation for Shop Priming Galvanized Items: After galvanizing, thoroughly clean railings of grease, dirt, oil, flux, and other foreign matter, and treat with metallic phosphate process.

C. Shop prime iron and steel items unless they are to be embedded in concrete, sprayed-on fireproofing, or masonry, or unless otherwise indicated.

1. Shop prime with universal shop primer unless indicated.

D. Preparation for Shop Priming: Prepare surfaces to comply with SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."

E. Shop Priming: Apply shop primer to comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.

1. Stripe paint corners, crevices, bolts, welds, and sharp edges.

2.13 ALUMINUM FINISHES

A. As-Fabricated Finish: AA-M12.

B. Clear Anodic Finish: AAMA 611, Class I, AA-M12C22A41.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Install all items except those to be embedded in concrete or other masonry which shall be installed under Division 03 and Division 04 respectively. Install items to be attached to concrete or masonry after such work is completed in accordance with the details shown. Fastening to wood plugs in masonry will not be permitted.

B. Touch up abrasions in the shop primer immediately after erection. Paint areas left unprimed for welding after welding.

C. Clean and repair, after installation, zinc coating which has been burned by welding, abraded, or otherwise damaged. Thoroughly clean damaged area and remove all traces of welding flux and loose or cracked zinc coating prior to painting. Paint the cleaned area per the requirements of ASTM A780.

D. Install specialty products in accordance with the manufacturer's recommendations.

E. Weld headed anchor studs in accordance with manufacturer's recommendations.

F. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.

G. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.

H. Field Welding: Comply with the following requirements:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

I. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction. Provide threaded fasteners for use with concrete and masonry inserts, toggle bolts, through bolts, lag screws, wood screws, and other connectors.

1. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

J. Corrosion Protection: Coat concealed surfaces of aluminum and steel that come into contact with grout, concrete, masonry, wood, or dissimilar metals with the following:

1. Aluminum Contacting a Dissimilar Metal: Apply a heavy brush coat of zinc-chromate primer followed by two coats of aluminum metal and masonry paint to the dissimilar metal.
2. Aluminum Contacting Masonry or Concrete: Apply a heavy coat of approved alkali resistant paint to the masonry or concrete.
3. Aluminum Contacting Wood: Apply two coats of aluminum metal and masonry paint to the wood.
4. Steel Contacting Exposed Concrete or Masonry: Apply heavy bitumastic troweling mastic.
5. Between aluminum stair treads, and steel supports, insert 1/4 inch thick neoprene isolator pads, 85 plus or minus 5 Shore A durometer, sized for full width and length of bracket or support.

3.2 INSTALLING MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on Shop Drawings.

3.3 INSTALLING BEARING AND LEVELING PLATES

A. Clean concrete bearing surfaces of bond-reducing materials and roughen to improve bond to surfaces. Clean bottom surface of plates.

B. Set bearing and leveling plates on wedges, shims, or leveling nuts. After bearing members have been positioned and plumbed, tighten anchor bolts. Do not remove wedges or shims but, if

protruding, cut off flush with edge of bearing plate before packing with nonshrink grout. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

3.4 ADJUSTING AND CLEANING

A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

1. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.

B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780/A 780M.

END OF SECTION

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SECTION 05513

METAL GRATING STAIRS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Industrial Class stairs with aluminum-grating treads.
2. Aluminum railings and guards attached to metal stairs.
3. Aluminum handrails attached to walls adjacent to metal stairs.

1.3 COORDINATION

A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written instructions to ensure that shop primers and topcoats are compatible with one another.

B. Coordinate installation of anchorages for metal stairs, railings, and guards.

1. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, blocking for attachment of wall-mounted handrails, and items with integral anchors, that are to be embedded in concrete.
2. Deliver such items to Project site in time for installation.

C. Coordinate locations of hanger rods and struts with other work so they do not encroach on required stair width and are within fire-resistance-rated stair enclosure.

D. Schedule installation of railings and guards so wall attachments are made only to completed walls.

1. Do not support railings and guards temporarily by any means that do not satisfy structural performance requirements.

1.4 ACTION SUBMITTALS

A. Product Data: For metal grating stairs and the following:

1. Gratings.
2. Grout.

B. Shop Drawings:

1. Include plans, elevations, sections, details, and attachment to other work.
2. Indicate sizes of metal sections, thickness of metals, profiles, holes, and field joints.
3. Include plan at each level.
4. Indicate locations of anchors, weld plates, and blocking for attachment of wall-mounted handrails.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For professional engineer's experience with providing delegated-design engineering services of the kind indicated, including documentation that engineer is licensed in the State in which Project is located.

B. Welding certificates.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Fabricator of products.

B. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Aluminum."

1.7 DELIVERY, STORAGE AND HANDLING

A. Store materials to permit easy access for inspection and identification.

1. Keep structural members off ground and spaced by using pallets, dunnage, or other supports and spacers.
2. Protect structural members and packaged materials from corrosion and deterioration.
3. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures.

    a. Repair or replace damaged materials or structures as directed.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Structural Performance of Stairs: Metal stairs shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:

1. Uniform Load: 100 lbf/sq. ft..
2. Concentrated Load: 300 lbf applied on an area of 4 sq. in..
3. Uniform and concentrated loads need not be assumed to act concurrently.
4. Stair Framing: Capable of withstanding stresses resulting from railing and guard loads in addition to loads specified above.
5. Limit deflection of treads, platforms, and framing members to L/360.

B. Structural Performance of Railings and Guards: Railings and guards, including attachment to building construction, shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:

1. Handrails and Top Rails of Guards:

a. Uniform load of 50 lbf/ft. applied in any direction.
b. Concentrated load of 200 lbf applied in any direction.
c. Uniform and concentrated loads need not be assumed to act concurrently.

2. Infill of Guards:

a. Concentrated load of 50 lbf applied horizontally on an area of 1 sq. ft..
b. Infill load and other loads need not be assumed to act concurrently.

3. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.

a. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

2.2 METALS

A. Metal Surfaces: Provide materials with smooth, flat surfaces unless otherwise indicated. For components exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.

B. Aluminum Bars for Grating Treads: ASTM B221 extruded aluminum, alloys as follows:

1. 6061-T6 or 6063-T6, for bearing bars of gratings and shapes.
2. 6061-T1, for grating crossbars.

2.3 FASTENERS

A. General: Provide Type 316 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B633 or ASTM F1941/F1941M, Class Fe/Zn 5 where built into exterior walls.

B. Fasteners for Anchoring Railings and Guards to Other Construction: Select fasteners of type, grade, and class required to produce connections suitable for anchoring railings and guards to other types of construction indicated and capable of withstanding design loads.

C. Bolts and Nuts: Regular hexagon-head bolts, ASTM A307, Grade A; with hex nuts, ASTM A563; and, where indicated, flat washers.

D. Anchor Bolts: ASTM F1554, Grade 36, of dimensions indicated; with nuts, ASTM A563; and, where indicated, flat washers.

E. Post-Installed Anchors: Torque-controlled expansion anchors or chemical anchors capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E488/E488M, conducted by a qualified independent testing agency.

1. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 stainless-steel bolts, ASTM F593, and nuts, ASTM F594.

2.4 MISCELLANEOUS MATERIALS

A. Welding Electrodes: Comply with AWS requirements.

B. Nonmetallic, Shrinkage-Resistant Grout: ASTM C1107/C1107M, factory-packaged, nonmetallic aggregate grout; recommended by manufacturer for exterior use; noncorrosive and nonstaining; mixed with water to consistency suitable for application and a 30-minute working time.

2.5 FABRICATION, GENERAL

A. Provide complete stair assemblies, including metal framing, hangers, railings, guards, clips, brackets, bearing plates, and other components necessary to support and anchor stairs and platforms on supporting structure.

1. Join components by welding unless otherwise indicated.
2. Use connections that maintain structural value of joined pieces.

B. Assemble stairs in shop to greatest extent possible.

1. Disassemble units only as necessary for shipping and handling limitations.
2. Clearly mark units for reassembly and coordinated installation.

C. Cut, drill, and punch metals cleanly and accurately.

1. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated.
2. Remove sharp or rough areas on exposed surfaces.

D. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

E. Form exposed work with accurate angles and surfaces and straight edges.

F. Weld connections to comply with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. Weld exposed corners and seams continuously unless otherwise indicated.
5. At exposed connections, finish exposed welds to comply with NOMMA's "Voluntary Joint Finish Standards" for Finish #4 - Good quality, uniform undressed weld with minimal splatter.

G. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible.

1. Where exposed fasteners are required, use Phillips flat-head (countersunk) screws or bolts unless otherwise indicated.
2. Locate joints where least conspicuous.
3. Fabricate joints that are exposed to weather in a manner to exclude water.
4. Provide weep holes where water may accumulate internally.

2.6 FABRICATION OF ALUMINUM-FRAMED STAIRS

A. NAAMM Stair Standard: Comply with NAAMM AMP 510, "Metal Stairs Manual," for Industrial Class, unless more stringent requirements are indicated.

B. Stair Framing:

1. Fabricate stringers of aluminum plates or channels.

a. Stringer Size: As indicated on Drawings.
b. Provide closures for exposed ends of channel stringers.
c. Finish: Mill.

2. Construct platforms and tread supports of aluminum plate or channel headers and miscellaneous framing members as indicated on Drawings.

   a. Provide closures for exposed ends of channel framing.
   b. Finish: Mill.

3. Weld or bolt stringers to headers; weld or bolt framing members to stringers and headers.

C. Metal Bar-Grating Stairs: Form treads and platforms to configurations shown from metal bar grating; fabricate to comply with NAAMM MBG 531, "Metal Bar Grating Manual."

1. Fabricate treads and platforms from pressure-locked aluminum grating with 1-1/4-by-3/16-inch bearing bars at 15/16 inch o.c. and crossbars at 4 inches o.c.

   a. Surface: Serrated.
   b. Finish: Mill.

2. Fabricate grating treads with cast-abrasive nosing and with aluminum angle or plate carrier at each end for stringer connections.

   a. Secure treads to stringers with bolts.

3. Fabricate grating platforms with nosing matching that on grating treads.

   a. Secure grating to platform framing with bolts.

D. Risers: Open.

E. Toe Plates: Provide toe plates around openings and at edge of open-sided floors and platforms, and at open ends and open back edges of treads.

1. Material and Finish: Aluminum plate to match finish of other aluminum items.
2. Fabricate to dimensions and details indicated.

2.7 FABRICATION OF STAIR RAILINGS AND GUARDS

A. Comply with applicable requirements in Section 05520 "Metal Railings."

2.8 FINISHES

A. Aluminum stairs shall be Mill Finished.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify elevations of floors, bearing surfaces and locations of bearing plates, and other embedments for compliance with requirements.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF METAL STAIRS

A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing metal stairs to in-place construction.

B. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal stairs. Set units accurately in location, alignment, and elevation, measured from established lines and levels and free of rack.

C. Install metal stairs by bolting base plates to concrete unless otherwise indicated.

1. Grouted Baseplates: Clean concrete bearing surfaces of bond-reducing materials and roughen to improve bond to surfaces.

a. Clean bottom surface of baseplates.
b. Set aluminum-stair baseplates on wedges, shims, or leveling nuts.
c. After stairs have been positioned and aligned, tighten anchor bolts.
d. Do not remove wedges or shims, but if protruding, cut off flush with edge of bearing plate before packing with grout.
e. Promptly pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

1) Neatly finish exposed surfaces; protect grout and allow to cure.
2) Comply with manufacturer's written installation instructions for shrinkage-resistant grouts.

D. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, or similar construction.

E. Fit exposed connections accurately together to form hairline joints.

3.3 INSTALLATION OF RAILINGS AND GUARDS

A. Adjust railing and guard systems before anchoring to ensure matching alignment at abutting joints with tight, hairline joints.

1. Space posts at spacing indicated or, if not indicated, as required by design loads.

2. Plumb posts in each direction, within a tolerance of 1/16 inch in 3 feet.
3. Align rails and guards so variations from level for horizontal members and variations from parallel with rake of stairs for sloping members do not exceed 1/4 inch in 12 feet.
4. Secure posts, rail ends, and guard ends to building construction as follows:

    a. Anchor handrail and guard ends to concrete with flanges mechanically connected or welded to rail and guard ends and anchored with post-installed anchors and bolts.

B. Attach handrails to wall with wall brackets.

1. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads.
2. Secure wall brackets to building construction as required to comply with performance requirements.

3.4 REPAIR

A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

1. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.

B. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Section 09910 “Painting”.

END OF SECTION

SECTION 05520

METAL RAILINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Aluminum pipe guardrails, railings, balusters, and fittings.

B. Related Requirements:

1. Section 03300 “Cast-In-Place Concrete”: Execution requirements for placement of anchors, as specified in this Section, in concrete.
2. Section 05502 “Metal Fabrications”:

1.3 ACTION SUBMITTALS

A. Section 01300 “Submittals”: Requirements for submittals.

B. Shop Drawings: Indicate profiles, sizes, connection attachments, anchorage, size and type of fasteners, and accessories.

1.4 INFORMATIONAL SUBMITTALS

A. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

B. Test Reports: Certified copy of mill test reports on each aluminum proposed for use showing physical properties and chemical analysis.

C. Certificates: Certify that welders have been qualified under AWS within previous 12 months to perform required welds.

D. Field Quality-Control Submittals: Indicate results of Contractor-furnished tests and inspections.

E. Qualifications Statements:

1. Submit qualifications for fabricator and erector.
2. Submit manufacturer's approval of fabricator and erector.

1.5 QUALITY ASSURANCE

A. Perform Work for structural aluminum according to AA ADM 1.

B. Finish welded joints according to NOMMA Guideline 1, Finish #1.

C. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."

1.6 QUALIFICATIONS

A. Fabricator: Company specializing in fabricating products specified in this Section with minimum three Insert years' documented experience and approved by manufacturer.

B. Erector: Company specializing in performing Work of this Section with minimum three years' documented experience and approved by manufacturer.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

1.8 EXISTING CONDITIONS

A. Field Measurements: Verify field measurements prior to fabrication. Indicate field measurements on Shop Drawings.

PART 2 - PRODUCTS

2.1 GENERAL

A. Provide two rail mechanically fastened or welded pipe railing systems as indicated, fabricated with 1-1/2 inch nominal diameter pipe. Provide Schedule 80 pipe posts, minimum and rails and handrail of Schedule 40 pipe, minimum. Provide continuous posts and top rails. Spacing of posts not to exceed 5 feet 0 inches on center and shall be uniformly spaced except as otherwise indicated. Install railing posts in vertical position.

1. Welding: Provide circumferential welds ground smooth and even to produce a railing that is neat in appearance and structurally sound. Weld in conformity with AWS standards for materials being joined. Cope and fasten rail to post connections with continuous welds. Provide handrail system free of burrs, sharp edges or protrusions on welds. Clean and hand buff welds after fabrication so welds and surrounding area blend with the adjacent finish.

    a. For welding aluminum, use a weld filler alloy that is compatible with alloys to be joined, that will not discolor the pieces to be joined, and that will not be discolored by anodizing.

2. Mechanical Fasteners: Locate unobtrusively in countersunk holes with the top, flush with rail surface.
3. Bending: Form bends in railings as indicated. No distortion of circular railing shape will be allowed. Provide corner bends with a 3 inch centerline radius.

B. Assemble railing in sections as long as practical, but not greater than 24 feet in length. Provide field splice when an assembled section is to be attached to another section. Provide field splices in railing panels that cross over structure expansion joints.

1. Field Splices: Use internal splice sleeves located within 8 inches of railing posts. Weld sleeves to rails on one side and fasten with set screws to rails on other side. Detail field splice to take differential expansion between railing system and the supporting structure.
2. When field splice occurs in a railing panel crossing a structure expansion joint, weld sleeves to rails on one side and be free to slide in the rails on other side. Detail field splice to take same movement as structure expansion joint.

C. Provide bases or supports for railing posts and handrail as indicated on drawings.

1. Where guardrail and handrail is to be fastened to walls, provide screwed wall flanges fastened to walls with three 3/8 inch stainless-steel expansion anchors. The horizontal projection of handrail support off the wall shall provide 2-1/4 inch minimum clearance around the handrail.

D. For railing openings, fabricate safety gates of matching pipe and rail material and configuration. Provide self-closing gates with approved stop, latch, and stainless-steel closure spring and hinges.

E. For railing openings, fabricate barrier chains of stainless-steel having 1/4 inch links, with eleven links per foot. Fasten chains to handrail posts at elevation of each rail. Connect one end of each chain to one post with a 1/4 inch diameter stainless-steel eye bolt and other end connected to other post by means of a heavy chromium plated bronze swivel eye slide harness snap and a similar eye bolt.

F. Provide toe boards on railings adjacent to a drop elevation of 4 feet or more. Toeboards are not required on inclined portion of stairway railings or where concrete or steel curbs exist at 4 inches or more in height. Provide toeboards fabricated of 4 inch high channels of same material as railing, having a minimum thickness of 1/8 inch and flanges of not less than 3/4 inch or more than 1-1/2 inch in width. Position toeboards with a maximum clearance of 1/4 inch from floor

and fasten to railing posts with 1/4 inch stainless-steel U-bolts, with J-bolts at corner posts, and with clip angles and two 1/4 inch stainless-steel expansion bolts at walls.

G. Protect railings by paper, an approved coating, or both against scratching, splashes of mortar, paint, or other defacements during transportation, erection, and until adjacent work is complete. Remove protective materials and make surfaces clean and free from stains, marks, or defects.

2.2 MATERIALS

A. Aluminum Railing System: provide a mechanically fastened, seamless, extruded aluminum pipe system.

1. Rails: ASTM B 429 Alloy 6063-T6.
2. Posts: ASTM B 429 Alloy 6061-T6.
3. Splice and reinforcing sleeves, brackets, end caps, toeboards, and similar components: ASTM B 221 or ASTM B 209, Alloy 6063-T6 or 6061-T6.
4. Cast Fittings: ASTM B 26/B 26M, Alloy No. 214.
5. Railing System Fastening Hardware: ASTM A 276, Type 316 stainless-steel.
6. Finishes: Clear anodized finish after welding, AAMA 611, Class I, AA M12C22A41..

2.3 MISCELLANEOUS MATERIALS

A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

1. For aluminum railings, provide type and alloy as recommended by producer of metal to be welded and as required for color match, strength, and compatibility in fabricated items.

B. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.

C. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187/D 1187M.

2.4 FABRICATION

A. Fit and shop-assemble components in largest practical sizes for delivery to Site, but not to exceed 24ft in length.

B. Fabricate components with joints tightly fitted and secured. Furnish sleeves to accommodate site assembly and installation.

C. Form simple and compound curves by bending pipe in jigs to produce uniform curvature for each repetitive configuration required. Maintain cylindrical cross section of pipe throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces.

D. Exposed Mechanical Fastenings: Flush countersunk screws or bolts, unobtrusively located, and consistent with design of component, except where otherwise noted.

E. Supply components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where otherwise noted.

F. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.

G. Accurately form components to each other, and to building structure.

H. Accommodate expansion and contraction of members and building movement without damage to connections or members.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive Work.

B. Verify that concealed blocking and reinforcement are installed and correctly located to receive wall-mounted handrails.

3.2 PREPARATION

A. Clean and strip aluminum where site welding is required.

3.3 INSTALLATION

A. Install items, except those to be embedded in concrete under Division 03 or installed in masonry under Division 04. Install items to be attached to concrete or masonry after such work is completed in accordance with indicated details. Do not fasten to wood plugs in masonry.

B. Install components plumb, level, and square, accurately fitted, and free from distortion or defects.

C. Anchor railings to structure with anchors and cast aluminum bases.

D. Conceal bolts and screws whenever possible. Where not concealed, use flush countersunk fastenings.

E. Assemble with sleeves to accommodate tight joints and secure installation.

F. Protect steel surfaces that come into contact with exposed concrete or masonry with a protective coating of an approved heavy bituminous troweling mastic applied in accordance with manufacturer's instructions prior to installation.

G. Where aluminum contacts a dissimilar metal, apply a heavy brush coat of zinc-chromate primer followed by two coats of aluminum metal and masonry paint to the dissimilar metal.

H. Where aluminum contacts masonry or concrete, apply a heavy coat of approved alkali resistant paint to masonry or concrete. Coat, with a heavy coat of bituminous paint, concealed surfaces of aluminum that are in contact with grout, concrete, masonry, wood, or dissimilar metals.

I. Where aluminum contacts wood, apply two coats of aluminum metal and masonry paint to the wood.

J. Between aluminum gratings, aluminum stair treads, or aluminum handrail brackets and steel supports, insert 1/4 inch thick neoprene isolator pads, 85 plus or minus 5 Shore A durometer, sized for full width and length of bracket or support.

3.4 CLEANING AND PROTECTION

A. Clean aluminum by washing thoroughly with clean water and soap and rinsing with clean water.

B. Protect finishes of railings from damage during construction period with temporary protective coverings approved by railing manufacturer. Remove protective coverings at time of Substantial Completion.

END OF SECTION

SECTION 05531

BAR GRATINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes metal bar gratings.

B. Related Requirements:

1. Section 05510 "Metal Grating Stairs" for grating treads and landings of aluminum-framed stairs.
2. Section 05502 “Metal Fabrications” for grating supports.
3. Section 05520 "Metal Railings" for structural metal pipe and tube handrails and railings.

1.3 COORDINATION

A. Coordinate installation of grating with installation of related items. Deliver such items to Project site in time for installation.

1.4 ACTION SUBMITTALS

A. Product Data: For the following:

1. Clips and anchorage devices for gratings.
2. Paint products.
3. Manufacturers' published load tables.

B. Shop Drawings: Include plans, sections, details, and attachments to other work. Identify size, material, and location of supporting members and forward requirements to Section 05502 “Metal Fabrications”.

1.5 INFORMATIONAL SUBMITTALS

A. Mill Certificates: Signed by manufacturers of aluminum,, certifying that products furnished comply with requirements.

B. Welding certificates, qualified in the previous 12 months.

1.6 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."

1.7 FIELD CONDITIONS

A. Field Measurements: Verify actual locations of walls and other construction contiguous with gratings by field measurements before fabrication.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Provide grating conforming to ANSI/NAAMM MBG 531, Type P-19-4, size of grating as shown on Drawings. Do not exceed fabricator’s maximum recommended grating span.

B. Limit grating deflection to 1/4 inch maximum for a uniform live load of 100 psf on maximum span.

2.2 METAL BAR GRATINGS

A. Metal Bar Grating Standards: Comply with NAAMM MBG 531, "Metal Bar Grating Manual."

B. Pressure-Locked, Rectangular-Bar Aluminum Grating: Fabricate by swaging crossbars between bearing bars.

1. Aluminum Finish: Mill finish.

C. Delete following Article if no ferrous metals are used.

2.3 ALUMINUM

A. General: Provide alloy and temper recommended by aluminum producer for type of use indicated, with not less than the strength and durability properties of alloy, and temper designated below for each aluminum form required.

B. Extruded Bars and Shapes: ASTM B 221 (ASTM B 221M), alloys as follows:

1. Grating Bearing Bars: 6061-T6 or 6063-T6.
2. Grating Crossbars: 6061-T1.

C. Aluminum Sheet: ASTM B 209 (ASTM B 209M), Alloy 5052-H32.

D. Welding electrode, aluminum: 5356 filler alloy.

2.4 FASTENERS

A. General: Unless otherwise indicated, provide Type 316 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633 or ASTM 1941 1941M), Class Fe/Zn 5, at exterior walls. Select fasteners for type, grade, and class required.

1. Provide stainless-steel fasteners for fastening aluminum.

B. Grating clamps, nuts, bolts, washers and other fastening devices for grating shall be Type 316 stainless steel. Anchor blocks, when used, shall be of the same material as the grating. Anchor grating to supporting system using saddle clips.

C. Stainless-Steel Bolts and Nuts: Regular hexagon-head annealed stainless-steel bolts, nuts, and, where indicated, flat washers; ASTM F 593 for bolts and ASTM F 594 for nuts, Alloy Group 2 (A4).

2.5 FABRICATION

A. Shop Assembly: Fabricate grating sections in shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.

B. Cut, drill, and punch material cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

C. Form from materials of size, thickness, and shapes indicated, but not less than that needed to support indicated loads.

D. Fit exposed connections accurately together to form hairline joints.

E. Provide for anchorage of type specified; coordinate with supporting structure.

F. Removable Grating Sections: Fabricate with banding bars attached by welding to entire perimeter of each section. Include anchors and fasteners of type indicated or, if not indicated, as recommended by manufacturer for attaching to supports.

1. Provide no fewer than four saddle clips for each grating section with each clip designed and fabricated to fit over two bearing bars.

2. Provide no fewer than four flange blocks for each section of aluminum I-bar grating, with block designed to fit over lower flange of I-shaped bearing bars.
3. Furnish threaded bolts with nuts and washers for securing grating to supports.
4. Furnish self-drilling fasteners with washers for securing grating to supports.

G. Fabricate cutouts in grating sections for penetrations indicated. Arrange cutouts to permit grating removal without disturbing items penetrating gratings.

H. Additional Fabrication:

1. Edge-band openings in grating that interrupt one or more bearing bars with bars of same size and material as bearing bars.
2. Do not notch bearing bars at supports to maintain elevation.
3. For openings 2 inches or greater in diameter or dimension, band grating edges with a bar of same depth and thickness as bearing bars. Weld cut bearing bars or cross bars to banding bar.
4. Provide trench grating with symmetrical cross bar arrangement.
5. Fabricate metal frames and supports for grating of same material as grating, unless otherwise indicated.

2.6 ALUMINUM FINISHES

A. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I.

B. Mill finish.

PART 3 - EXECUTION

3.1 PREPARATION

A. Coordinate locations and elevations of grating supports provided under provisions of Section 05502 “Metal Fabrications.” Verify that members are properly installed to support bar gratings specified in this Section.

B. Coordinate and furnish anchorages, setting drawings, diagrams, templates, instructions and directions for installation of anchorages, including concrete inserts, sleeves, anchor bolts and

miscellaneous items having integral anchors that are to be embedded in concrete or masonry construction.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. Install assemblies in accordance with manufacturer's installations instructions. Install products plumb, level, and square, unless otherwise required by the design.

B. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing gratings to in-place construction and grating supports.

C. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing gratings. Set units accurately in location, alignment, and elevation; measured from established lines and levels and free of rack.

D. Provide additional supports at penetrations through grating in order to meet design criteria.

E. Fit exposed connections accurately together to form hairline joints.

G. Field Welding: Comply with AWS recommendations and the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.

H. Corrosion Protection: Coat concealed surfaces of aluminum that will come into contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.

3.3 INSTALLING METAL BAR GRATINGS

A. General: Install gratings to comply with recommendations of referenced metal bar grating standards that apply to grating types and bar sizes indicated, including installation clearances and standard anchoring details.

B. Attach removable units to supporting members with type and size of clips and fasteners as specified.

3.4 ADJUSTING AND CLEANING

A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint and paint exposed areas with same material as used for shop painting to comply with SSPC-PA 1 requirements for touching up shop-painted surfaces.

1. Apply by brush or spray to provide a minimum 2.0 -mil dry film thickness.

END OF SECTION

SECTION 09901

SHOP PRIMING

1.1 SUMMARY

A. Section includes shop primers not included in other sections.

B. Related Requirements:

1. Division 09 for field applied painting.
2. Other specifications that reference this specification for primers.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include written statement, or published product data, that the confirms that the shop primer materials are compatible with the finish and field coatings.

B. Samples: For each exposed product.

1.3 QUALITY ASSURANCE

A. Compatibility of Coating Systems: Shop priming with primers that are guaranteed, in writing, by the manufacturer to be compatible with field applied and other coatings.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Submerged Surfaces: Shop primer for ferrous metals which will be in contact with water being treated, either submerged or which are subject to splash action or which are specified to be considered submerged service:

1. Shop Prime Coat: (Zinc Micaceous Iron Oxide Polyurethane Aromatic Shop Primer):

a. TNEMEC: Series 1 Omnithane.
b. Carboline: Carboguard 561.
c. Sherwin-Williams Company (The): Corothane I Zinc Primer 1K Mio-Zinc.
d. PPG PMC: Durathane MCZ 97-679 Series or PPG PMC Amerlock 400.
e. Or equal.

B. Non-Submerged Surfaces: Shop primer for ferrous metals which will not be in contact with water being treated, not submerged and not subject to splash action:

1. Shop Prime Coat: (Zinc Micaceous Iron Oxide Polyurethane Aromatic Shop Primer):

a. TNEMEC: Series 1 Omnithane.
b. Carboline: Carboguard 561.
c. Sherwin-Williams Company (The): Corothane I Zinc Primer 1K Mio-Zinc.
d. PPG PMC: Durathane MCZ 97-679 Series or PPG PMC Amercoat 68HS.
e. Or equal.

C. Submerged Surfaces:

1. Shop Prime Coat for Ductile Iron Pipe: (Epoxy, Polyamidoamine Shop Primer):

a. TNEMEC: Series N140 Pota-Pox-Plus.
b. Carboline: Carboguard 561.
c. Sherwin-Williams Company (The): Macropoxy 5500.
d. PPG PMC: Aquapon HB Potable Water Epoxy Coating 95-132 Series or PPG PMC Amerlock 2 Epoxy.
e. Or equal.

2. Shop Prime Coat for Ferrous Metal Surfaces: (Zinc Micaceous Iron Oxide Polyurethane Aromatic Shop Primer):

a. TNEMEC: Series 1 Omnithane.
b. Carboline: Carboguard 561.
c. Sherwin-Williams Company (The): Corothane I Zinc Primer 1K Mio-Zinc.
d. PPG PMC: Durathane MCZ 97-679 Series.
e. Or equal.

PART 3 - EXECUTION

3.1 PREPARATION

A. Surface preparation: Comply with the manufacturer's written requirements for the substrate to be primed.

3.2 PROTECTION

A. Non-Primed Surfaces: Apply a heavy shop coat of grease or other suitable rust-resistant coating to gears, bearings surfaces and other similar surfaces which are not to be field painted.

1. Maintain this coating to prevent corrosion until final acceptance testing of equipment.

END OF SECTION

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SECTION 09910

PAINTING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes surface preparation and the application of paint systems on the following substrates on the project:

1. Concrete.
2. Steel and iron.
3. Galvanized metal.
4. Aluminum (not anodized or otherwise coated).
5. Copper.
6. Plastic.

B. Section includes painting all exposed structural and miscellaneous steel; mechanical and electrical equipment; gates, operators and posts; pipe, fittings and valves; electrical conduit and appurtenances; exposed interior ducts; all as specified in the attached painting schedules and all other work obviously required to be painted unless otherwise specified. Minor items not mentioned in the schedule of work shall be included in the work of this Section where they come within the general intent of this Section as stated herein.

C. Aluminized steel, above roof level, for stacks: Paint with silicone aluminum as specified. Other aluminum-paint only where noted (as is specified).

D. Paint items noted in “Painting Schedule.”

E. Provide vinyl film letters and numbers for markings as specified.

F. Paint items noted in other Specification Sections as having factory finish and other factory finished items are obviously not field painted.

G. Paint all factory finish painted items replaced, repaired or damaged during construction.

H. The various Sections are responsible, as stated in each, for preparation and field touch-up of abrasions, welds and damaged primed areas of primed or galvanized components after erection.

I. The following items will not be painted:

1. Concrete except where specified above and scheduled to be painted and seamless flooring.
2. Stainless steel louvers, doors and frames.
3. Non-ferrous metals and stainless steel, unless specifically noted otherwise.

4. Factory pre-finished architectural components.
5. Packing glands and other adjustable parts and name plates of mechanical equipment.
6. Parts of buildings not exposed to sight, unless specifically noted otherwise.
7. Maintenance equipment
8. Plumbing fixtures.
9. Mechanical, HVAC, Plumbing and Electrical equipment which has been finished painted in the factory as specified in Divisions 11, 15 and 16.

J. Related Requirements:

1. Valve identification is included in Divisions 15.
2. Shop priming of equipment and piping (except copper piping) are specified in Section 09901 “Shop Priming” and included in the respective Section with the item to be primed.
3. Section 05502 "Metal Fabrications" for shop priming metal fabrications.
4. Section 05520 "Metal Railings" for shop priming and painting pipe and tube railings.
5. Section 05531 "Bar Gratings" for shop priming metal gratings.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples for Initial Selection: For each type of topcoat product.

C. Samples for Verification: For each type of paint system and each color and gloss of topcoat.
1. Submit Samples on rigid backing, 8 inches square.
2. Apply coats on Samples in steps to show each coat required for system.
3. Label each coat of each Sample.
4. Label each Sample for location and application area.

D. Product List: Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules. Include color designations.

1.3 QUALITY ASSURANCE

A. Shop Primers, specified in Section 09901, “Shop Priming” and other Sections are required to be certified by the manufacturer of the field applied painting manufacturer to be compatible with the materials specified in this Section.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F.

1. Maintain containers in clean condition, free of foreign materials and residue.
2. Remove rags and waste from storage areas daily.

1.5 FIELD CONDITIONS

A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F.

B. Do not apply paints in snow, rain, fog, or mist; when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Provide products by one of the following:

1. Tnemec, Inc.(TN);
2. The Sherwin Williams Company (SW)
3. PPG Architectural Finishes, Inc. (PPG)
4. PPG Architectural Finishes, Inc. Ameron (AME)
5. Or approved equal.

2.2 MATERIALS

A. Material Compatibility:

1. Provide materials for use within each coating system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
2. Provide products of same manufacturer for each coat in a coating system.

B. Use paint materials without adulteration and mixed, thinned and applied in strict accordance with manufacturer's directions for the applicable materials and surface.

C. Colors: As selected by Engineer from manufacturer's full range.

2.3 COLOR CODING FOR PIPES AND EQUIPMENT

A. The color code establishes, defines and assigns a definite color for each process system. Paint all elements which are an integral part of the system, that is originating from the equipment and/or supplying the equipment, between and up to but not including the fixed flanges nor the flexible conduit connections on the equipment. Paint valves and fittings in the color of the main body of the pipe.

B. All pipes and equipment shall be painted with final coat color selected by the Engineer and shall be treated as an integral part of the Contract.

C. All hanger saddles and pipe support floor stands shall be painted the same color and with the same paint as the pipe it supports. Hanger rods and hanger rod connections to building structure shall be painted to match the color of the wall or ceiling to which it is attached.

2.4 LETTERING OF TITLES

A. Indicate the name of the materials in each pipeline and alongside this an arrow indicating the direction of flow of fluids on each pipe system. Locate the titles shall not more than 26 feet apart and directly adjacent to each side of any wall the pipeline breaches, adjacent to each side of the valve regulator, flowcheck, strainer cleanout and all pieces of equipment.

B. Identify titles by the identity of the contents with complete name at least once in each space through which it passes and thereafter by generally recognized abbreviations, letters or numerals as approved. Place identification title locations in general they shall be placed where the view is unobstructed and on the two lower quarters of pipe or covering where they are overhead. Title to be clearly visible from operating positions and adjacent to all control valves.

C. Die cut numbers and letters from 3.5 mil vinyl film and pre-space them on carrier tape. Protect adhesive and finish surface with one piece removable liners. Use white or black to provide high contrast to the substrate color.

D. Letter size shall be as indicated in the following table:

OUTSIDE DIAMETER OF PIPE OR COVERING	SIZE OF LEGEND LETTERS
3/4-in to 1-1/4-in	1/2-in
1-1/2-in to 2-in	3/4-in
2-1/2-in to 6-in	1-1/2-in
8-in to 10-in	2-1/2-in
Over 10-in	3-in

E. Use Type B ASI/2 by ASI Sign Systems; Architectural Graphics Inc. or equal. Provide Optima Bold, upper case letter type. Use Grid 2 spacing. Match arrow to letter type and size. Follow the instructions of the manufacturer in respect to storage, surface preparation and applications of letters.

2.5 TITLES FOR EQUIPMENT

A. Provide titles consisting of vinyl film as specified above on all equipment using 1-in high Optima Bold upper case, Grid 2 spacing. Use white or black to provide high contrast to the substrate color. Use titles shown on mechanical drawings for bidding purposes. Mount titles at eye level on machines or at the upper most broad vertical surface of low equipment. Where more than one piece of the equipment item to be titled exists, number the items consecutively as indicated on the mechanical drawings or as directed by the Engineer; for example, Pump No. 1, Pump No. 2, etc. Titles shall be composed in more than one line if required and justified on the left-hand side.

2.6 INDUSTRIAL COATING SYSTEMS

A. Coating System Schedules, Nonferrous Metal, Plastic, Fiberglass

1. Where isolated non-ferrous parts are associated with equipment or piping, use the coating system for the adjacent connected surfaces. Do not coat handrails, gratings, frames, or hatches. Use primers recommended by coating manufacturer.
2. Polyvinyl chloride plastic (PVC), indoors and outdoors, not submerged.
3. Surface Preparation: Solvent cleaned SSPC-SP1
4. System Description: Acrylic

2.7 TESTING EQUIPMENT

A. Furnish wet and dry film thickness gauges, electronic moisture meter and all other equipment required by the Engineer for inspection.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of work.

1. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:

a. Concrete: 12 percent.

B. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.

C. Proceed with coating application only after unsatisfactory conditions have been corrected.

1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates and paint systems indicated.

B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.

1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection.

C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.
1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.

D. Concrete Substrates: Remove release agents, curing compounds, efflorescence, and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces to be painted exceeds that permitted in manufacturer's written instructions.

E. Masonry Substrates: Remove efflorescence and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces or mortar joints exceeds that permitted in manufacturer's written instructions.

F. Steel Substrates: Remove rust, loose mill scale, and shop primer if any. Clean using methods recommended in writing by paint manufacturer but not less than the following:

1. SSPC-SP 2.
2. SSPC-SP 3.
3. SSPC-SP 7/NACE No. 4.
4. SSPC-SP 11.

G. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and areas where shop paint is abraded. Paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.

H. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.

I. Aluminum Substrates: Remove loose surface oxidation.

J. Plastic Trim Fabrication Substrates: Remove dust, dirt, and other foreign material that might impair bond of paints to substrates.

3.3 APPLICATION

A. Apply paints according to manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual."

1. Use applicators and techniques suited for paint and substrate indicated.
2. Paint surfaces behind movable items same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed items with prime coat only.
3. Paint both sides and edges of exterior doors and entire exposed surface of exterior door frames.
4. Paint entire exposed surface of window frames and sashes.
5. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
6. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished if acceptable to topcoat manufacturers.

B. Tint undercoats same color as topcoat, but tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Provide sufficient difference in shade of undercoats to distinguish each separate coat.

C. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.

D. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

E. Paint the following work where exposed to view:

1. Equipment, including panelboards and switch gear.
2. Uninsulated metal piping.
3. Uninsulated plastic piping.
4. Pipe hangers and supports.
5. Metal conduit.
6. Plastic conduit.

3.4 FIELD QUALITY CONTROL

A. Dry Film Thickness Testing: Owner may engage the services of a qualified testing and inspecting agency to inspect and test paint for dry film thickness.

1. The Contractor shall touch up and restore painted surfaces damaged by testing.
2. If test results show that dry film thickness of applied paint does not comply with paint manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with paint manufacturer's written recommendations.

3.5 CLEANING AND PROTECTION

A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Engineer, and leave in an undamaged condition.

D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.6 PAINTING SCHEDULE

A. Dry Film Thickness (DFT) for each paint product is not part of paint schedule. Submit both the Wet Film Thickness (WFT) and DFT for each product as part of submittal process. Apply paint and coating products to comply with manufacturer's DFT thickness and application recommendations in the approved submittal.

B. The following types of paints by Tnemec Co. (TN), The Sherwin Williams Company (SW), PPG Protective & Marine Coatings, (PPG), and Ameron International (AME) have been used as a basis for the paint schedule; use one of these paints or equal:

C. Epoxy:

1. TN:Hi-build Epoxoline II, Series N69.
2. SW: Macropoxy 646, B58 Series.
3. PPG: Pitt-Guard 97-145 Series Epoxy Mastic.
4. AME: Amerlock 2/400 Series Epoxy.

D. Waterborne Cementitious Acrylic: Result in pinhole free surface.

1. TN:Envirofil, Series 130-6602.
2. SW: Cement-Plex 875, B42 Series.
3. PPG: Cementitious Waterproofing Block Filler 95-217 Series.
4. AME: Amerlock 400 BF Epoxy Block Filler.

E. High-Build Acrylic Polyurethane Enamel:

1. TN:Endura-Shield - semi-gloss, Series V73.
2. SW: Acrolon 218 HS, B65 Series.
3. PPG: Pitthane HB Semigloss Urethane 95-8800 Series.
4. AME: Amercoat 450HSG Polyurethane.

F. High Heat Silicone Aluminum (to 600 degrees F):

1. TN:No product.
2. SW: Heat-Flex Hi-Temp 1000 Aluminum, B59-820 Series.
3. PPG: Speedhide 6-220 Series Silicone Aluminum Coating.
4. AME: Amercoat 878 Silicone Aluminum Coating.

G. Tie Coat, Low VOC, Epoxy:

1. TN:FC Typoxy, Series V27.
2. SW: Macropoxy 646, B58 Series.
3. PPG: Pitt-Guard Epoxy Mastic 95-245 Series.
4. AME: Amercoat 385 Multi-Purpose Epoxy.

H. Acrylic Latex Emulsion, Eggshell Finish:

1. TN:Tneme-Cryl, Series 6.
2. SW: DTM Primer/Finish, B66 Series.
3. PPG: Pitt-Tech Plus 90-1110 Series Satin DTM Acrylic.
4. AME: Amercoat 220 Waterborne Acrylic.

I. Vinyl Acrylic Surface Sealer:

1. TN:PVA Sealer, Series 51.
2. SW: Prep-Rite 200 Primer, B28 Series.
3. PPG: Speedhide 6-2 Vinyl Acrylic Drywall Primer.
4. AME: Amercoat 148 Acrylic Primer.

J. The following surfaces shall have the types of paint scheduled below applied at the dry film thickness (DFT) in mils per coat as recommended by manufacturer:

1. Exterior non- submerged ferrous metals (except first coat-hollow metal-pressed metal work):

   a. First Coat: On properly prepared unprimed metal or for touch-up:

      1) TN: Hi-build Epoxoline II, Series N69.
      2) SW: Macropoxy 646, B58 Series.
      3) PPG: Pitt-Guard 97-145 Series Epoxy Mastic.
      4) AME: Amerlock 2/400 Series Epoxy.

   b. Second Coat:

      1) TN: Hi-build Epoxoline II, Series N69.
      2) SW: Macropoxy 646, B58 Series.
      3) PPG: Pitt-Guard 97-145 Series Epoxy Mastic.
      4) AME: Amerlock 2/400 Series Epoxy.

c. Third Coat:

1) TN: Endura-Shield - semi-gloss, Series V73.
2) SW: Acrolon 218 HS, B65 Series.
3) PPG: Pitthane HB Semigloss Urethane 95-8800 Series.
4) AME: Amercoat 450HSG Polyurethane.

2. Interior non-submerged concrete scheduled for painting:

a. First and Second Coats:

1) TN: Hi-build Epoxoline II, Series N69.
2) SW: Macropoxy 646, B58 Series.
3) PPG: Pitt-Guard 97-145 Series Epoxy Mastic.
4) AME: Amerlock 2/400 Series Epoxy.

3. Interior non-submerged ferrous metals (except first coat of previously painted metal work), on properly prepared unprimed metal or for touch-up:

a. First Coat:

1) TN: Hi-build Epoxoline II, Series N69.
2) SW: Macropoxy 646, B58 Series.
3) PPG: Pitt-Guard 97-145 Series Epoxy Mastic.
4) AME: Amerlock 2/400 Series Epoxy.

b. Second and Third Coats:

1) TN: Hi-build Epoxoline II, Series N69.
2) SW: Macropoxy 646, B58 Series.
3) PPG: Pitt-Guard 97-145 Series Epoxy Mastic.
4) PPG: Amerlock 2/400 Series Epoxy.

4. Submerged ferrous metals and ferrous metals subject to submersion or splashing. Surface shall be lightly sanded or abraded before application of first field coat.

a. First and Second Coats:

1) TN: Hi-build Epoxoline II, Series N69.
2) SW: Macropoxy 646, B58 Series.
3) PPG: Pitt-Guard 97-145 Series Epoxy Mastic.
4) PPG: Amerlock 2/400 Series Epoxy.

5. Plastic piping and, where scheduled to be painted, plastic components:

a. First and Second Coats:

1) TN: Hi-build Epoxoline II, Series N69.
2) SW: Macropoxy 646, B58 Series.

3) PPG: Pitt-Guard 97-145 Series Epoxy Mastic.
4) AME: Amerlock 2/400 Series Epoxy.

6. Pipe insulation: (Plastic or metal sheathed insulation-paint as scheduled for appropriate substrate):

a. First Coat:

1) TN: Vinyl-Acrylic Sealer, No. 51-792.
2) SW: Prep-Rite 200, B28 Series.
3) PPG: Speedhide 6-2 Vinyl Acrylic Drywall Primer.
4) AME: Amercoat 148 Acrylic Primer.

b. Second and Third Coats:

1) TN: Hi-build Epoxoline II, Series N69.
2) SW: Macropoxy 646, B58 Series.
3) PPG: Pitt-Guard 97-145 Series Epoxy Mastic.
4) AME: Amerlock 2/400 Series Epoxy.

7. Aluminum Designated to be Painted:

a. Mechanically abrade surfaces to comply with SSPC SP 16 "Brush-off Blast Cleaning of Coated and Uncoated Galvanized Steel, Stainless Steels, and Non-ferrous Metals".

b. First and Second Coats - (Interior):

1) TN: Hi-build Epoxoline II, Series N69.
2) SW: Macropoxy 646, B58 Series.
3) PPG: Pitt-Guard 97-145 Series Epoxy Mastic.
4) AME: Amerlock 2/400 Series Epoxy.

c. First Coat - (Exterior):

1) TN: Hi-build Epoxoline II, Series N69.
2) SW: Macropoxy 646, B58 Series.
3) PPG: Pitt-Guard 97-145 Series Epoxy Mastic.
4) AME: Amerlock 2/400 Series Epoxy.

d. Second Coat - (Exterior):

1) TN: Endura-Shield - semi-gloss, Series V73.
2) SW: Acrolon 218 HS.
3) PPG: Pitt-Guard 97-145 Series Epoxy Mastic.
4) AME: Amerlock 2/400 Series Epoxy.

8. Copper Piping:

    a. First and Second Coats:

        1) TN: Hi-build Epoxoline II, Series N69.
        2) SW: Macropoxy 646, B58 Series.
        3) PPG: Pitt-Guard 97-145 Series Epoxy Mastic.
        4) AME: Amerlock 2/400 Series Epoxy.

9. Hot Ferrous Metal Surfaces:

    a. First and Second Coats:

        1) TN: No product.
        2) SW: Heat-Flex Hi-Temp 1000 Aluminum, B59-820 Series, Aluminum.
        3) PPG: Speedhide 6-220 Series Silicone Aluminum Coating.
        4) AME: Amercoat 878 Silicone Aluminum Coating.

10. Previously Painted Metal Surfaces:

    a. First coat on substrates prepared as approved and replacing first coat of above-specified systems. Complete painting with remainder of specified system for each type of substrate.

    b. First Coat:

        1) TN: FC Typoxy, Series V27.
        2) SW: Macropoxy 646, B58 Series.
        3) PPG: Pitt-Guard 97-145 Series Epoxy Mastic.
        4) AME: Amerlock 2/400 Series Epoxy.

11. Exterior galvanized steel surfaces:

    a. Mechanically abrade surfaces to comply with SSPC SP 16 "Brush-off Blast Cleaning of Coated and Uncoated Galvanized Steel, Stainless Steels, and Non-ferrous Metals".

    b. First Coat:

        1) TN: FC Typoxy, Series V27.
        2) SW: Macropoxy 646, B58 Series.
        3) PPG: Pitt-Guard Epoxy Mastic 95-245 Series.
        4) AME: Amercoat 385 Multi-Purpose Epoxy.

    c. Second Coat:

        1) TN: Endura-Shield - semi-gloss, Series V73.
        2) SW: Acrolon 218 HS.
        3) PPG: Pitthane HB Semigloss Urethane 95-8800 Series.
        4) AME: Amercoat 450HSG Polyurethane.

12. Acrylic Latex.

a. Use a single component, water-based acrylic latex with a fungicide additive having a minimum solids content of 35 percent by volume. Apply a prime coat as recommended by manufacturer. Select coating material, which is available in ANSI safety colors.

b. Prime Coat

1) DFT = 2-3 mils (50-75 microns).
2) Products: IP-DevFlex 4020, Carboline D3358, PPG 148, Hemucryl 1803.

c. Finish Coats (2 or more):

1) DFT = 6-8 mils (150-200 microns).
2) Products: IP-DevFlex 4216, Carboline D3359, PPG 220, Hemucryl 4803, or equal.

d. Total System DFT = 8-11 mils (200-275 microns).

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SECTION 09972

HIGH-PERFORMANCE CONCRETE COATINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. CCUA Standard Technical Specifications are included on Drawing G-2. Contractor shall conform to the latest standards from CCUA.

1.2 SUMMARY

A. Furnish all labor, materials, equipment and incidentals required to prepare the concrete and to supply and install corrosion resistant liner on all new interior concrete surfaces where indicated on the Drawings. Corrosion resistant liner system shall be applied to only interior concrete.

B. Corrosion-resistant liner shall be formulated and installed to protect concrete surfaces from corrosion.

C. The surfaces to be coated will be exposed to H_2S, humidity, water, other components of raw sewage and sludge, and the corrosive by-products formed above the water level.

D. Corrosion resistant liner system shall be applied when structures are in the dry condition.

E. Related Requirements:

1. Section 01300 “Submittals”.
2. Section 01881 “Tightness Testing Performance Requirements”.
3. Section 03015 “Modifications to Existing Concrete”.
4. Section 03300 "Cast-in-Place Concrete”.

1.3 ACTION SUBMITTALS

A. Submit, in accordance with Section 01300 “Submittals”, complete detailed shop drawings and a liner system schedule for all materials furnished under this Section including the following:

1. Manufacturer's current printed recommendations and product data sheets for all liner system products supplied under this Section including manufacturers printed performance criteria, surface preparation and application requirements and procedures, volatile organic compound data, and safety requirements.

2. Manufacturer’s termination and discontinuity details (joints, penetrations, metal embeds, wall/slab interface, corners, etc.).
3. Safety Data Sheets (SDS) for any materials brought on-site including all resurfacing system materials, solvents, and abrasive blast media.
4. Storage requirements including temperature, humidity, and ventilation for liner system materials.
5. Manufacturer's requirements, including application and safety procedures for liner system materials.

B. Corrosion Resistant liner system Manufacturer’s written instructions and drawing details for treatment of liner system materials at terminations in the structures to be coated including: pipe penetrations, metal embedments, gate frames, overlapping and integration with the existing Spectrashield liner system and other terminations to be determined from the Contract Drawings. This information shall also include detail treatment for the corrosion resistant liner system at all joints in the concrete.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer and manufacturer.

B. Product Certificates: Notarized certificate for liner system stating that product meets requirements of this Section.

C. Manufacturer’s Certification of Installer.

1.5 QUALITY ASSURANCE

A. The manufacturer of the liner system shall furnish an affidavit attesting to the successful use of its material as a liner system for concrete structures for a minimum period of 5 years in wastewater headspace conditions recognized as severe due to biogenic sulfide corrosion or otherwise detrimental to concrete and certifying that submitted products are suitable for application on the surfaces and for the service conditions. The affidavit shall also document verification by the manufacturer of the corrosion resistant liner system of the subcontractor’s qualification as an approved installer of the specified liner materials and verify that the personnel who will perform this work have been trained to the satisfaction of the selected manufacturer. This affidavit shall also list the application personnel who will work on the corrosion resistant liner system installation covered by this Section. The names of the tradespersons performing surface preparation, clean-up, and other miscellaneous labor functions will not have to be listed on the affidavit.

B. The liner system shall be applied by a qualified applicator trained in handling, mixing and application of the material including the required surface cleaning and preparation. A list of at least five references of projects using the specified liner system shall be provided to the Engineer for review. These references shall include contact names and telephone numbers such that their references can be verified.

C. Field quality control inspection and testing of the liner system work will be provided by the Contractor in accordance with Part 3 of this Section.

D. The Contractor shall not use or retain contaminated, outdated, or diluted materials for resurfacing. All materials used shall be from new containers not previously opened.

E. The manufacturer's requirements, including application procedures and safety procedures shall be followed in detail and strictly adhered to at all times when the work is in progress.

F. The Contractor shall use only products of the approved manufacturer and shall use products of only one manufacturer in any one system.

G. The Contractor shall make available all locations and phases of the work for access by the Engineer or other personnel designated by the Engineer. The Contractor shall provide ventilation and egress to safely access the liner system work.

H. The Contractor shall conduct his work such that the liner system is installed as specified herein and as recommended by the liner system manufacturer. Any nonconforming liner system work shall be corrected as specified herein or as recommended by the manufacturer at no additional cost to the Owner.

I. The Contractor is ultimately responsible for the workmanship and quality of the liner system installation. Inspections by the liner system Manufacturer, the Engineer, or others does not limit the Contractor's responsibility for the quality of the liner system work.

J. If any requirements of this specification are contradicted by a referenced standard or vice-versa, the matter shall be resolved in writing by the Engineer.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver all materials to the site in their original, unopened containers. Each container shall bear the manufacturer's name and label.

B. Materials shall be stored in accordance with manufacturer's recommendations in enclosed structures and shall be protected from weather and adverse temperature conditions. Flammable materials shall be stored in accordance with state and local codes. Materials exceeding storage life as defined by the manufacturer shall be removed promptly from the site.

C. Mix all materials in an enclosed mixing area to protect the mixing operation and materials from direct sunlight, inclement weather, freezing, or other means of damage or contamination.

1.7 FIELD CONDITIONS

A. The field conditions shall be as indicated in this Section unless otherwise allowed by the liner system manufacturer and approved in writing by the Engineer.

B. Apply liner system only when ambient air temperature is between 65 and 95 deg F.

C. Do not apply liner system when relative humidity exceeds 90 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.

D. Substrate surface temperature - 50°F minimum, and at least 10°F higher than dew point temperature.

E. No dust generation shall be allowed during this period.

F. Concrete pH shall be between 9.0 and 11.5 and as recommended by the high-performance liner system manufacturer.

1.8 WARRANTY

A. The Manufacturer warrants that the product and installation meet that quality and technical standards published in their current literature and be free from defects, including adhesion, bubbling, deterioration or failure of liner system for a period of 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 HIGH-PERFORMANCE CONCRETE LINER SYSTEM

A. Composition

1. The material used in the liner system shall be a combination of powder, liquid and hardener that must be mixed together as used, specially compounded to protect concrete surfaces from biogenic sulfide corrosion.

B. Physical Properties are as follows:

1. All cured corrosion-resistant liner system shall be free of cracks, pinholes or other defects adversely affecting the protective characteristics of the material. The Engineer may authorize the repair of such defects by approved methods.
2. The liner system shall have good impact resistance and shall have sufficient elongation to bridge existing static hairline cracks (those which do not see thermal movement) in the concrete.
3. The liner system shall be repairable at any time during the life of the structure.
4. Special Safety and Handling:

    a. There are no special safety of handling procedures.

C. The specified products for the filling of all bugholes and voids up to ½ inch in depth or resurfacing the concrete prior to lining application shall be as follows:

1. For Spectrashield, per manufacturer recommendation to meet warranty requirements in this Section.

D. The specified products for resurfacing concrete and the filling of all bugholes and voids in the concrete deeper than ½ inch shall be as follows:

1. For Spectrashield, per manufacturer recommendation to meet warranty requirements in this Section.

E. The specified products for the lining system shall be as follows:

1. Lining system by Spectrashield, manufactured by CCI Spectrum, Inc.

PART 3 - EXECUTION

3.1 HOISTING, SCAFFOLDING, STAGING AND PLANKING

A. Provide, set-up, and maintain all required scaffolds, and staging and planking, and perform all hoisting work required to complete the work of this Section as indicated and specified.

B. Scaffolds shall have solid backs and floors to prevent dropping materials therefrom to the floors or ground.

3.2 GENERAL

A. Thinners or cleaning solvents used shall be approved by the liner system manufacturer.

B. Strictly follow the liner system manufacturer's written instructions and the requirements of this specification regarding all aspects of protective lining work including: mixing, application, recoat times and curing.

C. Environmental Requirements:

1. Comply with the liner system manufacturer's recommendations as to environmental conditions under which liner materials can be applied.
2. Do not apply liner system materials when dust is being generated.
3. Provide all temporary lighting during the work equivalent to one 200 watt explosion proof incandescent lamp per 100 square feet of work area.

3.3 CONTROL OF AMBIENT CONDITIONS IN STRUCTURES TO BE COATED

A. Control ambient conditions in the structures to be coated, and provide protective enclosures during surface preparation, application, and curing, to meet the specified conditions. This control work shall be continued throughout the liner system installation and curing.

B. The minimum ambient condition requirements inside the structures for liner system work shall be as follows:

1. During all phases of liner system installation and curing:

    a. Air temperature - 65°F minimum
    b. Relative humidity - below 90%
    c. Substrate surface temperature - 50°F minimum, and at least 10°F higher than dew point temperature
    d. No dust generation

C. Contractor shall provide ventilation and isolation of each structure to be coated. Contractor shall provide all means necessary to exhaust noxious gases and odors, which may be present during the work.

3.4 SURFACE PREPARATION

A. Comply with initial cleaning and surface preparation, as specified herein, and manufacturer's written instructions and recommendations applicable to substrates and liner system indicated.

B. Surface Preparation of New Concrete Substrates

1. Abrasive blast clean or hydro blast clean all new or repaired concrete surfaces to remove all degraded or loose concrete, and to produce a sound, clean substrate free of laitance, surface contaminants, loose materials, or otherwise deleterious substances. Cleaning shall be in accordance with SSPC-SP-13/NACE.
2. Cleaning of new concrete surfaces must produce a minimum, uniform substrate anchor pattern or surface profile between CSP 6 and 7 in accordance with ICRI 310.2.
3. Cleaning of repaired concrete surfaces, after proper cure of resurfacing mortars, must produce a minimum, uniform substrate anchor pattern or surface profile between CSP 4 and 5 in accordance with ICRI 310.2.
4. Should cleaning not remove degraded or loose concrete, chipping or other abrading tools shall be used to remove the deteriorated concrete until a sound, clean substrate is achieved which is free of calcium sulfate, loose coarse or fine aggregate, laitance, loose hydrated cement paste, and otherwise deleterious substances. Abrasive blast cleaning and any other means necessary shall be used to open up all air voids or "bugholes" to expose their complete perimeter and depth. Leaving shelled over, hidden air voids beneath the exposed concrete surface will not be acceptable. Concrete substrate shall be dry prior to the application of any surface filler or liner system materials.
5. All new concrete to be coated shall have achieved a minimum of 28 days of cure time prior to liner system application.
6. New concrete surfaces shall not have been cured using curing compounds, but rather will have been wet cured.
7. Acceptable surface preparation must produce a concrete surface pH of 9.0 to 11.5 to be confirmed by surface pH testing as specified under PART 3. Acceptable surface preparation must remove all concrete acid reaction materials. Prior to application of resurfacing mortar, test pH of concrete surfaces in accordance with ASTM F710, minimum 6 locations per surface. Submit results to engineer for review and determine if additional concrete removal is required.
8. Following inspection of the concrete surface preparation by the Contractor and acceptance by the Engineer, thoroughly vacuum clean all concrete surfaces to be coated

to remove all loose dust, dirt, and spent abrasive leaving a dust free, sound concrete substrate. All debris produced by blast cleaning shall be removed from the structures to be coated and disposed of by the Contractor at an approved location in accordance with all applicable local, state, and federal regulations. Inspect again and if specified conditions are met, the Engineer will accept the substrate prior to commencement of liner system installation. Blow down cleaning with compressed air will not be acceptable.

C. Surface Preparation of Bare and Coated Metal Substrates Onto Which Lining System Will Terminate

1. The approved lining system for concrete will terminate onto metal substrates at various transitions, embedments and penetrations. Abrasive blast clean all such surfaces to remove all dirt corrosion products, and other substances that would prevent the specified liner system adhesion from being achieved. All ferrous metal surfaces (not ductile iron) shall be blast cleaned to a Near White Blast in accordance with SSPC-SP-10. All metal surfaces shall be cleaned to produce a minimum surface profile of 4.0 mils which is uniform.
2. Post Blast Cleaning: Once abrasive blast cleaning has been accepted, proceed as follows:

    a. Remove all traces of grit, dust, dirt, rust scale, friable material, loose corrosion products or embedded abrasives from substrate by vacuum cleaning prior to linrt system application.
    b. Prevent contamination of the concrete or metal surfaces after blasting from workers' fingerprints, deleterious substances on workers' clothing, or from atmospheric conditions. If, after cleaning, contamination occurs, reblast and reclean to achieve specified substrate cleanliness. Care must be taken to hold the specified degree of cleanliness on metal surfaces to prevent rust bloom prior to proceeding with application of the lining materials.

3.5 INSTALLATION OF LINING SYSTEM

A. Unless specified elsewhere herein, strictly comply with the liner system manufacturer’s most recent written instructions with respect to the following:

1. Mixing of All Materials.
2. Protection and Handling of All Materials.
3. Recoat Limitation and Cure Times.
4. Minimum Ambient and Substrate Temperatures, Substrate's Degree of Dryness, Relative Humidity and Dew Point of Air.
5. Application.
6. Final Curing.
7. Use of Proper Application Equipment.

B. The protective liner system shall provide sealed substrates to prevent penetration of H_2S gas and liquids.

C. Repair all voids or damaged areas of the concrete substrates to be lined using the specified trowel applied repair materials recommended by the manufacturer to provide “bughole” free surfaces for the corrosion resistant liner.

D. Total thickness of multi-layer liner system shall be a minimum of 500 mils.

E. Provide liner system terminations at leading edges (above or below the water line) and at all metallic interruptions to the concrete substrate, i.e. pipe supports, pipe penetrations, gates to adjacent structures, tanks, and channels, etc. Treat terminations in accordance with the termination details and instructions provided by the liner system manufacturer.

F. Treat liner system application at joints or cracks in accordance with the drawing details or written instructions provided by the liner system manufacturer.

3.6 CURING OF PROTECTIVE LINER SYSTEM

A. Protected finish liner from damage during curing as recommended by the liner system manufacturer. Ambient conditions shall be controlled during curing to ensure the minimum air temperature and minimum relative humidity as required by the liner system manufacturer.

3.7 CLEAN-UP

A. At the completion of the liner installation work, remove all equipment, surplus material, and debris from the site. The surrounding surface area, including roadways, and all other surfaces shall be restored to their pre-project condition.

3.8 FIELD QUALITY CONTROL INSPECTION AND TESTING

A. Manufacturer's Field Services: Manufacturer's representative shall provide technical assistance and guidance for surface preparation and application of liner systems. Manufacturer's representative shall hold point inspections to review surface preparation prior to application of liner system.

B. Contractor or Contractor's representative shall perform the procedures listed below in conjunction with the requirements of this Section and prepare daily inspection reports documenting all required Q.C. inspection and test findings. The inspector will inspect the work to determine conformance to the contract documents.

C. Inspect and record substrate profile (anchor pattern) requirements visual inspection and comparison to ICRI 310.2 CSP Replicas for concrete substrates. Perform profile comparison for concrete once for every 100 sq. ft. of surface area to be lined.

D. Measure and record ambient air temperature once every two hours of each shift using a thermometer and measure and record substrate temperature once every two hours using a surface thermometer.

E. Measure and record relative humidity every two hours of each shift using a sling psychrometer in accordance with ASTM E337.

F. Check for the presence of substrate moisture in the concrete by performing the Standard Test method for Indicating Moisture in Concrete by the Plastic Sheet Method in accordance with

ASTM D4263. If the presence of moisture is indicated, take measures to force dry the concrete substrate prior to commencing with lining system application. Force drying can be accomplished using indirect heaters and fans. If the source of substrate moisture cannot be eliminated by force drying, the Contractor shall consult with the Engineer. Perform this test once for every 200 sq. ft. of area to be coated and more frequently at darkened concrete areas.

G. Confirm correct mixing of liner materials as specified herein.

H. Inspect and record that the "pot life" of liner materials is not exceeded during installation.

I. Provide and record adhesion of the liner system materials in accordance with ASTM D7234. Testing shall be performed at one location for every 200 sq. ft. of surface area to be coated. Use the following procedure:

1. Clean the liner system surface to remove all oil, dirt, dust or other contaminants.
2. Cut through the liner system material into the substrate using a circular core drill in accordance with the pertinent standard requirements.
3. Mix and apply rapid setting two component epoxy adhesive onto the abrasive blast cleaned disk or load fixture. Install the disk or load fixture firmly over the cut out circular area and hold in place using tape or other means to secure it until adhesive has cured.
4. Remove the disk or load fixture with the Pull Off Testing instrument, strictly following the instrument manufacturer's instructions.
5. Read or calculate the adhesive tensile pull value and record in pounds per square inch (psi). The adhesive tensile pull value must exceed 300 psi and must remove concrete over 90% of the load fixture surface that is attached to the underside of the disk or load fixture. If it does not, two additional adhesion tests will be performed in the same 200 sq. ft. area. If the requirements set forth above are still not met, the liner installation in this area will be deemed unacceptable and shall be removed and reinstalled immediately until acceptable adhesion is achieved (at no additional cost to the Owner). All test locations are to be repaired by the Contractor to achieve a pinhole free liner system directly following acceptable results at no additional cost to the Owner.

J. Measure and record the thickness of the liner system using the following methods:

1. Use notched gauge in accordance with ASTM D4414 for Wet Film Thickness at least once every 50 sq. ft. of liner area. (For metal and resurfaced concrete substrates.)
2. Following cure, the liner system shall be tested for dry film thickness once for every 500 sq. ft. of surface area using a Positector 100 DFT Gauge calibrated in accordance with the instrument manufacturer's instructions. Any areas found to be below 500 mils DFT above filled bugholes and above the prepared substrate profile shall receive an additional application of the liner system or shall be removed/recoated as required to meet the total DFT requirement at no additional cost to the Owner. Additional thickness may be problematic in areas where mechanical moving equipment tolerances are critical. At such locations, liner removal and reapplication to the specified film thickness may be required, at no additional cost to the Owner.

K. All liner system surfaces shall be visually inspected for areas showing poor adhesion, air inclusion, edges or seam defects or any other defects in the liner system preventing a complete

seal of the surfaces to be protected. Any and all deficiencies or defective work (not in compliance with this Section or related Sections) will be marked by the inspector for repairs or removal/replacement by the Contractor at no additional cost to the Owner.

L. Holiday and Pinhole Testing

1. Location of holidays and pinholes in the liner system shall be performed in the field using spark testing. Upon completion of the liner system installation, thoroughly dry and clean the surface of the liner and conduct visual inspection and holiday testing. All areas of the liner failing to meet the field test shall be repaired and retested. The spark testing shall be done with a Tinker & Rasor Holiday Detector (Model AP-W). This testing must be performed in accordance with ASTM D4787, using the revised procedure that follows:
2. Trial Holiday Detection-Drill a 1/16 inch diameter hole through the liner system into the concrete 100 feet away from the ground connection. Follow ASTM D4787 Section 12 for adjusting the voltage setting for the 1/8 inch thick lining. Generally, the setting should total 100 volts per mil of thickness. Adjust the voltage +/- 5% to the established setting and pass the electrode over the known holiday to ensure detection at this distance from ground and at the recommended voltage setting. If detected, proceed by moving the electrode over the liner surface slowly (approximately 1/2 to 1 foot per second) and mark holiday for repair as they are detected. If the known holiday is not detected, proceed as follows:

    a. Check cleanliness (shiny metal clean) of ground connection and repeat detection of known holiday.
    b. Check battery power charge for instrument.
    c. Try a new ground location and repeat detection of known holiday.
    d. Gradually increase the instrument voltage until the known holiday can be detected and check the liner system thickness at this location. The rule for voltage settings is 100 volts per mil of coating thickness.
    e. The voltage setting should follow the rule of 100 volts per mil of coating thickness.

3. Marking of Holidays

    a. Holidays are to be marked on the liner using felt tipped pens or other markers approved by the liner system material manufacturer. Holidays are to be repaired in strict accordance with the lining manufacturer's recommendation, at no additional cost to the Owner. Holiday detection is to be repeated only over the liner repair locations.

M. Final Inspection

1. Perform a final inspection to determine whether liner system work meets the requirements of the specifications. This work shall be performed by the Engineer, the Owner and the Contractor.
2. Mark any rework required on any pinholes, holidays or any other inadequacies in the quality of the liner system work. Such areas shall be recleaned and repaired by the Contractor as specified herein at no additional cost to the Owner.

END OF SECTION

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SECTION 10140

SIGNAGE

PART 1 GENERAL

1.01 SCOPE OF WORK

A. Furnish all labor, materials, equipment and incidentals required and design and deliver signage for the Project as shown on the Drawings and as specified herein.

B. The work includes:

1. Panel signs

1.02 SUBMITTALS

A. Submit, in accordance with Section 01300

B. Product Data: For each type of product indicated.

C. Shop Drawings:

1. Show fabrication and installation details for signs.

2. Show sign mounting heights, locations of supplementary supports to be provided by others, and accessories.

3. Provide message list, typestyles, graphic elements, and layout for each sign.

D. Qualification Data: For Installer and fabricator.

E. Maintenance Data: For signs to include in maintenance manuals.

1.03 REFERENCE STANDARDS

A. American Architectural Manufacturers Association

1. AAMA 611 -Voluntary Specifications for Anodized Architectural Aluminum

2. AAMA 2603 -Voluntary Specification, Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels

B. ASTM International

1. ASTM A 240/A 240M -Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications

2. ASTM A 529/A 529M -Specification for High Strength Carbon-Manganese Steel of Structural Quality

3. ASTM A 572/A 572M -Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel

4. ASTM A 591/A 591M -Specification for Steel Sheet, Electrolytic Zinc-Coated, for Light Coating Weight [Mass] Applications

5. ASTM A 653/A 653M -Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process

6. ASTM A 666 -Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar

7. ASTM A 1008/A 1008M - Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low Alloy and High-Strength Low-Alloy with Improved Formability

8. ASTM B 26/B 26M -Specification for Aluminum Alloy Sand Casting

9. ASTM B 36/B 36M -Specification for Brass Plate, Sheet, Strip, and Rolled Bar

10. ASTM B 152/B 152M -Specification for Copper Sheet, Strip, Plate, and Rolled Ba

11. ASTM B 209 -Specification for Aluminum and Aluminum-Alloy Sheet and Plate

12. ASTM B 221 -Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes

13. ASTM B 584 -Specification for Copper Alloy Sand Castings for General Applications

14. ASTM D 256 -Test Methods for Determining the Izod Pendulum Impact Resistance of Plastics

15. ASTM D 638 -Test Method for Tensile Properties of Plastics

16. ASTM D 648 -Test Method for Deflection Temperature of Plastics Under Flexural Load in Edgewise Position

17. ASTM D 790 -Test Method for Flexural Properties for Unreinforced and Reinforced Plastics and Electrical Insulating Material

18. ASTM D 1044 -Test Method for Resistance of Transparent Plastics to Surface Abrasion

19. ASTM D 4802 -Specification for Poly(Methyl Methacrylate) Acrylic Plastic Sheet

C. International Code Council/American National Standards Institute

1. ICC/ANSI A117.1 -Accessible and Usable Buildings and Facilities

D. National Association of Architectural Metal Manufacturers

1. Metal Finishes Manual for Architectural and Metal Products.

E. SSPC: The Society for Protective Coatings

1. SSPC-SP 5/NACE No. 1 - Joint Surface Preparation Standard SSPC-SP 5/NACE No. 1: White Metal Blast Cleaning

2. SSPC-SP 8 - Surface Preparation Specification No. 8: Pickling

F. Underwriters Laboratories Inc.

1. UL 924 -Emergency Lighting and Power Equipment

G. Florida Building Code, Accessibility.

H. Where reference is made to one of the above or other referenced standards, the revisions in effect at the time of bid opening shall apply.

1.04 QUALITY ASSURANCE

A. Installer Qualifications: An employer of workers trained and approved by manufacturer.

B. Fabricator Qualifications: Shop that employs skilled workers who custom-fabricate products similar to those required for this Project and whose products have a record of successful in-service performance.

C. Source Limitations for Signs: Obtain each sign type indicated from one source from a single manufacturer.

1.05 PROJECT CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit installation of signs in exterior locations to be performed according to manufacturers' written instructions and warranty requirements.

1.06 COORDINATION

A. Coordinate placement of anchorage devices with templates for installing signs.

1.07 WARRANTY

A. Manufacturer's standard form in which manufacturer agrees to repair or replace components of signs that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:
   a. Deterioration of metal finishes beyond normal weathering.
   b. Deterioration of embedded graphic image colors and sign lamination.

2. Warranty Period: Five years from date of Substantial Completion.

PART 2 PRODUCTS

2.01 MATERIALS

A. Aluminum Castings: ASTM B 26/B 26M, of alloy and temper recommended by sign manufacturer for casting process used and for use and finish indicated.

B. Aluminum Sheet and Plate: ASTM B 209, alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with at least the strength and durability properties of Alloy 5005-H32.

C. Aluminum Extrusions: ASTM B 221, alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with at least the strength and durability properties of Alloy 6063-T5.

D. Acrylic Sheet: ASTM D 4802, Category A-1 (cell-cast sheet), Type UVA (UV absorbing).

E. Applied Vinyl: Die-cut characters from vinyl film of nominal thickness of 3 mils with pressure-sensitive adhesive backing, suitable for exterior applications.

2.02 PANEL SIGNS

A. Manufacturers: Provide products by one of the following:

1. ACE Sign Systems, Inc.

2. APCO Graphics, Inc.

3. Gemini Incorporated.

4. Mohawk Sign Systems

5. Signature Signs, Incorporated

6. Or approved equal

B. Exterior Panel Signs: Provide smooth sign panel surfaces constructed to remain flat under installed conditions within a tolerance of plus or minus 1/16 inch measured diagonally from corner to corner, complying with the following requirements:

1. Aluminum Sheet: 0.080 inch thick.

2. Panel Size: 24” x 24” (Minimum)

3. Mounting:

    a. Unframed.
    b. Concrete Wall mounted.
    c. Manufacturer's standard noncorroding anchors for substrates encountered.

4. Color: As selected by Owner from manufacturer's full range.

C. Applied Vinyl: Die-cut characters from vinyl film of nominal thickness of 3 mils with pressure-sensitive adhesive backing.

1. Panel Material: Clear acrylic sheet with opaque color coating, subsurface applied.

D. Colored Coatings for Acrylic Sheet: For copy and background colors, provide colored coatings, including inks, dyes, and paints, that are recommended by acrylic manufacturers for optimum adherence to acrylic surface and are UV and water resistant for five years for application intended.

1. Color: As selected by Owner from manufacturer's full range.

2.03 ACCESSORIES

A. Anchors and Inserts: Provide nonferrous-metal or hot-dip galvanized anchors and inserts for exterior installations and elsewhere as required for corrosion resistance. Use toothed steel or lead expansion-bolt devices for drilled-in-place anchors. Furnish inserts, as required, to be set into concrete or masonry work.

2.04 FABRICATION

A. General:

1. Provide manufacturer's standard signs of configurations indicated.

2. Welded Connections: Comply with AWS standards for recommended practices in shop welding. Provide welds behind finished surfaces without distortion or discoloration of exposed side. Clean exposed welded surfaces of welding flux and dress exposed and contact surfaces.

3. Mill joints to tight, hairline fit. Form joints exposed to weather to exclude water penetration.

4. Preassemble signs in the shop to greatest extent possible. Disassemble signs only as necessary for shipping and handling limitations. Clearly mark units for reassembly and installation, in location not exposed to view after final assembly.

5. Conceal fasteners if possible; otherwise, locate fasteners where they will be inconspicuous.

2.05 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.06 ALUMINUM FINISHES

A. Baked-Enamel Finish: AA-C12C42R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: acid-chromate-fluoride-phosphate conversion coating; Organic Coating: as specified below). Apply baked enamel complying with paint manufacturer's written instructions for cleaning, conversion coating, and painting.

1. Organic Coating: Thermosetting, modified-acrylic enamel primer/topcoat system complying with AAMA 2603 except with a minimum dry film thickness of 1.5 mils, medium gloss.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.

B. Verify that items including anchor inserts are sized and located to accommodate signs.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Locate signs and accessories where indicated, using mounting methods of types described and complying with manufacturer's written instructions.

1. Install signs level, plumb, and at heights indicated, with sign surfaces free of distortion and other defects in appearance.

B. Wall-Mounted Signs:

1. Comply with sign manufacturer's written instructions except where more stringent requirements apply.

2. Mechanical Fasteners: Use nonremovable mechanical fasteners placed through predrilled holes. Attach signs with fasteners and anchors suitable for secure attachment to substrate as recommended in writing by sign manufacturer.

3.03 CLEANING AND PROTECTION

A. After installation, clean soiled sign surfaces according to manufacturer's written instructions. Protect signs from damage until acceptance by Owner.

3.04 SIGNAGE SCHEDULE

PANEL SIGNAGE SCHEDULE		
Quantity	Sign Copy	Location
1	NOTICE Confirm Ground Water Level is Below Tank Slab Prior To Draining Structure	Located on exterior wall of BTU No. 3. Located near the access stairway as shown on the Drawings.

END OF SECTION

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SECTION 11286

SLIDE GATES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes: Stainless steel gates at the Influent Structure, BTU No. 3 and BTU No. 1 (replacement gate).

1.3 DEFINITIONS

A. Operating Head: Distance from centerline of gate to maximum water level of channel.

1.4 ACTION SUBMITTALS

A. Product Data: Manufacturer's product information for system materials and component equipment.

B. Shop Drawings:

1. System materials and component equipment.
2. Description of materials cross-referenced to a sectional drawing listing material by trade name and ASTM reference number.
3. Certified shop and installation drawings showing details of construction, dimensions and anchor bolt locations.
4. Installation and anchoring requirements, fasteners, and other details.
5. Descriptive literature, bulletins and/or catalogs of the equipment.
6. The weight of each component.
7. Description of surface preparation and shop prime painting of gates and accessories.
8. Gate identification number, location, service, type, size, design pressure, operator details, stem details, and loads.
9. Listing of forces transmitted to floor stands if applicable.

1.5 INFORMATIONAL SUBMITTALS

A. Manufacturer's Certificate: Products meet or exceed specified requirements.

B. Manufacturer's Instructions: Detailed instructions on installation requirements, including storage and handling procedures.

C. Source Quality-Control Submittals: Results of shop tests and inspections.

D. Field Quality-Control Submittals: Results of Contractor-furnished tests and inspections.

E. Manufacturer Reports:

1. Certify that equipment has been installed according to manufacturer's instructions.
2. Document activities on Site, adverse findings, and recommendations.

F. Qualifications Statements:

1. Submit qualifications for manufacturer and licensed professional.

1.6 DELEGATED DESIGN SUBMITTALS

A. Delegated Design Submittals: Submit signed and sealed shop drawings with design calculations and assumptions for seating pressure.

B. Copy of PE License of Engineer of Record.

1.7 CLOSEOUT SUBMITTALS

A. Section 01701 “Project Closeout” for closeout procedure requirements.

B. Project Record Documents: Record actual locations of installed gates and components.

C. Operation and Maintenance Data: Submit maintenance instructions for equipment and accessories.

1.8 MAINTENANCE MATERIAL SUBMITTALS

A. Section 01730 “Operating and Maintenance Data” for maintenance materials requirements.

B. Spare Parts:

1. Furnish manufacturer's recommended spare parts for 5 percent of the gates supplied.

C. Tools: Provide special tools and spare parts required for normal operation and maintenance of the equipment.

D. O&M Manual: Provide copies of manufacturer's O&M manuals per requirements in Section 01730 “Operation and Maintenance Data”.

1. Include required cuts, drawings, equipment lists, descriptions, etc. to instruct operating and maintenance personnel unfamiliar with such equipment.
2. Include trouble shooting data and full preventive maintenance schedules.

E. Factory Representative: Provide factory representative to instruct representatives of the Owner on proper operation and maintenance of the equipment.

1.9 QUALITY ASSURANCE

A. Gate manufacturer to be ISO 9001:2015 certified or provide an alternate quality assurance plan for review and approval by the Engineer.

B. Maintain a copy of each standard affecting Work of this Section on Site.

C. Iron and steel products supplied under this Section must comply with the American Iron and Steel provisions of the Contract.

1.10 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum three years' documented experience.

B. Licensed Professional: Professional engineer experienced in design of specified Work and licensed in the State of Florida.

1.11 DELIVERY, STORAGE, AND HANDLING

A. Section 01600 “Materials and Equipment” for transporting, handling, storing, and protecting products requirements.

B. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.

C. Store materials according to manufacturer's instructions.

D. Protect materials from physical damage, moisture and dust by storing in clean, dry location remote from areas involved in construction operations.

1. Provide additional protection according to manufacturer's instructions.

1.12 EXISTING CONDITIONS

A. Field Measurements: Verify field measurements prior to fabrication. Document field measurements on Shop Drawings.

1.13 WARRANTY

A. Section 01740 “Warranties and Bonds” for warranties requirements.

B. Furnish five-year manufacturer's warranty for gates.

C. Furnish five-year manufacturer's warranty that clear plastic stem covers will not crack, discolor, or become opaque.

PART 2 - PRODUCTS

2.1 PERFORMANCE AND DESIGN CRITERIA

A. Slide gates have the characteristics, operating head and dimensions as tabulated in the Gate Schedule included on the Drawings.

B. Minimum Vertical Loading: 50 percent of force on the gate from operating head acting on horizontal centerline of gate, multiplied by effective gate area, plus weight of slide and stem.

C. Gate Reinforcement: As required for deflection not greater than 1/720 of span or 1/16-inch, whichever is less.

D. Operating Head:

1. Safety Factor: Design gate to operate under specified operating head with safety factory of five.

2.2 STAINLESS STEEL SLIDE GATES

A. Manufacturers:

1. Whipps, Inc., Athol, MA;
2. RW Gate Company, Troy, NY;
3. Hydro Gate Denver, CO; or
4. Waterman Valve LLC, Exeter, CA.

B. Description:

1. Comply with AWWA C561.
2. Self-contained stainless steel slide gate, with extended frame, yoke, lifting stem attached to yoke, lift and lift support, stem, stem guide, and stem block.
3. Size: As indicated on Drawings.
4. Operating Head: As indicated on Drawings.
5. Closure: As indicated on Drawings.
6. Opening: As indicated on Drawings.

C. Gates: Type 316 stainless steel, self-contained type with disc arranged to lower to open and with guides designed to mount on the face of or embedded in concrete.

1. Disc or Sliding Member: Type 316 the stainless-steel plate reinforced with vertical and horizontal stainless steel members welded to the plate not more than 16 inch apart.

    a. Deflection: 1/720 of span of the gate or 1/16-inch, whichever is less, under the design head.
    b. When the gate size and head pressures justify the use of a thick edge design, the portion of the disc that engages the guide shall have a minimum thickness of 1/2-inch.
    c. Reinforcing Ribs: When thick edge design is utilized, extend into guides so they overlap seating surface of the guide.
    d. A Specially Molded Resilient Seal:

        1) Mounted on bottom of frame.
        2) Seal Shape: Produce a seating surface with minimum width of 3/4 inch and extend into secondary slot of the guide.
        3) Vertical Seal Face: In contact with seating surface of guide providing a proper seal at the corners.

    e. Reinforcements, Retainer and Bolts: Same material as disc.

2. Minimum Thickness: 1/4 inch.
3. Configuration: Removable.

D. Guides: Type 316 stainless steel construction, designed for maximum rigidity, weighing a minimum of 3 lbs per foot.

1. The structural members for the guide and guide extensions are to be formed into a one-piece shape for rigidity.
2. Holes for anchor bolts maximum every 18 inches for face mounted units or embedding keyways for embedded units.
3. When the gate size and head pressures justify the use of a thick edge design, the portion of the face-mounted frame, where the anchor bolts penetrate, will have a minimum thickness of 1/2-inch.
4. Guides to extend beneath opening a sufficient amount to support the disc in fully down or open position for downward opening gates.
5. Weld angle to guides across the invert of the opening on face-mounted gates and up both sides of all gates. Seals shall be of the self-adjusting type as described in this Section.
6. Where guides extend above operating floor, they must be sufficiently strong, so no further reinforcing is required.
7. Where required, the yoke supporting the operating bench stand will be formed by two C-channel structural members welded at top of the guides providing a one-piece rigid frame.
8. Guides extensions to be “C” or “L” shaped stainless-steel members, or similar, for rigidity, weighing a minimum of 11lbs per foot.

E. Gate Seal:

1. Gate to be sealed with UV stabilized, self-adjusting UHMWPE material with a nitrile compression cord.

2. Seal to be placed in a stainless-steel channel, welded to the guides of the gate.
3. Seals to be provided on the invert and sides of gate, and along the top seal member on gates identified in the schedule to have a top closure.
4. Deflection: Arrange seal to have a minimum deflection of 1/16-inch.
5. Attachment hardware to be same material as the guides.
6. All seats and seals, including the invert seal, shall be mechanically fastened with 316 stainless steel attachment bolts.

F. Yokes: Type 316 stainless-steel construction with the yoke supporting the operating bench stand.

1. Formed by welding two "C" channels to the top of the guides to provide a single piece rigid frame.
2. Arrangement: Disc and stem to be removable without disconnecting the yoke.
3. Top of yoke height: Minimum – 42-in.

G. Frames: One-piece configuration.

1. Mounting: Embedded.
2. Material: Type 316 stainless steel.
3. Furnish continuous embed or mounting flange.
4. Thickness: 1/4 inch
5. Seats: Ultra-high-molecular-weight polymer.

H. Lifting Nut: Brass.

1. Grease fitting.
2. Roller bearings or ball bearing above and below lifting nut.

I. Lifting Stem: Type 316 stainless steel for the entire length.

1. Tensile Strength: 60,000 psi.
2. Diameter: Of sufficient size at base of thread to lift the weight of the gate, offset the resistance of the gate to the maximum unbalanced head and fully allow for starting impact.
3. Transmit in compression at least two times the rated output of the crank operated floor stand with a 40 pound effort on the crank.
4. Stems More Than One Section: Joined by stainless steel couplings pinned and bolted to the stems.
5. Threaded and Keyed Couplings of Same Size: To be interchangeable.
6. Bronze Stop Collars: On the stem preventing over closing of the gate.
7. Minimum Diameter: 1-1/2 inch to withstand twice the rated output of the operator.
8. Slenderness Ratio (l/r): Less than 200.
9. Stem Guides: Provide as recommended by manufacturer. Adjustable in two directions and spaced at sufficient intervals to adequately support the stem. Spacing not to exceed 10 feet.
10. Configuration: Rising. Removable.
11. Thread: Machine rolled threads, Acme type, single or double lead.
12. Diameter: 1-1/2 inch .
13. Fully lubricated.

14. Stem Covers: Provide rising stem gates with clear fracture resistant butyrate plastic covers.

    a. Will not discolor or become opaque for a minimum of 5 years after installation.
    b. Capped, vented, and of a length to allow full travel of gate.
    c. Bottom end mounted in a housing or adapter plate for easy field mounting.
    d. Indicator markings showing gate position.

15. Operator: Wheel or crank as indicated in the gate schedule included in the Drawings.
16. Scum baffle: Provide scum baffle on each BTU effluent gate as shown in the Drawings.

2.3 FINISHES

A. Stainless-Steel Surfaces: Mill finish.

B. Welds to be sandblasted or otherwise cleaned to remove weld burn and scale.

2.4 ACCESSORIES

A. Hardware: Type 316 stainless steel. Conform to ASTM A193/A194 and F593/F594 unless otherwise specified.

B. Attaching Bolts and Anchor Bolts: Type 316 stainless steel. Furnished by slide gate manufacturer.

C. Nameplates: Each gate is to be provided with a nameplate that includes the manufacturer's name, serial number, as a minimum. Nameplate to be mounted on the gate yoke or pedestal.

2.5 SOURCE QUALITY CONTROL

A. Section 01400 "Quality Control" for testing, inspection, and analysis requirements.

B. Shop inspection and testing of completed assemblies.

C. Owner Inspection: Make completed slide gates available for inspection at manufacturer's factory prior to packaging for shipment. Notify Owner at least seven days before inspection is allowed. All associated costs for travel, lodging, car rental, etc., necessary for owner inspection will be paid by the owner.

D. Owner Witnessing: Allow witnessing of factory inspections and test at manufacturer's test facility. Notify Owner at least seven days before inspections and tests are scheduled.

E. Certificate of Compliance: When fabricator is approved by authorities having jurisdiction, submit certificate of compliance indicating Work performed at fabricator's facility conforms to Contract Documents.

    1. Specified shop tests are not required for Work performed by approved fabricator.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 01400 “Quality Control” for installation examination requirements.

B. Verify facilities are ready to receive gates.

3.2 PREPARATION

A. Section 01400 “Quality Control” for installation preparation requirements.

B. Clean surfaces according to manufacturer's instructions.

3.3 INSTALLATION

A. Install gates according to manufacturer's instructions.

B. Ensure products are installed plumb, true, and free of warp or twist.

C. Locate operators to avoid interference with handrails and other Work.

D. Gate Installation: Under the supervision of the gate manufacturer’s factory representative.

1. Factory Representative: Furnish services of factory representative who has complete knowledge of proper installation, startup and operation of slide gates. Inspect the final installation and supervise a test of the equipment.

E. If there are difficulties in operation of the equipment due to the manufacturer's fabrication or Contractor's installation, additional service will be provided at no cost to the Owner.

F. Guides: Surface and Flange Mounted.

1. Install guides with expansion anchors or two-part epoxy anchoring system. Utilize backing nuts
2. Position guides at elevation as indicated on Drawings.
3. Grout space between the guides and the mounting surface according to manufacturer’s instructions.

G. Guides: Recessed.

1. Block out slot in concrete placement to receive guides.
2. Position guides at elevation as indicated on Drawings.
3. Grout guides in place according to manufacturer's instructions.

H. Lubricants: Oil and grease as required for initial operation.

3.4 FIELD QUALITY CONTROL

A. Section 01655 “Equipment Testing and Startup” for testing, adjusting, and balancing requirements.

B. Inspection: Verify gate and components alignment, smooth operation, with no binding or scraping.

C. Testing per AWWA C561:

1. Leakage Under 20 feet of Seating Head: 0.05 gpm/ft of seating perimeter
2. Leakage Under 20 feet of Unseating Head: 0.05 gpm/ft.
3. After installation, field test slide gates ensuring items of equipment are in compliance with Specifications, including leakage requirements.
4. For units failing to meet specified requirements, make necessary change and retest units. If unit remains unable to meet test requirements to Engineer’s satisfaction, it will be replaced with a satisfactory unit at no additional cost to Owner.

D. Factory Representative: Manufacturer's representative experienced in installation of products furnished per this Section on Site for installation, inspection, field testing, and instructing and training Owner's personnel in maintenance of equipment.

E. Equipment Acceptance: Adjust, repair, modify, or replace components failing to perform as specified and re-inspect.

1. Make final adjustments to equipment under direction of manufacturer's representative.

F. Furnish physical checkout and installation certificate from equipment manufacturer's representative attesting equipment has been properly installed and is ready for startup and testing.

G. Submit the equipment manufacturer's Certificate of Field Testing.

H. Submit the equipment manufacturer's Certificate of Functional Testing.

3.5 ADJUSTING

A. Section 01400 “Quality Control” for starting and adjusting requirements.

B. Adjust gates to provide smooth operation.

3.6 MANUFACTURER'S SERVICES

A. Manufacturer shall advise, consult, and instruct the Contractor on:

1. Installation procedures and adjustments.
2. Startup and testing of the finished installation.

B. Provide classroom training and hand-on demonstrations.

C. Develop and submit to Engineer and Owner a training lesson plan. Submit proposed lesson plans for scheduled instruction 30 days prior to the commencement of training. Lesson plans will be approved by the Engineer a minimum of 7 days prior to scheduled instruction.

D. Lesson Plans: Detail specific instruction topics. Where applicable, reference and attach training aids to be utilized in the instruction. Describe "Hands-on" demonstrations planned for the instruction, including estimated duration for each training segment.

E. Provide Owner's training including operational and maintenance instruction to two separate operational and maintenance teams over two separate time periods. Give training at times convenient to operational or maintenance teams being trained in coordination with the Owner. Accordingly, some training may be conducted during hours outside a normal Monday through Friday, 8:00 a.m. to 4:00 p.m. workday. Include following operational training as a minimum:

1. Theory of operation.
2. Unit capacity and design criteria.
3. Operational troubleshooting and diagnostics procedures.
4. Step-by-step operating procedures.
5. System operation and optimization practices.
6. Control set point modification procedures.

F. Minimum maintenance training topics:

1. Step-by step, "hands-on" assembly and disassembly procedural instructions.
2. Replacement part identification and ordering procedures.
3. Lubrication procedures, including drain-down and refill procedures.
4. Recommended routine maintenance procedures.
5. Troubleshooting and diagnostic procedures.

G. Man-hour requirements listed below are exclusive of travel time and do not relieve the manufacturer of the obligation to provide sufficient service to place equipment in satisfactory operation. Manufacturer's factory representative shall be present at frequent enough intervals to ensure proper installation, testing and initial operation of the equipment. Minimum time on site per trip based on 8-hour working days.

1. Supervise Installation: Trips – 1, Hours/Trip - 8.
2. Inspect and Approve Installation: Trips – 3, Hours/Trip - 8.

    a. Manufacturer's factory representative shall submit to the Engineer a written certification that the system has been installed in accordance with the manufacturer's recommendations.

3. Instruct Owner's personnel in proper startup and O&M: Trips – 1, Hours/Trip - 8.

    a. Instruction may be given upon completion of Item 2, provided that the O&M manuals have been submitted to and accepted by the Engineer

4. Supervise and Assist in Testing: Trips – 3, Hours/Trip – 8.

    a. May be done upon completion of Item 3 if acceptable to the Engineer. The time required for performance testing is in addition to the above specified hours.

3.7 SCHEDULES

A. Gate Schedule: Manufacturer will supply gates within the project as indicated in the gate schedule located on the Drawings. In the absence of seating and unseating head data, the manufacturer will assume a flooded basin condition from top of concrete to base of gate and assume both a seating and unseating loading condition.

3.8 DEMONSTRATION

A. Section 01655 “Equipment Testing and Startup” for demonstration and training requirements.

B. Demonstrate equipment operation, routine maintenance, and emergency repair procedures to Owner's personnel.

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SECTION 11378

BIOLOGICAL TREATMENT UNIT EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes biological treatment unit system (BTU No. 3) equipment including mechanical aerators, mechanical mixers, gates, variable frequency drives (VFDs) controls and ancillary equipment.

B. All the equipment under this Section shall be furnished by a single Manufacturer (the Aeration Equipment Manufacturer) fully experienced, reputable, and qualified in the manufacture of the equipment specified. The equipment shall be provided by Ovivo (Salt Lake City, UT). Refer to 00800 Article 1 – Definition number 56. Propriety Item.

C. The Contractor shall ensure the aerator and motor manufacturers coordinate his/her design with the supplier of the VFDs, as specified in Section 16400 “Electrical Apparatus”.

D. The Contractor shall supply the effluent weir gate and ensure coordination with the effluent weir gate and the Aeration Equipment Manufacturers.

1.2 Related Requirements:

1. Section 01300 “Submittals”.
2. Section 01655 “Equipment Testing and Startup”.
3. Section 01730 “Operation and Maintenance Data”.
4. Section 01740 “Warranties and Bonds”.
5. Section 05520 “Metal Railings”.
6. Section 09901 “Shop Priming”.
7. Section 09910 “Painting”.
8. Section 11286 “Slide Gates”
9. Section 16150 “Electric Motors”.
10. Section 16400 “Electrical Apparatus”.
11. Section 16900 “Instrumentation and Control”

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for aerators, mixers, gates and instruments.

2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Shop Drawings:

1. Include plans, elevations, sections, and mounting details.
2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection. Indicate anchor bolt locations, aerator impeller diameter, aerator impeller rotational speed (rpm) and aerator impeller tip speed (fps).
3. Include drawings showing compliance with the submerged turbine mixer performance specified herein.
4. Include details on dissolved oxygen (DO) and oxidation reduction potential (ORP) probes. Indicate required clearances, method of assembly, components and location of each.
5. Detail fabrication and assembly of provided equipment including details of the dry well and gear reducer lubrication points.
6. Include installation operation, and start-up procedures including lubrication requirements. A complete bill of materials for all equipment shall be provided with the operation and maintenance (O&M) manual.
7. Include complete motor data.
8. Include a list of spare parts that are supplied with the project.
9. Include oxygen transfer efficiency test reports from a minimum of two U.S. installations. Oxygen transfer data shall be obtained from a full-scale oxidation ditch. Tests from basins that are not operating as an oxidation ditch shall not be acceptable. All test data shall be furnished in English units based on United States Standard Conditions.
10. Written certification from the aerator manufacturer that the proposed aerators are guaranteed to meet the specified velocity requirements. Shop drawings will not be reviewed without this certification.
11. Include diagrams for power, signal, and control wiring.

C. No samples will be required.

D. Aeration equipment manufacturer must have a minimum of fifteen (15) years' experience in the design of oxidation ditches at a minimum of 50 installations in North America which have been operating for at least ten (10) years. A complete U.S. installation list shall be submitted to document this requirement.

E. The combination of impeller design, impeller size, impeller rotational speed, and basin dimensioning influences the oxygenation capacity and propulsion of the system.

1. Aeration equipment manufacturer shall have over fifteen (15) years' experience in measuring oxygen transfer efficiencies of aerators over the entire range of sizes offered by the Manufacturer in various full-scale oxidation ditch configurations in the United States. The Manufacturer shall provide a tabulation of results of oxygen transfer tests at a minimum of twelve (12) separate installations which has similar size aerators specified for this project. In addition, the Manufacturer shall provide a complete oxygen transfer test report showing all calculations and raw data sheets. The results shall demonstrate that the aerator met the performance characteristics required by this specification.

2. Aeration equipment manufacturer shall have over fifteen (15) years' experience in measuring propulsion characteristics (channel velocities) over the entire range of sizes offered by the Manufacturer in various oxidation ditch configurations in the United States. The Manufacturer shall provide a tabulation of results of channel velocity tests at a minimum of twenty (20) separate installations which has similar size aerators specified for this project. In addition, the Manufacturer shall provide a complete velocity test report showing all calculations and raw data sheets for the same aerator HP as required by these specifications. The results of the tabulation of results and the submitted full-scale test report shall demonstrate that the aerator met the performance characteristics required by this specification.

F. Only the Excell® Aerator impeller type by Ovivo Water (Salt Lake City, UT), is allowed on this project. Refer to 00800 Article 1 – Definition number 56. Propriety Item.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: Submit O&M manuals for the equipment in compliance with the Contract Documents, 30 days prior to shipment. In addition to requirements of Section 01730 "Operation and Maintenance Data", manuals shall include:

1. Name, address, and telephone number of the nearest competent service representative who can furnish parts and technical service.
2. Descriptive literature, including illustrations, covering the operational features of the equipment, specific for the particular installation, with all inapplicable information omitted or marked out.
3. Operating, maintenance and troubleshooting information.
4. Complete maintenance parts list.
5. Complete connection, interconnecting and assembly diagrams.
6. Approved Shop Drawings.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Aeration Equipment Manufacturer must have experience providing process equipment and control systems applicable to this project. The Aeration Equipment Manufacturer must submit the following information and meet the experience requirements specified below:

1. Test report from two full-scale oxygen transfer tests in biological treatment units with aerators of similar size installed.

B. Fabricator Qualifications: All shop welding shall conform to the latest standards of the American Welding Society (AWS). Fabricated assemblies shall be shipped in convenient sections as permitted by carrier installations.

C. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by the Aeration Equipment Manufacturer.

D. Testing Agency Qualifications: Member company of NETA or an NRTL.

1.6 DELIVERY, STORAGE, AND HANDLING

A. The Contractor shall store and temporarily support equipment prior to installation in strict accordance with the Aeration Equipment Manufacturer's recommendations and instructions. Protect all exposed surfaces. Keep records of the storage parameters and the dates that storage procedures were performed. The Contractor shall be responsible for work, equipment, and materials until inspected, tested and finally accepted.

B. Store gear reducers, motors, VFDs and control system components in buildings or trailers which have a concrete or wooden floor, a roof and fully closed walls on all sides. Protect the equipment from being contaminated by dust, dirt, vibration and moisture.

C. Temporarily connect equipment with built in space heaters to a power source and keep heaters in operation. Rotate all shafts that have bearings on at least a monthly basis.

D. Fabricated assemblies shall be shipped in the largest sections permitted by carrier regulations and shall be properly match-marked for ease of field erection. The units shall be erected and lubricated in strict accordance with the instructions of the Aeration Equipment Manufacturer's field engineer.

1.7 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to repair or replace components of all equipment of this section that fail(s) in materials or workmanship within specified warranty period.

B. The Contractor shall provide warranties for the items specified in this section accordance with Section 01740, "Warranties and Bonds" unless noted otherwise in this Section.

C. The equipment supplier shall warrant the steel support structure shall be free from deflection greater than L/720 under all applicable loading conditions for a period of 24 months following final completion. The equipment supplier shall repair or replace the support structure if it is found to be deficient in this criterion.

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

A. Design Flows, Loads and Concentrations

1. Influent Flows and Loads: Biological Treatment Unit (BTU) No. 3 specified in this Section shall be designed to treat the following influent flows and loads:

a. BTU No. 3 Design Flow Capacity: 2.0 MGD

b. Design Flows:

Parameter	BTU No. 3 Flows (MGD)
Average Daily Flow (ADF)	1.66
Average Daily Maximum Month Flow (ADMM)	1.90
Maximum Daily Flow (MDF)	2.80
Peak Hour Flow (PHF)	4.02

c. Design Influent Loads:

Parameter	Load (lbs/day)	Concentration at 1.66 MGD ADF (mg/L)
AD $cBOD_5$	4,157	300
ADMM $cBOD_5$	7,369	532
MD $cBOD_5$	8,455	610
AD TSS	3,892	281
ADMM TSS	6,289	454
MD TSS	7,783	562
AD TKN	767	55.4
ADMM TKN	960	69.3
MD TKN	1,093	78.9
AD TP	87	6.28
ADMM TP	129	9.32
MD TP	130	9.39

d. Design Plant Effluent Concentrations: These effluent concentrations are maximum values and shall never be exceeded as long as the influent flows and loads specified are not exceeded.

Parameter	Concentration (mg/L)
Surface Water Discharge	
Total Nitrogen	7.6, Annual Average 9.5, Monthly Average 11.4, Weekly Average 15.2, Single Sample
Total Phosphorus	1.52, Annual Average 1.9, Monthly Average 2.28, Weekly Average 3.04, Single Sample
Reclaimed Water	
Total Nitrogen	5.0, Monthly Maximum 10.0, Single Sample

e. General Design Requirements:

1) BTU No. 3 Design Basis:

a) Design Solids Retention Time (SRT) at ADMM Influent Loads: 6 Days
b) Design MLSS Concentration: 3,700 mg/L
c) Design Minimum Mixed Liquor Temperature: 18 °C
d) Sidewater Depth: 12 feet
e) Minimum Sidewall Freeboard: 1’-2”
f) Oxidation Ditch Volume: 1.6 MG
g) Aerator Type: Low-speed, fixed mechanical aerator with surface aerator impeller.
h) Number of Aerators (total): Three
i) Motor Size (each aerator): 75 HP

B. Products: Subject to compliance with requirements, provide the following Carrousel® BNR System equipment:

1. Low speed, fixed, mechanical surface aerators. Each aerator shall consist of a drive motor, gear reducer, coupling, shaft, surface impeller, a submerged radial pumping impeller and appurtenances, including the Excell® Velocity Enhancer.
2. Fixed, mechanical mixers for installation in the Anoxic zone(s). Each mixer shall consist of a drive motor, gear reducer, shaft and an radial/axial impeller.
3. denitIR internal recycle (IR) flow control gate. Gate shall consist of a manual operator, stand, shaft and gate assembly.
4. Effluent weir gate. Weir gate shall consist of a manual operator, stand, shaft and gate assembly. See Section 11286 “Slide Gates”.

5. The existing Oculus control system shall be used to control BTU No. 3. Control logic necessary for control shall be installed in the existing PLC. Input/output (I/O) for BTU No. 3 will be provided from a separate PLC over Ethernet/IP.

2.2 AERATOR

A. Capacities and Characteristics:

1. Surface impeller of the dual impeller aerator shall deliver an oxygen transfer efficiency of no less than 3.6 lb. O2/HP-hr based on motor output power at standard transfer conditions. If the Aeration Equipment Manufacturer cannot provide full documentation as required, to demonstrate compliance with this requirement, the Aeration Equipment Manufacturer shall perform full-scale tests of oxygen transfer efficiency in the presence of the Engineer.
2. Aeration equipment must be capable of effectively mixing the basin during basin dewatering until the water level in the basin is reduced to a depth of 3 feet. If this requirement cannot be met with the aeration equipment, in-channel submersible mixers must be included in the Aeration Equipment Manufacturer's scope of supply.

B. Aerator Motors

1. Motor:

   a. Single speed 75 HP, 1800 rpm
   b. Totally enclosed fan cooled, constant torque, inverter duty rated, premium efficiency motor wired for 460 volt, 60 cycle, 3 phase current and suitable for VFD application with a 2:1 speed turndown.
   c. Temperature Rating: 40°C ambient with Class F insulation and Class B temperature rise at full load.
   d. Service Factor: 1.15 on sine wave power and 1.0 service factor on VFD supplied power per applicable NEMA Standards.
   e. Bearing Life: Minimum 200,000 hours per AFBMA B10

2. Construction: Cast iron, Mill & Chemical or Corro-duty.
3. Mount: Flange mount to the gear reducer in a vertical position.
4. Furnish with a canopy cap (drip cover) and suitable lifting lugs.
5. Motor to Gear Reducer Connection: Flexible coupling.
6. Service Condition:

   a. Motors suitable for operation in a moisture-laden atmosphere.
   b. Conduit boxes gasketed with neoprene or equivalent material, to prevent moisture from entering the stator through the conduit box.
   c. Stainless steel condensation drains shall be suitably positioned in the lower external surface, so that any accumulation of moisture can drain from the complete motor housing.

7. Ball bearings shall be supplied and shall be grease lubricated. Grease reservoirs shall be ample and provisions shall be made for regreasing with a lubrication system where grease is flushed through the bearings.

8. The winding end turns shall be dipped and baked with a non-hygroscopic varnish, the stator bores and rotor cores shall be coated with epoxy paint.

9. Enclosure finish painted by the motor manufacturer at the factory with a corrosion-resistant paint to provide additional protection against moisture and contaminants.

10. Nameplates: Stainless steel.

11. Each motor shall be equipped with a suitably sized space heater to keep condensation from forming when the motor is not running.

12. Each motor shall be equipped with a normally closed thermostatic heat protection device to protect the motor from overheating during operation. The unit shall immediately stop the aerator drive motor in the event of excessive heat buildup.

C. Aerator Gear Reducers

1. Each gear reducer shall be of the helical gear type and shall be sized with a minimum service factor for all components of the reducer of at least 2.0 times the motor nameplate horsepower rating in accordance with applicable American Gear Manufacturers' Association (AGMA) standards 2001-C95 errata June 28, 1990, when each unit is operating at full load motor horsepower, 24 hours a day continuous running under moderate shock loads. The efficiency shall not be less than 94 percent based on the gear reducer input horsepower. The gear reducer shall be specifically designed for the loading associated with aerators and/or mixers and shall have an independent lower bearing. The bearing shall be external to the gear box housing to accommodate an oversized shaft/bearing assembly capable of handling external axial and radial forces associated with the longer overhung loads. Alternate designs which do not meet this requirement are not acceptable.

2. The gear reducers shall be designed for vertical input and output shaft operation and the housing shall be cast iron construction with provisions for the attachment of suitable lifting devices. Each reduction unit shall have gearing of the helical gear type. Worm gearing will not be acceptable. The units shall be designed to AGMA Service Classification III. All shafts shall be supported on tapered roller or double spherical roller bearings. Gears and pinions shall be made of alloy steels. Shafting shall be made out of medium carbon steel. The gear teeth shall be through-hardened or carburized. Flame hardened gears will not be acceptable. All gears shall be made from alloy steels with sufficient hardenability to obtain case and core properties meeting the requirements for grade 2 material in accordance with ANSI/AGMA 2001-C95. The steel alloy shall be selected, and the heat treatment shall be controlled, to obtain a microstructure that meets all the requirements for grade 2 material in accordance with ANSI/AGMA 2001-C95.

3. All gears shall meet the accuracy requirements for AGMA quality No. Q12 in accordance with ANSI/AGMA 2001-B88. Pitting resistance and bending fatigue resistance shall be rated in accordance with ANSI/AGMA 2001-B88.

4. All bearings incorporated within the gear reduction unit shall have a rating-life expectancy (B10) of 100,000 hours rating-life expectancy (B10), except those bearings attached directly to the output shaft which shall have a rating of 250,000 hours. All bearings shall be of the anti-friction type. Bearing life shall be rated in accordance with ANSI/AFBMA Std. 11-1990 based on operating continuously at the rated full load horsepower and speed.

5. The lubrication of the speed reducer shall conform to AGMA 9005-E02. A reliable lubrication system shall be provided for the gears and bearings. Lubrication systems which rely wholly or in part upon an oil circulating pump shall incorporate a proven reliable pressure device which will immediately stop the driving motor and transmit an alarm signal to the motor control center in the event of insufficient lubrication. Each electrical switch shall be wired to its respective aerator motor control center. External oil cooling will not be permitted. The unit shall be provided with a dipstick or sight glass to observe oil levels. Oil fill and drain lines shall be sufficient size to permit efficient functioning and shall be located on the gear unit in a position which is easily accessible from the bridge platform. The oil drain piping shall be installed so that a container may be placed under the drain discharge.

6. The Contractor shall supply the first charge of run in oil for the reducers, and if necessary due to run time, the change of oil. The Contractor shall purchase the oil from a local firm selected by the Owner, in accordance with the information in the O&M manual, to assure lubricant compatibility.

7. All grease lubricated bearings shall have seals to retain the grease. The low-speed shaft shall have grease lubricated bearings and shall have a dry well to prevent oil leakage. The dry well shall be 100% maintenance free with no wearing parts. The dry well shall be sealed by a non-contact double labyrinth seal with a return drain above. Additionally, the output end of the well shall include the upper and lower bearing seals and separate oil seal. All grease lubrication pressure lines shall be fed from fittings accessibly located above the platform supporting the mechanism.

8. The housing shall be constructed of high tensile strength gray cast-iron conforming to ASTM A48 class 30 minimum with integral dry well construction to eliminate oil leakage at the output shaft and prevent loss of lubrication in the event of a seal failure. The housing shall be stressed relieved prior to machining. The housing shall be tested to preclude casting porosity or weld defects that could result in oil leakage. Lifting lugs shall be provided on the housing suitably located to enable safe removal of the combined electric motor and gear unit from the supporting platform. Removable inspection cover(s) or inspection port(s) shall be provided.

9. Each gear reducer shall be mounted on a support with hot dipped galvanized steel bolts. The support shall be mounted on four (4) zinc plated jack studs inserted in the platform structure and designed to withstand all normal operating loads. The jack studs shall have the capability to provide a total vertical adjustment of six (6) inches. The jack stud nuts shall be drilled and tapped with set screws and vibration isolation pads and stainless steel washers shall be provided.

D. Aerator Impellers, Shafts and Couplings

1. The surface impeller shall be of a design approved by DHV for use in biological treatment unit systems and shall provide oxygenation and propulsion of the mixed liquor in the biological treatment unit.

2. The impeller assembly shall consist of a surface and submerged impeller connected to a common aerator. The surface impeller shall provide oxygenation and propulsion of the mixed liquor in the biological treatment unit. The submerged radial impeller shall provide additional propulsion of the mixed liquor at the bottom portion of the biological treatment unit. The impeller assembly shall operate at a maximum output speed of 40 rpm. The surface impeller shall present a minimum amount of edge perpendicular to the flow to prevent any attachment of solid materials. If the submerged impeller is not used, submersible in-channel mixers shall be provided.

3. Each surface impeller shall be a rim-blade type with ten (10) equally spaced blades and constructed of 1/4" minimum steel plate. The rim plate shall be submerged at all operating conditions, except during basin draining operations, to reduce the effects of variable loading on the aerator support structure and deck. This shall be clearly shown on the submittal drawings. The impeller blades and disc shall be an integral, shop welded unit requiring no field assembly or welding.

4. Each submerged radial impeller shall consist of radial pumping blades and hub that shall be an integral, shop-welded unit requiring no field assembly or welding. Each submerged radial impeller shall draw no more than 15% of the aerator nameplate horsepower at full speed and immersion.

5. The submerged radial impeller shall be positioned above the basin floor and the partition wall extension shall be formed with the partition wall unless a horizontally adjustable wall extension adapter plate is shown on the plans. If required the adapter plate shall be constructed of 304 stainless steel plate, configured to simulate the thickness of the partition wall, and shall be rigidly secured to the concrete partition wall with stainless steel fasteners. The Velocity enhancer shall be constructed in concrete by Contractor.

6. The aerator shaft shall be attached to the gear reducer by a rigid, cast iron flange-type coupling. A retainer plate shall be provided for mounting to the end of the gear reducer output shaft to provide protection against disengagement of the coupling from the gear reducer output shaft. The flanges and flange-type coupling shall be assembled with A325 high strength bolts only. Stainless steel fasteners are not acceptable.

7. All structural steel used in the fabrication of the aerator shall conform to the requirements of "Standard Specifications for Structural Steel" ASTM Specification A36. All shop welding shall conform to the latest standards of the AWS. Fabricated assemblies shall be shipped in convenient sections as permitted by carrier installations.

E. Aerator Painting

1. Unless otherwise noted, all ungalvanized fabricated iron and steel surfaces shall receive a shop-cleaned surface preparation equivalent to SSPC-SP-10 immediately prior to shop-

priming. Shop-priming shall consist of One (1) coat(s) of Tnemec 161-1211 primer or approved equal to 3.0 to 5.0 Mils D.F.T. Touch up and finish painting shall be the responsibility of the Contractor.

2. The motors and gear reducers shall receive a minimum shop-cleaned surface preparation equivalent to SSPC-SP-1 immediately prior to shop-priming and finish coating. Shop-priming and finish painting shall consist of a coating that is compatible with a high quality finish coating that is specifically resistant to chemical, solvent, salt water, and acid environmental conditions. Touch-up painting shall not be the responsibility of the equipment manufacturer.

F. Aerator Spare Parts

1. One oil sensing cutout switch.
2. One flexible motor coupling.
3. Provide all spare parts required for one year's operation at design loading for all wearable parts.
4. Contractor shall provide Manufacturers recommended lubricant for one year's operation at design loading.

2.3 ANOXIC BASIN MIXER

A. Capacities and Characteristics:

1. The mixer design is based on the performance requirements for the biological nutrient removal system; consideration of the future long-term O&M costs to the Owner and optimization of the mixing regime by including both an axial and radial component to the mixer. No exceptions will be made to these performance requirements as specified in this Section.
2. The structural design was based on mixers supplied by Ovivo USA, LLC. Alternate systems will not be accepted. Reference Specification Section 13231, "Wire and Strand Prestressed Concrete Tank".
3. Anoxic Basin Mixer Performance:

    a. Number of Mixers: Two
    b. Maximum Impeller Speed: 64.76 rpm
    c. Maximum Power Draw: 7.5 hp

B. Mixer Motor

1. Each mixer shall be driven by a totally enclosed fan cooled (TEFC), constant torque, premium efficiency 7.5 hp (maximum) motor wired for 460 volt, 60 cycle, 3 phase current. The motors shall be rated at 40°C ambient with Class F insulation and shall have a Class B temperature rise at full load. The motor shall have a service factor of 1.15 and shall comply with the applicable provision of the Standards of NEMA. The minimum AFBMA B10 bearing life shall be 100,000 hours and shall be LP Frame. The nominal motor speed shall be 1800 rpm.

2. The motors shall be cast iron construction, Mill & Chemical or Corro- duty, and shall be integrally mounted to the gear reducer. They shall be mounted in a vertical position to the gear reducer and furnished with a canopy cap (drip cover) and suitable lifting lugs.

3. Motors shall be suitable for operation in a moisture-laden atmosphere. The conduit boxes shall be gasketed with neoprene or equivalent material, so as to prevent moisture from entering the stator through the conduit box. Ball bearings shall be supplied, grease reservoirs shall be ample and provisions shall be made for re greasing with a lubrication system where grease is flushed through the bearings. The winding end turns shall be dipped and baked with a non-hygroscopic varnish, the stator bores and rotor cores shall be coated with epoxy paint. The entire enclosure shall be finish painted by the motor manufacturer at the factory with a corrosion-resistant paint to provide additional protection against moisture and contaminants. The nameplates shall be stainless steel.

4. Equip each motor with a 120 volt space heater to keep condensation from forming when the motor is not running.

5. Equip each motor with a normally closed thermostatic heat protection device to protect the motor from overheating during operation. Unit shall immediately stop the mixer drive motor in the event of excessive heat buildup.

C. Mixer Gear Reducer

1. Single reduction gear reducers will not be acceptable. Each gear reducer, or the final stage of each reducer, shall be of the helical gear type and shall be sized with a minimum service factor of 2.5 times the motor nameplate horsepower rating in accordance with applicable AGMA standard, when each unit is operating at full load motor horsepower, 24 hours a day continuous running under moderate shock loads. The minimum AFBMA B10 design bearing life shall be 100,000 hours on the input shaft. The efficiency shall not be less than 94 percent based on the gear reducer input horsepower. Gear reducer type shall match the existing BTU No. 2 mixers.

2. The gear reducers shall be designed for vertical input and output shaft operation and the housings shall be cast iron construction with provisions for the attachment of suitable lifting devices. Each stage of the reducer shall have a service rating that equals the minimum Service Factor stated above. Worm gearing will not be acceptable in any of the components. Pinion and gear materials shall be left to the discretion of the manufacturer provided they are rated according to appropriate AGMA durability and strength requirements. All output shafts shall be supported on tapered roller or double spherical roller bearings. The gear reducer housing shall be sealed with a corrosion resistant paint to provide maximum protection against moisture and contaminants. The applicable speed reducer components shall be designed in accordance with related AGMA standards referenced herein, except as modified or supplemented by this specification.

3. Gears and pinions shall be made of alloy steels. Shafting shall be made out of medium carbon steel. The gear teeth shall be through-hardened, nitrided or carburized. Flame hardened gears will not be acceptable. All gears shall be made from alloy steels with sufficient hardenability to obtain case and core properties meeting the requirements for grade 2 material in accordance with AGMA standards. The steel alloy shall be selected,

and the heat treatment shall be controlled, to obtain a microstructure that meets all the requirements for grade 2 material in accordance with AGMA standards.

4. All applicable gears shall meet the accuracy requirements for AGMA quality No. Q11/12 in accordance with AGMA requirements.

5. All bearings incorporated within the gear reduction unit shall have a rating-life expectancy (B10) of 100,000 hours except that the output bearings shall have a rating-life expectancy (B10) of 250,000 hours. All bearings shall be of the anti-friction type. Bearing life shall be rated in accordance with ANSI/AFBMA std. 11-1990 based on operating continuously at the rated full load horsepower and speed.

6. The lubrication of the speed reducer shall conform to AGMA standards. External oil cooling will not be permitted. The unit shall be provided with a sight glass to observe oil levels. The lubrication system shall incorporate a proven reliable leak detection switch device which will immediately stop the driving motor and transmit an alarm signal to the motor control center in the event of loss of lubricant down the shaft. Each electrical switch shall be wired to its respective mixer motor control center. External oil cooling will not be permitted. Oil fill and drain lines shall be sufficient size to permit efficient functioning and shall be located on the gear unit in a position which is easily accessible from the bridge platform. The oil drain piping shall be installed so that a container may be placed under the drain discharge. The Contractor shall supply the first charge of run in oil for the reducers, and if necessary due to run time, the change of oil. The Contractor shall purchase the oil from a local firm selected by the Owner, in accordance with the information in the O&M manual, to assure lubricant compatibility.

7. All grease lubricated bearings shall have seals to retain the grease. The low-speed shaft shall have grease lubricated bearings and shall have a multi-lip seal to prevent oil leakage. The seal shall fully enclose the output shaft.

8. The housing shall be constructed of high tensile strength gray cast-iron conforming to ASTM A48 class 30 minimum. The housings for vertical installation shall be of one (1) piece construction. Housing components shall be of adequate strength and rigidity to withstand all loads imposed from the operation of the equipment. The housings shall be designed and constructed to prevent harmful distortions resulting from thermal deformation, mechanical deformation or both. Housings shall be stressed relieved prior to machining. The housings shall be line bored to ensure that all gearsets and all bearings contact correctly. The housing shall be tested to preclude casting porosity or weld defects that could result in oil leakage. Lifting lugs shall be provided on the housing suitably located to enable safe removal of the combined electric motor and gear unit from the supporting platform.

9. The gear reducer shall have a hollow low speed shaft with a keyed fit to the mixer impeller shaft. The gear reducer shaft and the impeller shaft shall be locked together with a lock-nut at the top of the gear reducer housing. Units that do not form a one piece shaft or require coupling connections between the reducer and the impeller will not be accepted.

10. Each gear reducer shall be mounted on a steel mixer flange that extends the lower output shaft bearings a minimum of 32% more than the standard box. The flange shall be specifically designed for mixer application with long overhung loads and shall include a dry well sealing arrangement on the output shaft.

11. The motor and gear reducer assembly shall be run under no load conditions until the temperature stabilizes. The test shall be monitored for heat buildup, excess noise, and overall assembly/fit. The Contractor shall be responsible for assuring proper alignment and gap tolerance as set forth in the installation instructions.

12. In the field, the Contractor will prepare each gear reducer and then install the recommended lubrication oil so that start up after prolonged periods of shut-down in cold weather will not affect the unit. The Contractor shall furnish the oil as defined in the equipment O&M manual.

D. Mixer Impeller and Shaft

1. The impeller shall be designed as a low shear pump to reduce adverse floc shear effects, and shall be designed to pump essentially water with minimal air entrainment to optimize the operating stability.

2. Each impeller shall consist of a minimum of six (6) equally spaced downward pumping blades constructed of 1/4" minimum steel plate. The impeller shaft shall be of sufficient size to safely withstand the torque and hydraulic side forces imposed by the impeller. The impeller-hub shaft and blades shall be an integral, shop-welded unit requiring no field welding. The entire impeller/shaft assembly shall be completely shop assembled and shall be dynamically balanced at a minimum of 200 rpm.

3. The design shall preclude the use of a coupling used for mounting the mixer shaft to the gear reducer output shaft. The impeller shaft shall be locked into the gear reducer hollow shaft with a lock-nut at the top of the gear reducer. The impeller shaft shall be assembled to the impeller-hub with A325 high strength bolts only. Stainless steel fasteners are not acceptable.

4. The design shall preclude the use of underwater bearings to provide the required operating stability.

5. The impeller shall be specifically designed to provide pumping in both the radial and downward axial direction to achieve the proper mixing regime. The mixer blades shall be mounted on a 45 degree angle with relation to vertical to achieve this mixing pattern. Mixers that only provide axial pumping will not be considered.

6. All structural steel used in the fabrication of the mixer shall conform to the requirements of "Standard Specifications for Structural Steel" ASTM Specification A36. All shop welding shall conform to the latest standards of the AWS. Fabricated assemblies shall be shipped in convenient sections as permitted by carrier installations.

E. Mixer Anti-Vortex Baffles

1. One anti-vortex baffle for each mixer. Each baffle shall be attached to the structural concrete support columns. Each baffle shall be fabricated of 1/4" steel plate and shall have adequate stiffness to provide the required structural rigidity. The baffle shall be positioned at the water surface as close to the mixer shaft as possible. Assembly and anchor bolts shall be stainless steel.

F. Mixer Painting

1. The fabricated steel be prepared, primed and painted per Section 09901 “Shop Priming” and Section 09910 “Painting”.

2. The motors and gear reducers shall receive a minimum shop-cleaned surface preparation equivalent to SSPC-SP-1 immediately prior to shop-priming and finish coating. Shop-priming and finish painting shall consist of a coating that is compatible with a high quality epoxy finish coating that is specifically resistant to chemical, solvent, salt water, and acid environmental conditions. Touch-up painting shall not be the responsibility of the equipment manufacturer.

G. Mixer Spare Parts:

1. One low oil sensor.
2. One high speed flexible coupling.
3. Provide all spare parts required for one year’s operation at design loading for all wearable parts.
4. Contractor shall provide Manufacturers recommended lubricant for one year’s operation at design loading.

2.4 FLOW CONTROL GATE

A. Capacities and Characteristics:

1. One manually operated flow control gate shall be furnished per biological treatment unit suitable for installation in the bypass channel as shown on the Contract Drawings.

2. Each mechanism shall be with 90 degree travel.

3. The equipment furnished for each gate mechanism shall include: stand, rotating shaft, guide bearings, flow vane, fasteners and anchor bolts.

4. The flow control gate is designed to direct and control the flow from the aeration basin to the upstream anoxic basin as covered under US Patent No. 8,057,674B1.

5. Except where specifically indicated otherwise, all plates and structural members designated for submerged service shall be ¼” minimum thickness and reinforced as required. Stainless

steel 304 anchor bolts and 304 fasteners with necessary hex nuts and washers shall be provided for all parts of the gate assembly.

6. Fabricated assembles shall be shipped fully assembled except for attachment of the actuator, stand, shaft and guide bearings. The unit shall be designed to allow adjustment for concrete tolerances of ≤ ½". The unit shall be erected and lubricated in strict accordance with instructions from the Aeration Equipment Manufacturer.

B. Gate Rotating Assembly

1. Each gate shall be constructed from ¼" properly stiffened steel plate. Each gate shall include a revolving flow vane assembly fixed between guide bearings mounted to the floor and stand. The floor bearing shall be a thrust type alignment bearing, supporting the entire weight of the unit. The upper guide bearing shall be an integral part of the support stand and shall be mounted just below the worm gear reducer. The center guide bearing, if required by the shaft length, shall be mounted just above the water surface on the lower part of the shaft and shall be field aligned after installation of all other components, assuring proper rotational capability.

2. The revolving shaft shall be supported at each end in such a manner that a slight vertical or horizontal misalignment shall not interfere with the smooth operation of the gate. The shaft shall revolve from the turning of the hand wheel.

3. Each gate shall be designed to operate smoothly under the flow conditions existing in the aeration basin.

C. Gate Painting:

1. Unless otherwise noted, all ungalvanized fabricated iron and steel surfaces shall receive a shop-cleaned surface preparation equivalent to SSPC SP 10 immediately prior to shop-priming. Shop-priming shall consist of one (1) coat of Tnemec 161-1211 Epoxoline primer or approved equal to 3.0 – 5.0 mils DFT. Touch up and finish painting shall not be the responsibility of the equipment manufacturer.

2. Actuator shall be furnished with manufacturer's standard finish.

2.5 Operators

A. Unless otherwise shown on the Drawings, flow control gates shall be operated by a gear operated handwheel or crank. The benchstand shall be fully enclosed, equipped with roller bearings above and below the operating nut and with a mechanical seal around the operating nut. The pinion shaft shall be cadmium-plated and supported on roller bearings. A mechanical seal shall be provided around the pinion shaft where it extends from the hoist enclosure.

B. A side mount or front mount operator system utilizing right angle bevel boxes, stainless steel interconnecting shafting, and flexible couplings shall be furnished by the manufacturer when the benchstand is located over 48-in above the operating floor. The transmission system design shall provide for the gate to be operated from a position 30-in above the operating floor.

C. Bevel boxes for the transmission system shall be provided with cadmium plated pinion shafts supported on roller bearings. A mechanical seal will be provided around the pinion shaft where it extends from the bevel box enclosure.

D. Manual operators shall be furnished where shown and shall consist of a handwheel operator mounted on the gate yoke or on a floor stand, as indicated in the Drawings.

1. Handwheel operators shall have a minimum 18-in diameter handwheel and shall operate the gate under the specified operating head with not greater than 40 lbs of force on the handwheel. The operator shall be fully enclosed, equipped with roller bearings above and below the operating nut and mechanical seals. Alternatively, polyethylene bearing pads may be used.
2. Operators shall be equipped with fracture-resistant clear butyrate plastic stem covers which shall not discolor or become opaque for a minimum of five years after installation. The top of the stem cover shall be closed. The bottom end of the stem cover shall be mounted in a housing or adapter plate for easy field mounting. Stem covers shall be complete with indicator markings to indicate gate position.
3. 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. The direction of rotation to open shall be clockwise.

2.6 INSTRUMENTATION AND CONTROL

A. Unless otherwise indicated, all equipment used to monitor, and control BTU No. 3 shall be supplied by the Aeration Equipment Manufacturer. This is to keep continuity and single source responsibility for the entire system.

B. The controls shall be designed to provide high reliability. The Aeration Equipment Manufacturer shall provide the programming with logic functions to match the process and operational requirements of the system and the existing BTU No. 1 and BTU No. 2 controls. The instrumentation and controls shall allow the system to operate the equipment without excessive speed.

C. The existing Oculus control panel, located in the main electrical building, shall be field modified by the Aeration Equipment Manufacturer to add and integrate the new controls for BTU No. 3 with the existing controls for BTU No. 1 and BTU No. 2.

1. Modifications shall include the addition of a fiber optic network communications connection to the existing Plant SCADA system Ethernet/IP network. The Aeration Equipment Manufacturer shall modify the existing Oculus control panel to include an Ethernet switch with fiber capabilities, fiber optic cable patch panel, and fiber patch cables from the patch panel to the Ethernet switch. The Contractor shall provide fiber optic network communications from RTU710 to the Oculus control panel.

2. The input and output signals for the new BTU No. 3 equipment shall be connected in the field by the Contractor to the existing Plant SCADA System RTU720 PLC located in the effluent pump station electrical building.
3. The existing Oculus control panel PLC programming shall be modified by the Aeration Equipment Manufacturer to monitor and control the BTU No. 3 equipment over the Plant SCADA System network.
4. The existing Oculus control panel Operator Interface Terminal (OIT) programming shall be modified by the Aeration Equipment Manufacturer to add and integrate the new BTU No. 3 monitoring and controls to match the existing BTU No. 1 and BTU No. 2 monitoring and controls. Each existing Oculus control panel OIT screen shall be updated to add and integrate BTU No. 3.
5. Allen-Bradley FactoryTalk View ME Version 10 shall be used by the Aeration Equipment Manufacturer for all Oculus control panel OIT development. The OIT panel shall be using Firmware Version 9.
6. The Plant SCADA System Integrator shall upgrade the development of all of the existing Plant SCADA System RTU panel OITs using the same FactoryTalk View ME version and the same OIT firmware version used by the Aeration Equipment Manufacturer for the Oculus control panel OIT development.
7. Upon final approval of the new Oculus control panel OIT development, the approved programming files shall be transmitted by the Aeration Equipment Manufacturer to the Plant SCADA System Integrator to add the Oculus control panel OIT screens to the Plant SCADA System OIT screens at RTU710 and RTU720.
8. The Plant SCADA System Integrator shall be responsible for scaling and adjusting the Oculus OIT screens to properly display and function on the RTU panel OIT screens.

D. Operation

1. The Oculus control panel OIT and each Plant SCADA System OIT shall allow the operator the ability to modify the following, but not limited to, setpoints and parameters for the operation of the system:

    a. Aerator VFD speed adjustment.
    b. D.O. loop setpoints and limits.
    c. Aerator adjustment delay.

2. The Oculus control panel OIT and each Plant SCADA system OIT shall provide to the operator the following, but not limited to, monitoring parameters:

    a. Real time VFD speed(s).
    b. Real time D.O. level(s).
    c. Real time ORP level
    d. Aerator status.
    e. Mixer status.

E. Control

1. Aerator power input shall be adjusted to match process oxygen demands using Dissolved Oxygen (D.O.) concentration as the primary control parameter. The D.O. level will be monitored at the locations shown on the plans.

2. The D.O. signals shall be used to pace the aerator VFD in "Auto" operation. In "Manual" the operator shall be able to control the speed manually by using the OIT.
3. Proper velocity shall be maintained while running in Auto operation.
4. The D.O. levels shall have defined limits that shall be user-defined but factory preset. The factory set algorithms shall be the responsibility of the Aeration Equipment Manufacturer and shall be specifically designed for the installed system.
5. For BTU No. 3, during operation from the standby generator, automatic operation shall be limited to operation of two of the three aerators.
6. The entire system shall be designed to restart after power outage if no alarm conditions are present that would normally shut the unit down.
7. The aerator OFF time shall be monitored and an exercise alarm activated when a unit needs to be operated for warranty purposes.
8. All monitoring points available to the Oculus control panel PLC and OIT shall available to the Plant SCADA system via the Ethernet/IP network.

F. Analyzer

1. Each Analyzer shall be a microprocessor based instrument. Connections between the probe sensor and the controller shall be "plug-and-play" without requiring extensive programming or configuration. The system shall be able to perform automatic calibration of the DO/ORP monitoring system.
2. The controller shall have wireless downloading capability through an IR port located on the controller unit to download and print real time data, calibration history and current set points in a CSV format.
3. The controller unit shall allow control of the sensor and interface functions using menu driven software. The interface unit shall have a built-in data logger with the capacity to store data on 15-minute intervals for up to 6 months. The display for the unit shall be a graphic dot matrix LCD display, 128 x 64 pixels with LED backlighting. All user settings for the controller shall be retained indefinitely in non-volatile memory (EEPROM)
4. The controller unit shall include two analog 4 to 20mA output signals proportional to dissolved oxygen/ORP level and temperature and shall include two independent PID control functions including high/low phasing, setpoints, dead bands, off delay and on delay.
5. The unit shall include three (3) SPDT, user configurable Form 'C' alarm contacts, rated at 100 to 230 volts AC, 5 amp resistive maximum. The unit shall be capable of providing the following alarm conditions: low alarm setpoint, low alarm point dead band, high alarm setpoint, high alarm point dead band, off delay and on delay.
6. The controller unit shall automatically accept input in the range of 100 to 230 volts AC, single phase, 60 Hz. The controller shall be mounted in a NEMA 12/3R aluminum enclosure with 3 point latch. The enclosure shall be large enough to incorporate a surge protection device (SPD) and power disconnect switch.
7. A surge protection device (SPD) shall be provided at the instrument and shall protect both the 120V power as well as the analog signal. The SPD shall be an EDCO SLAC or approved equal.
8. The Controller shall be HACH Model SC 200 Controller as manufactured by the Hach Company.

G. DO Probe

1. Manufacturer: Hach Company - HACH LD.O.® Probe for dissolved oxygen and temperature measurement.
2. Continuous reading probe that utilizes luminescent sensor technology.
3. Construction:

    a. Foamed Noryl® and Type 316 stainless steel.
    b. Corrosion resistant and fully immersible.
    c. D.O. Sensor: :Polybutyl methoacrolate.

4. Operation:

    a. Not affected by H2S, pH, metals and salts normally found in domestic wastewater.
    b. Provide for electrolyte-free operation without need for sample conditioning.
    c. Probe shall not require periodic membrane changing.
    d. Sensor cap shall be easily replaceable.
    e. Cleaning accomplished by periodically wiping the sensor with clean rag.

5. Measurement Range: 0.00 to 20.00 mg/L dissolved oxygen and 32.0 to 212.0° F (0.0 to 100.0° C) temperature.
6. Accuracy: ±0.1 mg/L for levels less than 1.0 mg/L and ±0.2 mg/L for D.O. levels greater than 1.0 mg/L.
7. Sensitivity : ±0.5% of the span and the repeatability ±0.5% of the span.
8. Response Time: 1 to 60 seconds to 90 percent of the value upon a step change in D.O.

H. ORP Probe

1. Manufacturer: Hach Company - Hach Ryton ORP measurement sensor.
2. Differential Electrode Technique design using two measuring electrodes to compare the process value to a stable internal reference standard buffer solution. The standard electrode shall have non-flowing and fouling-resistant characteristics.
3. Construction

    a. Hex-shaped body to facilitate mounting and shall be constructed of
    b. Ryton® material for exceptional chemical resistance and mechanical strength.
    c. Install metal fittings without leakage usually caused by heating and cooling cycles when dissimilar materials are threaded together.
    d. Convertible body style featuring 1-inch NPT threads on both ends to mount into a standard 1-inch pipe tee, into an adapter pipe for union mounting with a standard 1-1/2 inch tee, or onto the end of a pipe for immersion into a vessel.

4. Sensor:

    a. Encapsulate built-in electronics of the sensor to protect from moisture and humidity.
    b. Built-in preamplifier to enable the signal to be transmitted up to 100 m (328 ft.) with standard cabling and up to 1000 m (3280 ft.) with a termination box.
    c. Titanium ground electrode (standard) to eliminate ground loop currents in the measuring electrodes.

I. D.O. / ORP Probe Mounting

1. Provide mounting system capable of being attached to hand railing.
2. Attach to an arm suspended in the basin of Schedule 80 PVC pipe and fittings and furnished by the installing contractor.
3. Swivel Bracket: Type 316 stainless steel that attaches the arm to the hand railing.
4. Provide all nuts, bolts, washers and other hardware used to mount the pole to the swivel bracket and to mount the bracket to the hand railing.
5. Construct probe mounting bracket to allow for calibration or exchange of the Probe without the use of tools.

2.7 SOURCE QUALITY CONTROL

A. Prepare test and inspection reports.

B. Aerator Shop Tests

1. The motor and gear reducer assembly shall be trial fit at the factory and match marked for ease of onsite installation. The high-speed coupling halves shall be factory mounted and aligned. The Contractor shall be coordinate with Manufacturer to assure proper alignment and gap tolerance as set forth in the installation instructions.
2. The gear reducer shall be run under no load conditions at full speed until the oil temperature has stabilized. The overall lubricant temperature, pressure and sound pressure level shall be recorded during steady-state operation.
3. After successful completion of the shop test and while the gear reducer is at operating temperature, the lubricant shall be drained and the gear reducer shall be flushed with filtered oil. The flushing oil shall be drained and the gear reducer shall be prepared for shipment.

C. Mixer Shop Test

1. The motor and gear reducer assembly shall be trial fit at the factory and match marked for ease of onsite installation. The high-speed coupling halves shall be factory mounted and aligned. The Contractor shall be responsible for assuring proper alignment and gap tolerance as set forth in the installation instructions
2. The gear reducer shall be run under no load conditions at full speed until the oil temperature has stabilized. The overall lubricant temperature, pressure and sound pressure level shall be recorded during steady-state operation.

PART 3 - EXECUTION

3.1 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

B. Perform the following tests and inspections with the assistance of a factory-authorized service representative:

1. The Manufacturer of the mechanical surface aerators and mixers shall furnish the services of a factory representative who has complete knowledge of proper operating and maintenance to inspect the final installation and supervise a test run of the equipment. The Manufacturer shall furnish a minimum of two separate trips and a minimum of 4 days total on-site service.
2. The test runs on the mechanical aerators and mixers shall be undertaken with water in the aeration tanks filled up to the high-water elevation shown on the Drawings. The Contractor shall be responsible for providing sufficient water or treated wastewater for filling the tanks for the test runs on the aerators. The test runs on the aerators shall confirm acceptable normal running noise, speed and direction.
3. After the equipment is installed and aligned, and the manufacturer's recommendations for initial startup have been implemented, the aerator shall be run at full speed and full load for a minimum of two hours after the oil temperature has stabilized. The gear reducer housing and shaft seals shall be checked for leakage of lubricant. Any leaks shall be corrected and the temperature rise of the lubricant in the oil sump of the gear reducer shall not exceed 100°F above ambient.
4. In the event of improper installation, the Contractor and the Manufacturer shall be responsible for supervising the correction of the work and subsequent test runs until the defects are corrected.
5. After installation, all weir gates shall be field tested at maximum differential head to ensure that all items of equipment are in compliance with this Section, including the leakage requirements.

    a. Maximum allowable leakage for weir gates shall be 0.1 gpm/ft of perimeter under the design seating head.

C. Prepare test and inspection reports.

D. In the event that any unit fails to meet the above requirements, the necessary changes shall be made and the unit retested. If the unit remains unable to meet the test requirements to the satisfaction of the Engineer, it shall be removed and replaced with a satisfactory unit at no additional cost to the Owner.

END OF SECTION

SECTION 13231

WIRE AND STRAND WRAPPED PRESTRESSED CONCRETE TANK

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Furnish all labor, materials, and incidentals required to design, construct, and test the elliptical wire wrapped prestressed concrete biological treatment unit tank (BTU No. 3), complete, as shown on the Drawings, and as specified herein. Also included are all cast-in-place concrete slabs, sumps and platforms in the tanks, base slab, and walls of tank; including manways.
2. Furnish and install all piping and fittings to the limits as shown on the Drawings and as specified herein and in other Sections.

B. Related Requirements:

1. Excavation, dewatering, and backfill are included in Division 02.
2. Concrete is included in Division 03.
3. BTU No.3 equipment is included in Section 11378 “Biological Treatment Unit Equipment”.
4. Pipe, valves, and fittings are included in Division 15.

1.2 COORDINATION

A. See Section 02060 “Soils and Aggregates for Earthwork” for compaction requirements.

B. Section 03350 “Concrete Finishing” specifies requirements for concrete finishing.

C. Section 10140 “Signage” includes signage for the tank.

D. Coordinate Work of this Section with Section 11378 “Biological Treatment Unit Equipment”.

E. Refer to Geotechnical Evaluation prepared by Meskel Engineering and Associates dated September 1, 2020, included in Appendix A.

1.3 PREINSTALLATION MEETINGS

A. Convene minimum two weeks prior to commencing Work of this Section.

1.4 ACTION SUBMITTALS

A. Section 01300 “Submittals”: Requirements for submittal.

B. Product Data: Manufacturer's information, specifications, and installation instructions for the tank appurtenances. This submittal will be reviewed for operational requirements only. Appurtenances include the following:

1. Inlet, outlet, and drain pipes
2. Wall Manways
3. Walkways
4. Supports

1.5 DELEGATED DESIGN SUBMITTALS

A. Design Data

1. Upon the completion of the construction of the tank(s), submit the design calculations of the "as-built tank(s)" stamped by a professional engineer registered in the State of Florida for the project records only. The calculations will not be reviewed by the Engineer. Calculations submitted prior to tank construction will be not be reviewed and will be returned for re-submittal upon completion of construction.

B. Shop Drawings:

1. Submit structural design drawings stamped by a professional engineer registered in the State of Florida.
2. Submit detailed erection shop drawings and construction procedures stamped by a professional engineer registered in the State of Florida.
3. Submit concrete mix design.
4. Provide complete details for the foundation, floor slab, walls, decks, piping, and all other details and accessories necessary to build the tanks.
5. The submittal will be reviewed for operational requirements only and will be used in the field by the Owner's representative during construction.

C. Certification

1. The tank manufacturer is responsible for the design and construction of the prestressed concrete tank(s). Submit written certification prepared, sealed, and signed by a professional engineer registered in the State of Florida that the design, details, and construction conform to the requirements of AWWA D110, this Section, and applicable city, county and state building codes.
2. Submit certification on Form 13231-A included at the end of this Section.

1.6 INFORMATIONAL SUBMITTALS

A. Section 01300, “Submittals” specifies requirements for submittals.

B. Statement of Qualification

1. Submit experience record in the design and construction of prestressed concrete tanks as specified herein.
2. Submit experience record in shotcrete work of each nozzleman and foreman to be employed on the project as specified herein.

C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

D. Test and Evaluation Reports.

E. Manufacturers' Instructions: Submit in accordance with Section 01730 “Operation and Maintenance Data.” Include method for draining tank.

F. Source Quality-Control Submittals: Indicate results of shop tests and inspections.

G. Field Quality-Control Submittals: Indicate results of Contractor furnished tests and inspections.

H. Manufacturer Reports.

I. Qualifications Statements:

1. Submit qualifications for manufacturer, fabricator, erector, and licensed professional.
2. Submit manufacturer's approval of fabricator.

J. Warranty certificate in accordance with Section 01740, “Warranties and Bonds”. See Paragraph 1.12.

1.7 CLOSEOUT SUBMITTALS

A. Section 01701 “Project Closeout” specifies requirements for submittals.

B. Project Record Documents: Record actual locations of walls, walkways, access hatches, opening in the structure, and other pertinent details. Include actual heights of wall, baffle, walkways, and other pertinent locations.

1.8 MAINTENANCE MATERIAL SUBMITTALS

A. Section 01701, “Project Closeout” specifies requirements for maintenance materials.

1.9 QUALITY ASSURANCE

A. Perform Work according to Clay County Utility Authority standards.

1.10 QUALIFICATIONS

A. Manufacturer: Company specializing in tank design and construction specified in this Section with minimum five years' experience in the design and construction of wire and, as applicable, strand wrapped prestressed concrete tanks as specified in this Section.

B. The design and construction of all aspects of the floor slab, walls, prestressing, shotcrete and roof of the wire and strand wound circular prestressed concrete tank shall be performed by the tank manufacturer using its own trained personnel and equipment and shall not be subcontracted or otherwise assigned.

C. All excavation, backfill, grading and concrete work shall be under the supervision and responsibility of the tank manufacturer, including the base slab and foundation. The manufacturer shall have designed and constructed at least 10 wire and strand, as applicable, wrapped prestressed concrete tanks conforming to AWWA D110 with Type II core wall(s) that have been put into service within the last 5 years. The tanks shall have a diameter and capacity of not less than 75 percent.

D. Foreman supervising the placing of the shotcrete shall have a minimum of 3 years' experience as a nozzleman. Each shotcrete nozzleman shall have a minimum of 2 years' experience on similar applications and shall be able to demonstrate by tests, if required, his/her ability to satisfactorily gun shotcrete of the required quality.

E. Licensed Professional: Professional engineer experienced in design of specified Work and licensed in State of Florida.

F. All design work for the tank shall be performed by a professional engineer with no less than five years of experience in the design and construction of prestressed composite tanks.

1.11 DELIVERY, STORAGE, AND HANDLING

A. Section 01600, "Material and Equipment" specifies requirements for transporting, handling, storing, and protecting products.

B. Deliver materials in manufacturer's packaging including application instructions.

1.12 WARRANTY

A. Section 01740 "Warranties and Bonds" specifies requirements for warranties.

B. The tank Manufacturer shall warranty the tank structure against any defective materials, leaks, structure, or workmanship for a period of 5 years from the date of final completion. If any materials or workmanship prove to be defective within that period, they shall be replaced or repaired by the tank Manufacturer.

C. If any leakage or other defects appear within the five-year period, the tank construction company shall promptly repair the tank at its own expense upon written notice by the Owner that such defects have been found. Leakage is defined in AWWA D110.

D. The tank construction company shall install all tank coatings and shall provide a warranty for workmanship and materials on all interior and exterior coatings for a five-year period from the date of the final acceptance of the work.

PART 2 - PRODUCTS

2.1 SYSTEMS

A. Tank:

1. Wire and strand wrapped prestressed concrete tank with a Type II core wall with galvanized steel diaphragm. The manufacturer may submit wire wrapped tanks for Engineer's approval if the design meets the requirements of this Section and the Drawings.

2. Tank will be 1.6-million gallons. Tank dimensions will be as shown on the Drawings.

B. Manufacturers:

1. Crom Corp. Gainesville, FL
2. Precon Corp. Newberry, FL
3. Or approved equal wire and strand wrapped prestressed concrete tank manufacturer with the specified core wall type.

2.2 COMPONENTS

A. Materials: New, of domestic manufacture, and conforming to AWWA D110 and the following material standards.

B. Concrete, shotcrete, and reinforcing steel for the tank core wall:

1. Conform to the requirements of AWWA D110 and ACI 301. Shotcrete shall conform to the requirements of ACI 506.2.
2. All concrete and shotcrete mixes shall utilize Type I/II Portland cement.
3. Coarse and fine aggregate shall meet the requirements of ASTM C33
4. A maximum of 25% cementitious material may be fly ash.

5. Concrete and reinforcing steel for all other structural elements, conform to the requirements of Division 3.
6. Admixtures causing accelerated or retarded set of the concrete, not allowed unless approved in writing by the Engineer.
7. Concrete Strength: Minimum concrete strength at 28 days.

a.	Pipe Encasement,	f'c = 3000 psi
b.	Footing and floors	f'c = 4000 psi
c.	Precast Wall Panels	f'c = 4000 psi
d.	Cast-in-place	f'c = 4000 psi

C. Prestressed Wire

1. Conform to ASTM A821, having a minimum ultimate strength of 231,000 psi, for 8-gauge wire, unless otherwise approved in writing by the Engineer.
2. Circumferential prestressing of the tank shall be achieved by the application of cold-drawn, high-carbon steel wire placed under high tension.
3. A substantial allowance shall be made for prestressing losses due to shrinkage and plastic flow in the shotcrete and due to relaxation in the prestressing steel.
4. The prestressing design shall conform to the following minimum requirements:

    a. Working stress for the tank wall, fs, shall be a maximum of 115,000 psi.
    b. The allowable design tensile stress in the prestressing wire before losses, fsi, shall be 145,600 psi or no greater than 0.63 fu, where fu is defined as the ultimate strength of the wire.
    c. Areas to be prestressed will contain no fewer than 10 wires per foot of wall for 8 gauge and 8 wires per foot of wall for 6 gauge.
    d. A maximum of 24 wires per layer per foot for 8 gauge and 20 wires per layer per foot for 6 gauge will be allowed.

5. Splices for horizontal prestressed reinforcement shall be ferrous material compatible with the prestressing reinforcement and shall develop the full strength of the wire.

D. Prestressed Strand

1. Linear prestressing of the straight walls may be achieved by the application of high-strength, seven-wire, low-relaxation strand.
2. The prestressing strand shall conform to the requirements of ASTM A416 for low-relaxation, uncoated steel strand.
3. The strand size shall be number 15 with a diameter of 0.60 in.

    a. The ultimate tensile strength, fpu, shall be 270,000 psi.

4. The prestressing design shall conform to the following minimum requirements:

    a. Initial tensile stress in the prestressing strand, fi, shall be 202,500 psi or no greater than 0.75 fpu, where fpu is defined as the ultimate strength of the strand

b. Final tensile stress in the prestressing strand, ff, shall be 189,000 psi or no greater than 0.70 fpu.

5. Prestressing strand shall be fully bonded with complete encasement of the strand and anchorages using grout.

E. Prestressing Strand Duct:

1. Duct for prestressing strand shall conform to the requirements of ASTM A619 and ASTM A527 for galvanized rigid flex-tube.
2. The prestressing duct shall be rigid corrugated, flex-tube duct sufficiently strong enough to retain its shape and position during construction.
3. The duct shall be capable of preventing intrusion of cement past from concrete during construction.
4. The ducts shall have a sufficient number of ports to allow for grouting the prestressing strand.
5. Ducts shall have an inside diameter which is ¼ in. larger than the nominal diameter of the prestressing strand for single strand tendons or, in the case of multiple prestressing strands, the inside cross-sectional area of the sheathing shall be at least two time the net area of the strand.

F. Prestressing Strand Grout:

1. Grout used to bond prestressing strands shall conform to the requirements of ASTM C1107 for packaged dry, hydraulic-cement.
2. Cement grout shall not contain water-soluble chloride ions in excess of 0.06 percent of the weight of the cement in the mix.

G. Non-prestressed reinforcement

1. Non-prestressed mild reinforcing steel shall be new billet steel meeting the requirements of ASTM A615/A615M with a minimum yield strength, f_y, of 60,000 psi.
2. Welded wire reinforcing shall be plain wire conforming to the requirements of ASTM A1064/A1064M with a minimum yield strength, f_y, of 65,000 psi.

H. Galvanized steel diaphragm

1. The galvanized steel diaphragm used in the construction of the core wall shall be 26 gauge with a minimum thickness of 0.017 in. conforming to the requirements of ASTM A653/A653M. Weight of zinc coating shall be not less than G90 of Table 1 of ASTM A653/A653M.
2. The diaphragm shall be formed with re-entrant angles and erected so that a mechanical key is created between the shotcrete and diaphragm. Maximum re-entrant angle spacing is 3-in with a minimum depth of 3/8".
3. The diaphragm shall be continuous to within 3 in. of the top and bottom of the wall. Horizontal joints or splices will not be permitted.
4. All vertical joints in the diaphragm shall be rolled seamed, crimped or sealed watertight using epoxy injection.

5. In all tanks designed to use a waterstop at the floor/wall joint, the steel shell diaphragm shall be epoxy bonded to the waterstop.

I. Elastomeric Materials:

1. Waterstops

a. Extruded from elastomeric plastic compound with virgin polyvinyl chloride as the basic resins.
b. Meet the performance criteria in the U.S. Army Corps of Engineers Specifications CRD-C572.

2. Elastomeric Bearing Pad

a. Neoprene or Natural Rubber Pad conforming to ASTM D2000, line call-outs M2BC410A14B14 and M4AA414A13 respectively.

J. Epoxy

1. Epoxy Sealants:

a. Epoxy shall conform to the requirements of ASTM C881/C881M.
b. Epoxy used for sealing the diaphragm shall be Type III, Grade 1, and shall be 100% solids, moisture insensitive, low modulus epoxy.
c. Epoxy used for placing the waterstop shall be Type II, Grade 2, and shall be 100% solids, moisture insensitive, low exotherm epoxy.
d. When pumped, maximum viscosity of the epoxy shall be 10 poises at 77°F.
e. The epoxy sealants used in the tank construction shall be suitable for bonding to concrete, shotcrete, PVC and steel.

2. Bonding Epoxy:

a. Epoxy resins used for enhancing the bond between fresh concrete and hardened concrete shall conform to the requirements of ASTM C881/C881M.
b. Epoxy resins shall be a two-component, 100% solids, moisture-insensitive epoxy and shall be Type II, Grade 2.

K. Moisture Barrier

1. Polyethylene Class A conforming to ASTM D4397. The thickness shall not be less than 6 mil.

L. Lightning Protection and Grounding

1. The tanks shall be provided with lightning protection and grounding in accordance with CCUA Electrical Standards.

M. Identification

1. A Type 316 stainless steel nameplate mounted on the outside of the tank at eye level.

2. Information on the nameplate shall include: tank manufacturer, usable volume in million gallons (MG), inner diameter in feet, date of tank substantial completion, warranty expiration date (at a minimum the date approved by shop drawing), and interior coating system.

3. Add sign to check groundwater levels before draining tank per Section 10140 "Signage."

N. Appurtenances:

1. Wall Manway:

   a. Watertight manway made of Type 316 stainless steel.
   b. Clear Opening: dimensions as shown on drawings.
   c. Provide gasket between manway cover and wall sleeve and attached to the manway cover.
   d. Manway cover to be bolted on to the exterior of the tank.

2. Through-wall pipe sleeves shall be Type 316 stainless steel sleeves with neoprene modular seal units. Waterstop rings on wall-pipes shall be Type 316 stainless steel.

3. Accessory hardware, unless otherwise noted, shall be Type 316 stainless steel conforming to ASTM F593.

2.3 PERFORMANCE AND DESIGN CRITERIA:

A. Tank Construction

1. Subbase: A granular base material shall be used beneath the membrane slab when the subgrade materials do not allow free drainage.

2. Floor and decks: Non-prestressed cast-in-place reinforced concrete

   a. Minimum thickness of the floor slab is 4-in.
   b. Provide thickened edge for the exterior wall footing. Footings for interior walls shall be thickened areas in the slab.
   c. Floor Slabs less than 6-inches: Provide single layer of reinforcement in each direction.
   d. Floor Slabs greater than 6-inches: Provide top and bottom reinforcement in each direction.

e. The transition from the bottom of the footings and pipe encasements to the underside of the floor slab shall not be steeper than 2 horizontal to 1 vertical. Pipe encasements shall be as shown on the on the Drawings.

3. Floor/Wall Joint - Fixed

4. Wall: Type II Shotcrete core wall with galvanized steel diaphragm. Exterior straight wall sections shall include linear prestressing to induce compression along the length of the wall to mitigate the effects of concrete shrinkage and creep.

5. Horizontal prestressing shall be continuous. Discontinuous prestressing tendons or strands will not be allowed.

6. Wall Top Slab Joint – Fixed

7. Decks: Concrete flat slab deck

8. Deck: Flat slab conforming to the applicable design codes and the recommendations in ACI 350R except that the allowable concrete shear stress and flexural steel stress shall not exceed 80 percent of the values recommended in ACI 350R. Roof slab steel reinforcement not less than 0.6 percent of the cross-sectional area of the concrete (0.3 percent at the top and 0.3 at the bottom). Reinforcing continuous (by lap splicing the reinforcing) from one edge of the roof to the opposite edge. Roof slab slope of one-quarter inch per foot for roof drainage.

9. Inner Tank Wall: Same AWWA Type core wall as specified for the outer wall. Tensile stress in the uncracked section due to combined ring tension and concrete shrinkage at working loads shall not exceed 0.10 F'c. Design all vertical and horizontal joints to minimize leakage. Joints with gaps not allowed.

10. Baffle Walls: Shotcrete or cast-in-place concrete. Design all vertical and horizontal joints to minimize leakage. Joints with gaps not allowed. Design and detail joints between interior baffle walls and wire-wrapped exterior and inner wall(s) to permit unrestrained circumferential expansion or contraction of the wire-wrapped walls while minimizing leakage through the joint. Joints with gaps not allowed.

11. Wall Openings

    a. When it is necessary for a pipe to pass through the tank wall, the invert of such pipe or sleeve shall provide no less than 18" clear space at the bottom of the wall to provide sufficient clear area for the prestressing wires. The prestressing wires required at the pipe elevation shall be distributed into circumferential bands immediately above and below the opening to maintain the required prestressing force while leaving an unbanded strip around the entire tank.
    b. Unbanded strips shall have a vertical dimension of no more than 36" unless an axi-symmetric shell analysis is performed to account for

compressive forces plus shear and moments caused by displacement of the prestressing wires into adjacent bands.

B. Design Loads - Minimum loading in the design of the tank(s) and tank appurtenances:

1. Unit Weights:

a. Concrete and Shotcrete – 150 pcf
b. Soil – 120 pcf
c. Water – 62.5 pcf
d. Steel – 490 pcf

2. Live Load for decks and walkways:

a. Floor – 62.4 psf times the height of water to overflow plus 6-in
b. Decks – 200 pound point load in any direction

3. Equipment Loads:

a. Aerators (each):

1) Number of Aerators - 3
2) Dead Load – 5,209 lbs
3) Torque – 11,405 ft-lbs
4) Force Upward – 1,493 lbs
5) Side load – 580 lbs
6) Moment Load – 4,564 ft-lbs

b. Mixers (each):

1) Number of Mixers - 2
2) Dead Load – 2,299 lbs
3) Torque – 1,168 lb-ft
4) Force Upward Operating Shock Load – 450 lbs
5) Force Upward Equivalent Static Design Load – 1,800 lbs
6) Side Load Operating Shock Load – 115 lbs
7) Side Load Equivalent Static Design Load – 460 lbs
8) Moment Load Operating Shock Load – 1,236 lbs
9) Moment Load Equivalent Static Design Load – 4,945 lbs

c. Effluent Weir Gate:

1) Number of Gates - 1
2) Dead Load – 1,960 lbs

d. Internal Recycle Flow Control Gate:

1) Number of Gates - 1
2) Dead Load – 976 lbs

4. Wind Load:

   a. Basic Wind Speed – 136 mph
   b. Exposure Category – C

5. Earth Pressure:

   a. Equivalent fluid pressure above groundwater level - 60 pcf
   b. Equivalent fluid pressure below groundwater level - 90 pcf
   c. Live Load surcharge equivalent to 2-ft earth

6. Allowable Bearing Pressure: 2 ksf

7. The tank will be designed assuming that the tank will only be drained when groundwater is below the bottom of the BTU tank slab.

2.4 COATINGS

A. Exterior tank colors shall be “Cloud” or equivalent as approved by the Owner.

B. Exterior Coatings

1. Exterior tank walls

   a. Surface Preparation: Remove all contaminants by power washing per SSPC-SP1.
   b. First Coat: Tnemec Series 156 Enviro-Crete or Sherwin-Williams Loxon XP 4.0 to 6.0 mils DFT
   c. Second Coat: Tnemec Series 156 Enviro-Crete or Sherwin-Williams Loxon XP 4.0 to 6.0 mils DFT
   d. Or approved equal.

2.5 SOURCE QUALITY CONTROL

A. Section 01400 “Quality Control” specifies testing, inspection, and analysis requirements.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Reinforcing Steel

1. Reinforcing steel: Install in accordance with the CRSI, Code of Standard Practice.

B. Placing Concrete

1. General Placement

a. Cast-in-place concrete floor: Install in accordance with ACI 318 and ACI 350R except as specified herein.
b. No concrete shall be mixed or placed during freezing weather without explicit permission. When placing concrete when air temperature is below 40 degrees F, the water, sand and gravel shall be heated so that the temperature of the concrete will be at least 50 degrees F. This temperature shall be maintained for 72 hours after placing. No concrete shall be placed on frozen ground.
c. In hot weather, concrete, when deposited, shall have a placing temperature that will not cause difficulty from loss of slump, flash set, or formation of cold joints. In no case shall the temperature of concrete being placed exceed 90 degrees F.

2. Floor Slab

a. Prior to placement of the floor slab, a 6 mil polyethylene moisture barrier shall be placed over the subbase. Joints in the polyethylene shall be overlapped a minimum of 6-in.
b. The floor slab including the thickened portion for the wall footing shall be placed in one continuous concrete placement. Construction joints between the floor slab and footings shall not be allowed. Where a construction joint is approved in writing by the Engineer, the joint shall have 6-in wide, 3/8-in thick PVC waterstop conforming to the same requirements as the wall - base slab waterstop.
c. The tank floor shall be wood/bull float finished per Section 03350 "Concrete Finishing". No water shall be added to the slab during finishing. Curing of the tank floor shall be accomplished by ponding the entire area within the waterstops with 2-in minimum of water within 24 hours after concrete placement. The floor shall be kept ponded for a minimum of 7 days.

3. Deck Slab

a. All concrete shall be consolidated by means of a vibrator for proper encasement of reinforcing steel.
b. Bolsters shall be used to support reinforcing steel and welded wire reinforcement to ensure positive control on placement of steel.
c. The decks and walkways shall be wood float finished and then receive a light broomed surface finish. No water shall be added during the finishing of the decks and walkways.
d. Concrete shall be cured for a minimum of 7 days.

C. Core Walls

1. Prestressed Core wall(s)

a. Exterior wall, inner tank wall details including the steel diaphragm, PVC waterstops, elastomeric bearing pads, sponge rubber fillers, prestressing steel, and shotcrete shall conform to the requirements of AWWA D110.

b. A PVC waterstop shall be installed in the wall to base joint as shown on the Drawings. Field splices shall be in accordance with the manufacturer's specifications. The waterstops shall be installed so as to form a continuous watertight dam. Adequate provisions shall be made to support and protect the waterstop during the progress of the work. Where the waterstop is placed in a concrete cove attached to the inner face of the wall, the cove shall attain 60 percent of its 28-day strength prior to the start of prestressing the wall.

c. Circumferential Prestressing

1) Stress readings on a calibrated stressometer, furnished by the tank manufacturer, shall be made on every prestressing wire or strand. A running log shall be maintained by the tank manufacturer of the stress readings and used to determine the final number of wires required.
2) In computing the final tension in the wires, an allowance for prestress loss due to creep, shrinkage, elastic deformation, and residual compression shall be provided for. The tank manufacturer shall submit an "as-built" revision to the design diagram showing the location and number of wires actually used for the project records only.
3) Prestressing shall be accomplished by a machine capable of continuously inducing a uniform initial tension in the wire before it is positioned on the tank wall. Tension in the wire shall be generated by methods not dependent on cold working or re-drawing of the wire. In determining compliance with design requirements, the aggregate force of all tensioned wires per foot of wall shall be considered rather than the force per individual wire, and such aggregate force shall be no less than that required by the design and as shown on approved drawings.

d. Shotcreting

1) No prestressing wire shall remain exposed during inclement weather over a holiday or weekend, it shall be covered with shotcrete and subsequently wet cure.
2) Vertical shooting wires shall be installed to establish uniform and correct thickness of shotcrete. Shooting wires shall be at 2-ft maximum on center around the circumference of the tank. The

final coat shall be applied true to shooting wires so as to form a cylindrical surface.

3) At the end of the day's work, or similar stoppage period, the shotcrete shall be sloped off at an angle of approximately 45 degrees. Before placing adjacent sections, the sloped portions shall be thoroughly cleaned and wetted by means of air and water blast. Shotcrete with a strength lower than specified shall be removed and replaced with sound material.

4) The shotcrete shall be cured by keeping the shotcrete continuously wet for 7 days.

5) Wet mix shotcrete shall receive a float finish or light broom finish on the interior and a sliced trowel finish on the exterior covercoat.

D. Wall Manway(s)

1. Manway(s) shall be installed at locations shown on the.
2. The invert of the manhole shall be 3-ft above the finished tank floor.

E. Erection: According to AWWA D110 and manufacturer's instructions.

3.2 TOLERANCES

A. Section 01400 “Quality Control” specifies requirements for tolerances.

B. Maximum Variation from Plumb 0.1%.

C. Maximum Offset from Indicated Alignment: 0.1%.

3.3 COATINGS

A. The exterior coatings of the tank (concrete surfaces and metallic surfaces) shall be coated by the tank construction company. The tank construction company shall have system responsibility for all coatings and shall not subcontract the work.

B. All coatings shall be applied a minimum of 28 days after final application of concrete or shotcrete.

C. All application procedures for coatings shall meet the requirements of this specification and the manufacturer's recommendations.

3.4 FIELD TESTING

A. Section 01400 “Quality Control” specifies requirements for inspecting and testing.

B. Concrete and Shotcrete Testing:

1. Compression Tests:

a. Compression test specimens shall be taken during construction from the first placement of each class of concrete specified herein and at intervals thereafter as selected by the Engineer to ensure continued compliance with these Specifications. At least one set of test specimens shall be made for each 50 yards of concrete/shotcrete placed. Each set of test specimens shall be a minimum of 5 cylinders.

b. Compression test specimens for concrete/shotcrete shall conform to ASTM C172/C172M for sampling and ASTM C31/C31M for making and curing test cylinders. Test specimens shall be 6-inch diameter by 12-inch high or 4-inch diameter by 8-inch high cylinders.

c. Compression test shall be performed in accordance with ASTM C39/C39M. Two test cylinders will be tested at 7 days and two at 28 days. The remaining cylinder will be held to verify test results, if needed.

2. Air Content Tests (concrete only):

a. Air content tests shall conform to ASTM C231/C231M (Pressure Method for Air Content).

b. Tests for air content shall be made prior to concrete placement and whenever compression test specimens are made.

c. Slump Tests (concrete only):

1) Slump tests shall be made in accordance with ASTM C143/C143M.

2) Slump tests shall be made whenever compression test specimens are made.

C. Testing the Completed Tank(s)

1. The tank shall be leak tested in accordance with AWWA D110. After the tank(s) have been completed, but before any backfill is placed, the tank(s) shall be filled slowly in the presence of the Engineer. Careful observation for leaks shall be made and any leaks that occur shall be immediately repaired.

2. The tank(s) shall be kept full of water until the Engineer is satisfied that all defects have been discovered and repaired. There shall be no flowing water allowed through the walls or floor slab. Damp spots that glisten on the surface of the tank(s) and spots where moisture can be picked up on a dry hand will not be allowed. Damp spots on the top of footing projections that are not from flowing water shall not be considered to be leakage.

3. The maximum allowable leakage for a 24-hour period, after a 48-hour period, in which the entire tank interior surface has been wetted, shall not exceed 0.05 percent of the tank volume. If the liquid volume loss exceeds this amount, leakage shall be considered excessive and the tank shall be repaired and retested.

4. All water for the first test will be furnished by the Owner. Water supplied will be non-potable water. The Owner shall be reimbursed for water required for retesting at the normal water rate. The use of this water supply shall be such that it does not adversely affect the normal pressure and flow in the distribution system.

3.5 CLEANING

A. Section 01701 “Project Closeout” specifies requirements for cleaning.

END OF SECTION

FORM 13231-A

FLORIDA PROFESSIONAL ENGINEER
CERTIFICATION FORM

The undersigned hereby certifies that he/she is a professional engineer registered in the State of Florida and that he/she has been employed by

_____ to design
(Name of Contractor)

One (1) 1.6 million gallon wire- wrapped, prestressed concrete BTU No. 3 tank in conformance with Section 13231 for the CCUA Fleming Island Wastewater Treatment Facility – BTU No. 3 Expansion.

The undersigned further certifies that he/she has performed or was in responsible charge of the design of the BTU No. 3 tank, that said design is in conformance with all applicable local, state and federal codes, rules, and regulations, including the requirements AWWA D110 and that his/her signature and P.E. stamp have been affixed to all calculations and drawings used in, and resulting from, the design.

A. The undersigned hereby agrees to make all "as-built" design drawings and calculations available to the Clay County Utility Authority or Owner's representative within seven days following substantial completion.

_____	_____
P.E. Name	Contractor's Name
_____	_____
Signature	Signature
_____	_____
Address	Title
	_____
	Address

SECTION 15042

COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes general requirements for single-phase and polyphase, general-purpose, horizontal, small and medium, squirrel-cage induction motors for use on alternating-current power systems up to 600 V and installed at equipment manufacturer's factory or shipped separately by equipment manufacturer for field installation.

1.3 COORDINATION

A. Coordinate features of motors, installed units, and accessory devices to be compatible with the following:

1. Motor controllers.
2. Torque, speed, and horsepower requirements of the load.
3. Ratings and characteristics of supply circuit and required control sequence.
4. Ambient and environmental conditions of installation location.

PART 2 - PRODUCTS

2.1 GENERAL MOTOR REQUIREMENTS

A. Comply with NEMA MG 1 unless otherwise indicated.

B. Comply with IEEE 841 for severe-duty motors.

2.2 MOTOR CHARACTERISTICS

A. Duty: Continuous duty at ambient temperature of 40 deg C and at altitude of 3300 feet above sea level.

B. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.

2.3 POLYPHASE MOTORS

A. Description: NEMA MG 1, Design B, medium induction motor.

B. Efficiency: Premium efficient, as defined in NEMA MG 1.

C. Service Factor: 1.15.

D. Multispeed Motors: Variable torque.

1. For motors with 2:1 speed ratio, consequent pole, single winding.
2. For motors with other than 2:1 speed ratio, separate winding for each speed.

E. Multispeed Motors: Separate winding for each speed.

F. Rotor: Random-wound, squirrel cage.

G. Bearings: Regreasable, shielded, antifriction ball bearings suitable for radial and thrust loading.

H. Temperature Rise: Match insulation rating.

I. Insulation: Class F.

J. Code Letter Designation:

1. Motors 15 HP and Larger: NEMA starting Code F or Code G.
2. Motors Smaller Than 15 HP: Manufacturer's standard starting characteristic.

K. Enclosure Material: Cast iron for motor frame sizes 324T and larger; rolled steel for motor frame sizes smaller than 324T.

2.4 ADDITIONAL REQUIREMENTS FOR POLYPHASE MOTORS

A. Motors Used with Reduced-Voltage and Multispeed Controllers: Match wiring connection requirements for controller with required motor leads. Provide terminals in motor terminal box, suited to control method.

B. Motors Used with Variable-Frequency Controllers: Ratings, characteristics, and features coordinated with and approved by controller manufacturer.

1. Windings: Copper magnet wire with moisture-resistant insulation varnish, designed and tested to resist transient spikes, high frequencies, and short time rise pulses produced by pulse-width-modulated inverters.
2. Premium-Efficient Motors: Class B temperature rise; Class F insulation.

3. Inverter-Duty Motors: Class F temperature rise; Class H insulation.
4. Thermal Protection: Comply with NEMA MG 1 requirements for thermally protected motors.
5. Provide grounding rings or straps on motors with variable frequency controller.

C. Severe-Duty Motors: Comply with IEEE 841, with 1.15 minimum service factor.

2.5 SINGLE-PHASE MOTORS

A. Motors larger than 1/20 hp shall be one of the following, to suit starting torque and requirements of specific motor application:

1. Permanent-split capacitor.
2. Split phase.
3. Capacitor start, inductor run.
4. Capacitor start, capacitor run.

B. Multispeed Motors: Variable-torque, permanent-split-capacitor type.

C. Bearings: Prelubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.

D. Motors 1/20 HP and Smaller: Shaded-pole type.

E. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal-protection device shall automatically reset when motor temperature returns to normal range.

PART 3 - EXECUTION (NOT USED)

END OF SECTION

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SECTION 15062

COUPLINGS, ADAPTERS, AND SPECIALS FOR PROCESS PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Pipe penetrations
2. Flexible connections
3. Sleeve-type couplings.

B. Related Requirements:

1. Section 05502, “Metal Fabrications”: Miscellaneous metalwork and fasteners as required by this Section
2. Section 09910, “Painting”: Product and execution requirements for painting specified by this Section
3. Section 02561, “Ductile-Iron Utility Pipe”: Pipe restraints
4. Section 15065, “Hangers and Supports for Process Piping”: Hangers, anchors, sleeves, and sealing of piping to adjacent structures
5. Section 15108, “Common Requirements for Process Valves”: Common product requirements for valves for placement by this Section

1.2 DEFINITIONS

A. Firestopping (Through-Penetration Protection System): The sealing or stuffing material or assembly placed in spaces between and penetrations through building materials to arrest movement of fire, smoke, heat, and hot gases through fire-rated construction.

B. FM: Factory Mutual Insurance Company; FM Global is the communicative name of the company.

C. WH: Warnock Hersey; indicates compliance to relevant building codes, association criteria, and product safety and performance standards.

1.3 COORDINATION

A. Section 01301, “Administrative Requirements”: Requirements for coordination.

B. Coordinate Work of this Section with installation of piping, valves and equipment connections specified in other Sections and indicated on Drawings.

1.4 PREINSTALLATION MEETINGS

A. Section 01301, “Administrative Requirements”: Requirements for preinstallation meeting.

1.5 SUBMITTALS

A. Section 01300, “Submittals”: Requirements for submittals.

B. Product Data:

1. Submit manufacturer catalog information for each specified product, including installation instructions.
2. Firestopping: Submit data on product characteristics, performance, and limitation criteria.
3. Flexible Pipe Connectors: Indicate maximum temperature and pressure rating, face-to-face length, live length, hose wall thickness, hose convolutions per foot and per assembly, fundamental frequency of assembly, braid structure, and total number of wires in braid.
4. Expansion Joints: Indicate maximum temperature, pressure rating, and expansion compensation.

C. Shop Drawings:

1. Identification:

    a. Submit list of wording, symbols, letter size, and color coding for pipe identification.
    b. Comply with ASME A13.1.

2. Indicate restrained joint details and materials.
3. Submit layout drawings showing piece numbers and location, indicating restrained joint locations.
4. Indicate layout of piping systems, including flexible connectors, expansion joints and compensators, loops, offsets, and swing joints.

D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

E. Delegated Design Submittals: Submit signed and sealed Shop Drawings with design calculations and assumptions for:

1. Flexible connectors
2. Expansion joints
3. Pipe Restraints:

    a. Determine restrained lengths and submit joint restraint details.
    b. Use joint restraint devices specifically designed for applications as described in manufacturer data.

4. Firestopping Engineering Judgments: For conditions not covered by UL- or WH-listed designs, submit judgments by licensed professional engineer suitable for presentation to authority having jurisdiction to accept as meeting fire-protection code requirements.

F. Manufacturer Instructions: Submit special procedures and setting dimensions.

G. Source Quality-Control Submittals: Indicate results of factory tests and inspections.

H. Field Quality-Control Submittals: Indicate results of Contractor-furnished tests and inspections.

I. Qualifications Statements:

1. Submit qualifications for manufacturer.

1.6 CLOSEOUT SUBMITTALS

A. Section 01701 “Project Closeout”: Requirements for submittals.

B. Project Record Documents: Record actual locations of piping appurtenances.

C. Identify and describe unexpected variations to pipe routing or discovery of uncharted utilities.

1.7 QUALITY ASSURANCE

A. Materials in Contact with Potable Water: Certified to NSF Standards 61 and 372.

B. Perform Work according to ASME B31.3 for installation of piping systems.

C. Perform Work according to Clay County Utility Authority standards.

D. Maintain copy of each standard affecting Work of this Section on Site.

1.8 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum 10 years' experience.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Section 01600 “Material and Equipment”: Requirements for transporting, handling, storing, and protecting products.

B. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.

C. Store materials according to manufacturer instructions.

D. Protection:

1. Protect materials from moisture and dust by storing in clean, dry location remote from construction operations areas.
2. Furnish temporary end caps and closures on piping and fittings and maintain in place until installation.
3. Provide additional protection according to manufacturer instructions.

1.10 EXISTING CONDITIONS

A. Field Measurements:

1. Verify field measurements prior to fabrication.
2. Indicate field measurements on Shop Drawings.

1.11 WARRANTY

A. Section 01740 “Warranties and Bonds”: Requirements for warranties.

PART 2 - PRODUCTS

2.1 PIPE SLEEVES

A. All construction except new concrete walls:

1. Material: Schedule 40 galvanized steel conforming to ASTM A53.
2. 2-inch minimum circumference water stop welded to exterior sleeve at midpoint
3. Ends cut and ground to be:

    a. Flush with ground
    b. Flush with ceiling
    c. 2 inches above finished floors
    d. Sealed with caulking
    e. Sized as required.

B. New concrete walls with pipes up to 20 inches in diameter:

1. Material: non-metallic High-Density Polyethylene Sleeves (HDPE)
2. Integral hollow molded water stops

    a. 4 inches larger than the outside diameter of the sleeve.

3. End caps for forming and reinforcing ribs.

4. Domestically manufactured by:

    a. Century-Line as manufactured by Pipeline Seal & Insulator, Inc., Houston, TX, or equal.

C. New concrete with pipes 20 to 60 inches in diameter:

1. Material: molded HDPE modular interlocking discs to make the width of the wall

    a. Corrugated
    b. Cell-Cast as manufactured by Pipeline Seal & Insulator, Inc., Houston, TX, or equal.

D. External wall penetrations:

1. 36 -in diameter and less may be made by means of a ductile iron sleeve capable of being bolted directly to the formwork:
2. Seal of the annular space between the carrier pipe and the sleeve made by means of a confined rubber gasket and be capable of withstanding 350 psi.:
3. Sleeve to have an integrally cast waterstop of 1/2-in minimum thickness, 2-1/2-in minimum height.
4. Manufacturers: Omni-Sleeve, Malden, MA or equal.

2.2 WALL CASTINGS

A. Ductile iron conforming to ANSI/AWWA A21.51/C151, thickness Class 53.

B. Diameter as required.

C. Flanges and/or mechanical joint bells drilled and tapped for studs where flush with the wall.

D. Castings provided with a 2-in minimum circumferential flange/waterstop integrally cast with or welded to the casting.

E. Located as follows:

1. for castings set flush with walls: located at the center of the overall length of the casting,
2. for castings which extend through wall: located within the middle third of the wall.

2.3 SEALING MATERIALS

A. Mechanical seals:

1. Of rubber links shaped to continuously fill the annular space between the pipe and the wall opening or sleeve.

2. Link pressure plates molded of glass reinforced nylon:

    a. colored throughout elastomer,
    b. permanent identification of the size and manufacturer's name molded into the pressure plate and sealing element.

3. Hardware:

    a. Mild steel with a 60,000 psi minimum tensile strength
    b. 2-part Zinc Dichromate coating per ASTM B-633
    c. Organic Coating, tested in accordance with ASTM B-117 to pass a 1,500-hour salt spray test.
    d. Use Type 316 Stainless Steel hardware:

        1) in chemical areas
        2) for submerged service
        3) for penetrations in tanks containing sludge or wastewater.

4. Completed sealing system:

    a. Duty pressure rated for 20 psig differential pressure.
    b. EPDM for all services except fire rated assemblies

        1) fire rated seals use silicone link material.

    c. Manufacturer: PSI-Thunderline/ Link-Seal as manufactured by Pipeline Seal & Insulator, Inc., Houston, TX, or pre-approved equal.

B. Sealant:

1. A two-part foamed silicone elastomer manufactured by:

    a. Dow Corning Co., Product No. 3-6548 silicone R.T.V.
    b. 3M brand fire barrier products caulk C.P. 25 and 3M brand moldable putty MP+;
    c. Flame-Safe fire stop systems FS-900 by Rectorseal.

2. Sealant bead configuration, depth and width in accordance with manufacturer's recommendations.

2.4 SLEEVE-TYPE COUPLINGS

A. Manufacturers:

1. Xylem (Smith-Blair) or equal.
2. Substitutions: Owner approved or equal.
3. Comply with AWWA C213, C219.
4. Middle Ring: Steel.
5. Followers: Steel.

6. Gaskets:

   a. Material: Buna-N.
   b. Comply with ASTM D2000.

7. Bolts: 316 Stainless Steel.

B. Finishes:

1. Factory fusion bonded epoxy coated.

2.5 FINISHES

A. Prepare piping appurtenances for field finishes as specified in Section 09910, - "Painting."

2.6 SOURCE QUALITY CONTROL

A. Section 01400 "Quality Control": Requirements for testing, inspection, and analysis.

1. Provide shop inspection and testing of completed assemblies.

B. Certificate of Compliance:

1. If manufacturer is approved by authorities having jurisdiction, submit certificate of compliance indicating Work performed at manufacturer's facility conforms to Contract Documents.
2. Specified shop tests are not required for Work performed by approved manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 01701 "Project Closeout": Requirements for installation examination.

B. Verify that field dimensions are as indicated on Shop Drawings.

C. Inspect existing flanges for nonstandard bolthole configurations or design and verify that new pipe and flanges mate properly.

D. Verify that openings are ready to receive sleeves.

E. Verify that pipe plain ends to receive sleeve-type couplings are smooth and round for 12 inches from pipe ends.

F. Verify that pipe outside diameter conforms to sleeve manufacturer's requirements.

3.2 PREPARATION

A. Section 01730 “Execution”: Requirements for installation preparation.

B. Cleaning: Thoroughly clean end connections before installation.

C. Close pipe and equipment openings with caps or plugs during installation.

D. Surface Preparation: Clean surfaces to remove foreign substances.

3.3 INSTALLATION

A. According to ASME B31.3.

B. Coating: Finish piping appurtenances as specified in Section 09910 “Painting” for service conditions.

C. Pipe Penetrations:

1. Flashing:

   a. Provide flexible flashing and metal counterflashing where piping penetrates weatherproofed or waterproofed walls, floors, and roofs.
   b. Flash floor drains with topping over finished areas with lead, 10 inches clear on sides, with minimum 36-by-36-inchsheet size.
   c. Fasten flashing to drain clamp device.

2. Sleeves:

   a. Exterior Watertight Entries: Seal with mechanical sleeve seals.
   b. Set sleeves in position in forms and provide reinforcement around sleeves.
   c. Size sleeves large enough to allow for movement due to expansion and contraction and provide for continuous insulation wrapping.
   d. Extend sleeves through floors 1 inch above finished floor level and calk sleeves.
   e. Where piping penetrates floor, ceiling, or wall, close off space between pipe and adjacent Work with stuffing insulation and calk airtight.
   f. Provide close-fitting metal collar or escutcheon covers at both sides of penetration.
   g. Install stainless-steel escutcheons at finished surfaces.

D. Restrained Joints: As specified in Section 02561 “Ductile-Iron Utility Pipe”.

E. Flexible Connections: Install flexible couplings at connections to equipment and where indicated on Shop Drawings.

F. Expansion Joints:

1. Install flexible couplings and expansion joints at connections to equipment and where indicated on Shop Drawings.

2. If expansion joint is supplied with internal sleeve, indicate flow direction on outside of joint.

3.4 FIELD QUALITY CONTROL

A. Section 01400 “Quality Control”: Requirements for inspecting and testing.

B. After installation, inspect for proper supports and interferences.

C. Repair damaged coatings with material equal to original coating.

3.5 CLEANING

A. Section 01701 “Project Closeout”: Requirements for cleaning.

B. Keep equipment interior clean as installation progresses.

END OF SECTION

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SECTION 15065

HANGERS AND SUPPORTS FOR PROCESS PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. This specification requires Contractor to delegate pipe support design to a pipe support design engineer hired by the Contractor. Where the Drawings show support types and/or locations, they shall be analyzed for adequacy to support loads and stresses calculated by the pipe support designer, modified if required, installed generally where shown, and integrated with the pipe support system design provided by the Contractor.

C. Related Requirements:

1. Section 01740, “Warranties and Bonds”: Warranty Requirements.
2. Section 03100, “Concrete Forming and Accessories”: Execution requirements for placement of sleeves in concrete forms specified by this Section.
3. Section 03300, “Cast-in-Place Concrete”: Execution requirements for placement of concrete housekeeping pads specified by this Section.
4. Section 09910, “Painting”: Product and execution requirements for painting specified by this Section.
5. Section 15062, “Couplings, Adapters, and Specials for Process Piping.”

1.2 COORDINATION

A. Coordinate Work of this Section with piping and equipment connections specified in other Sections and indicated on Drawings.

1.3 ACTION SUBMITTALS

A. Section 01300 “Submittals”: Requirements for submittals.

B. Product Data: Submit manufacturer's catalog data including load capacity.

C. Shop Drawings: Submit scaled piping layouts for each system. Indicate flow stream, pipe size(s) material(s), schedule(s), lining(s), critical dimensions between pipes, equipment and building features. Indicate by schedule pipe hanger/support type and locations. Provide detail of each type of hangers, supports, anchors, and guides.

D. Delegated Design Submittals: Support System Design

1. Engage the services of an independent registered professional engineer licensed in the State of Florida ordinarily engaged in the business of pipe support systems analysis and design, to analyze system piping and service conditions, and to develop a detailed support system design, specific to the piping material, pipe joints, valves, and piping appurtenances proposed for use.

    a. The proposed support system engineer shall have at least 5 years of experience in the analysis and design of similar systems, including the use of commercial and custom pipe supports and in the use of commercial pipe stress software programs.
    b. Engineer pre-approved support system engineering groups include the following:

        1) J. Blanco Associates, Inc. Hawthorne, NJ
        2) Fenny Engineering Company, Venice, FL
        3) LCI Engineering, Ottawa, Ontario, Canada.

2. The support system design shall include:

    a. Criteria by piping system.
    b. Summary of Contractor-selected related components including joints, class, valves, appurtenances, etc., and commercial supports and especially including pipe materials.
    c. Dead weight and dynamic analysis, including system thermal effects and pressure thrusts. Computer-based software system equivalent to Bentley Systems AutoPIPE or SST Systems CAEPIPE.

        1) Present each system in an isometric graphic and show the resolved and resultant force and moment systems, as well as all recommended hangers, supports, anchors, restraints, and expansion/flexible joints.

    d. Submit a support system design to the Engineer for review. The submittal needs to be stamped by a professional engineer registered in State of Florida
    e. All aspects of the analysis and design to comply with the provisions of ANSI B31.3 and the referenced standards.
    f. Coordinate support arrangements to eliminate interference with similar systems to be installed under HVAC, Plumbing, and Electrical; to account for structural expansion joints and to maintain access for both personnel and for the removal of equipment.

E. Manufacturers' Instructions: Submit special procedures and assembly of components.

1.4 INFORMATIONAL SUBMITTALS

A. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

B. Qualifications Statements:

1. Submit qualifications for manufacturer, fabricator, installer, and licensed professional.
2. Submit manufacturer's approval of installer.

1.5 DEFINITIONS

A. Ferrous Metal: Iron, steel, stainless steel, and alloys with iron as principal component.

B. Wetted or submerged: Submerged, less than 1-foot above liquid surface, below top of channel or tank wall, under cover or slab of channel or tank, or in other damp locations.

C. “Pipe” or “piping” shall mean all piping, piping system(s), hose, tube, fittings, joints, valves, and similar appurtenances.

D. Supports: wherever the word “supports” or “pipe supports” are used, they shall mean pipe supports, hangers, structural connections, concrete inserts (if allowed), anchors, guides, bolts, expansion units, restraints and all restraint, hanging, supporting, allowing controlled expansion, or other means of attaching piping along with the necessary appurtenances.

1.6 DELIVERY, STORAGE AND HANDLING

A. All supports and hangers shall be crated, delivered and uncrated so as to protect against any damage.

B. All parts shall be properly protected so that no damage or deterioration shall occur during a prolonged delay from the time of shipment until installation is completed.

C. Finished metal surfaces not galvanized, that are not of stainless steel construction, or that are not coated, shall be grease coated, to prevent rust and corrosion.

1.7 QUALITY ASSURANCE

A. Perform Work according to applicable authority for welding hanger and support attachments to building structure.

1.8 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing Products specified in this Section with minimum 10 years' experience.

B. Fabricator: Company specializing in fabricating products specified in this Section with minimum 10 years' experience.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Section 01600 “Material and Equipment”: Requirements for transporting, handling, storing, and protecting products.

B. Inspection: Accept materials on-Site in original factory packaging, labeled with manufacturer's identification.

C. Protect products from weather and construction traffic, dirt, water, chemical, and damage by storing in original packaging.

1.10 EXISTING CONDITIONS

A. Field Measurements: Verify field measurements prior to fabrication. Indicate field measurements on Shop Drawings.

1.11 WARRANTY

A. Section 01740 “Warranties and Bonds”: Requirements for warranties.

B. Furnish five-year manufacturer's warranty for pipe hangers and supports.

PART 2 - PRODUCTS

2.1 GENERAL

A. Support pipe and appurtenances connected to equipment to prevent any strain being imposed on the equipment. Comply with manufacturer’s requirements regarding piping loads being or not being transmitted to their equipment. Submit certification stating that such requirements have been met.

B. Support and secure all pipe and tubing in the intended position and alignment to prevent significant stresses in the pipe or tubing material, valves, fittings, and other pipe appurtenances. Design all supports to adequately secure the pipe against excessive dislocation due to thermal expansion and contraction, internal flow forces, and all probable external forces such as equipment, pipe, and personnel contact. Any structural steel members required to brace any piping from excessive dislocation shall conform to the applicable requirements of Section 05502 “Metal Fabrications” and shall be furnished and installed under this Section.

C. Contractor may propose minor adjustments to the piping arrangements in order to simplify the supports, or in order to resolve minor conflicts in the work. Such an adjustment might involve minor change to a pipe centerline elevation so that a single trapeze support may be used.

D. Where flexible sleeve, split ring, vibration, or other couplings are required at equipment, tanks, etc., the end opposite to the piece of equipment, tank, etc., shall be rigidly supported to prevent

transfer of force systems to the equipment. Do not install fixed or restraining supports between a flexible coupling and the piece of equipment.

E. Pipe supports:

1. Shall not induce point loadings but shall distribute pipe loads evenly along the pipe circumference.
2. Provide supports at changes in direction and elsewhere as shown in the Drawings or as specified herein.
3. No piping shall be supported from other piping or from metal stairs, ladders, and walkways, unless specifically directed or authorized by the Engineer.
4. Provide pipe supports to minimize lateral forces through valves, both sides of flexible split ring type couplings and sleeve type couplings, and to minimize all pipe forces on pump housings. Pump housings shall not be utilized to support connecting pipes.
5. Effects of thermal expansion and contraction of the pipe to be accounted for in the pipe support selection and installation.

F. Insofar as is possible, floor supports shall be given preference. Where specifically indicated, concrete supports, as shown on the Drawings, may be used. Base elbow and base tees shall be supported on concrete pedestals.

G. Restraints, flexible connections, expansion items, and related items as included in other specifications and shown on the Drawings.

2.2 PERFORMANCE REQUIREMENTS/DESIGN CRITERIA

A. All supports and appurtenances shall be standard products from approved manufacturers wherever possible, and shall be adequate to maintain the supported load in proper position under all operating conditions. Any reference to a specific figure number of a specific manufacturer is for the purpose of establishing a type and quality of product and shall not be considered as proprietary. Note that different materials required, as specified in Part 2 MATERIALS, may require different figures or model numbers than those shown.

1. The minimum working factor of safety for all items, with the exception of springs, shall be five times the ultimate tensile strength of the material, assuming 10 feet of water-filled pipe being supported and normal test pressures.
2. Design for all loads using a safety factor of 5.

B. The pipe support system shall not impose loads on the supporting structures in excess of the loads for which the supporting structure is designed.

2.3 MATERIALS

A. For support of metallic pipe:

1. Submerged, buried, or within outdoor structures (vaults, etc.): Type 316 stainless steel (SS).

2. Within chemical areas: Vinyl ester fiberglass reinforced plastic (FRP) for pipe size up to 2 inch, epoxy coated steel for 2-1/2 inches size and larger.
3. Other locations: steel with galvanizing where noted, or if not otherwise noted, coating as required in Division 09 Finished Painting.
4. Additional requirements (including dielectric insulation): see following paragraphs.

B. For support of non-metallic pipe:

1. Submerged, buried, or within vaults: Type 316 stainless steel or FRP.
2. Within chemical areas: vinyl ester FRP.
3. Other locations: steel with galvanizing where noted, or if not otherwise noted, coating as required in Division 09 Finished Painting; all with local stress protection shields.
4. Additional requirements (including stress protection shields): see following paragraphs

C. Wherever stainless steel is noted, it shall be Type 316 unless noted otherwise.

2.4 SUPPORT AND RESTRAINT SYSTEMS

A. Steel or Ductile Iron Piping

1. Cast iron and ductile iron, steel, and stainless steel piping shall be supported at a maximum support spacing of 10 feet with a minimum of one support per pipe section at the joints.
2. Support spacing for ductile iron, steel, and stainless steel piping 2-in and smaller diameter shall not exceed 5 feet.

B. Copper Piping

1. Supports for copper pipe shall be copper plated or shall have a 1/16 inch plastic coating.
2. Support spacing for copper piping and tubing 2 inch and smaller diameter shall not exceed 5 feet and greater than 2 inch diameter shall not exceed 8 feet.
3. Where pipe supports come in contact with copper piping, provide protection from galvanic corrosion by: wrapping pipe with 1/16 inch thick neoprene sheet material and galvanized protection shield; isolators similar to Cooper B-Line B3195CT; or copper-plated or PVC-coated hangers and supports.

C. Non-Metallic Piping

1. All uninsulated non-metallic piping such as PVC, CPVC, HDPE, PVDF, etc., shall be protected from local stress concentrations at each support point. Protection shall be provided by non-metallic protection shields or other method as approved by the Engineer.

    a. Where pipes are bottom supported 180 degrees, arc shields shall be furnished. Where 360-degree arc support is required, such as U-bolts, protection shields shall be provided for the entire pipe circumference. All U-bolts or clamps for non-metallic pipes shall be plastic coated.

b. Protection shields shall have an 18-gauge minimum thickness, not be less than 12 inches in length, and be securely fastened to pipe with Type 316 stainless steel straps not less than 1/2 inch wide.

2. Individually supported PVC pipes shall be supported as recommended by the pipe manufacturer except that support-spacing shall be manufacturers recommendation minus 2-ft. down to 5 ft spacing recommendation, then spacing shall be 3 feet.
3. Supports for horizontal multiple PVC plastic piping:

a. Shall be continuous wherever possible.
b. Multiple, suspended, horizontal plastic PVC pipe runs, where possible, shall be supported by ladder type cable trays such as: Husky Ladder Flange Out by MPHusky; or equal.
c. Rung spacing shall be 12 inches. Tray width shall be approximately 6 inch for single runs and 12 inches for double runs.
d. Ladder type cable trays shall be furnished complete with all hanger rods, rod couplings, concrete inserts, hanger clips, etc., required for a complete support system. Individual plastic pipes shall be secured to the rungs of the cable tray by strap clamps or fasteners similar to: Globe, Series 600; Unistrut Pipe/Conduit Clamps and Hangers; or equal.
e. Spacing between clamps shall not exceed 9 feet. The cable trays shall provide continuous support along the length of the pipe. Individual clamps, hangers, and supports in contact with plastic PVC pipe shall provide firm support but not so firm as to prevent longitudinal movement due to thermal expansion and contraction.

D. Framing Support System

1. See Part 2 MATERIALS for materials of construction.
2. Beams: Size such that beam stress does not exceed 25,000 psi and maximum deflection does not exceed 1/240 of span.
3. Column Members: Size in accordance with manufacturer's recommended method.
4. Support Loads: Calculate using weight of pipes filled with water.
5. Maximum Spans:

a. Steel and ductile iron pipe, 3 inch diameter and larger: 10 feet centers, unless otherwise shown.
b. Other pipelines and special situations: Same as noted in previous paragraphs. Supplementary hangers and supports may be required.

E. All vertical pipes shall be supported at each floor or at intervals of not more than 12 feet by approved pipe collars, clamps, brackets, or wall rests and at all points necessary to ensure rigid construction. All vertical pipes passing through pipe sleeves shall be secured using a pipe collar.

2.5 ANCHOR BOLTS/SYSTEMS

A. Anchoring Devices: Design, size, and space support anchoring devices, including anchor bolts, inserts, and other devices used to anchor support, to withstand shear, and pullout loads imposed by loading and spacing on each particular support. Do not use adhesive anchor bolts on any pipe support hung from a roof or ceiling, unless specifically noted otherwise.

B. All post-installed anchors in concrete shall have current published ICC-ES Evaluation Report indicating the anchor is approved for installation in cracked concrete.

C. The latest edition of the following specification and recommended practices shall become part of this specification as if written herein. Wherever requirements conflict, the more stringent shall govern.

1. ACI 318, Appendix D.
2. ACI 355.2, Mechanical Anchors "Qualification of Post-Installed Mechanical Anchors in Concrete"
3. Anchor manufacturer's published installation requirements.

D. Expansion anchors:

1. The length of expansion bolts shall be sufficient to place the wedge portion of the bolt a minimum of 1 inch behind the steel reinforcement.
2. Manufacturers:

a. Power-Stud+ SD4 and Power-Stud+ SD6 by Powers Fasteners, Brewster, NY,
b. Kwik Bolt as manufactured by Hilti USA, Tulsa, Oklahoma; or
c. Wej-it by Wej-it Expansion Products, Inc., Broomfield, Colorado.

E. Unless otherwise noted: use Type 304 stainless steel anchoring parts/bolts and hardware for non-submerged supports, Type 316 stainless steel for submerged anchors.

F. Size of anchor bolts as designed by manufacturer, 1/2 inch minimum diameter, or as shown on the Drawings.

G. Anchors to concrete in chemical areas shall be epoxy secured vinyl ester FRP all thread, insertion depth and size as required by the manufacturer for the design loads. Nuts, bolts and hardware shall all be vinyl ester FRP construction.

2.6 HANGER RODS

A. Where use of steel is allowed, hanger rods shall be hot-rolled steel, machine-threaded, and, except for stainless steel, galvanized after fabrication. The strength of the rod shall be based on its root diameter.

1. Hanger rods shall be attached to concrete structures using single or continuous concrete inserts by the named support manufacturers above. Where use of steel is allowed, inserts shall be malleable iron or steel with galvanized finish.

2. Beam-clamps, C-clamps, or welded-beam attachments shall be used for attaching hanger rods to structural steel members.

B. Minimum rod size for metallic rod hangers: (* For pipe diameters less than 14 inch, if using pipe roller, use 2 hanger rods with minimum diameter noted below for pipe's diameter).

	Nominal Pipe / Tube Diameter	Minimum Hanger Rod Diameter
1	Less than 2-1/2 inch	1/4 inch*
2	3 to 8 inches	1/2 inch*
3	10 to 14 inches	3/4 inch*
4	16 to 20 inches	2 at 1 inch
5	24 inches	2 at 1-1/4 inch
6	30 inches	2 at 1-1/2 inch

2.7 SINGLE PIPE HANGERS

A. Unless otherwise indicated, pipe hangers and supports shall be standard catalogued components, conforming to the requirements of MSS-41, 58, or 69 and shall be of the following type:

1. Anvil International
2. Equal models by: Carpenter & Patterson, Inc., Wobum, MA; Cooper B-Line; Gulf State Manufacturing; or Unistrut Northeast, Cambridge, Massachusetts.

B. Single pipes shall be supported by hangers suspended by hanger rods from structural steel members, concrete ceilings, bottom of trapeze hangers, and wall-mounted steel angle brackets.

C. Where pipes are near walls, beams, columns, etc., and located an excessive distance from ceilings or underside of beams, welded steel wall brackets similar to Carpenter and Patterson, Figure Nos. 68, 79, 84, or 139 shall be used for hanging pipe. Where single pipes rest on top of bracket pipe supports, attachments shall meet requirements as specified under multiple pipe hangers.

2.8 MULTIPLE PIPE HANGERS

A. Suspended multiple pipes, running parallel in the same horizontal plane that are adjacent to each other, shall be suspended by trapeze type hangers or wall brackets. Where use of steel is allowed, trapeze hangers shall consist of galvanized structural steel channel supported from galvanized threaded rod or attached to concrete walls, columns, or structural steel support members. See previous paragraphs about multiple PVC pipe supports.

B. Except as otherwise specified herein, pipe anchors used for attaching pipe to trapeze or multiple pipe wall brackets shall be anchor or pipe chairs similar to:

1. Anvil Fig. 175
2. Cooper B-Line B3147A or B3147B.
3. Where use of steel is allowed, material of construction shall be galvanized steel. Chair U bolts shall be tightened to allow freedom of movement for normal expansion and contraction except where pipe must be anchored to control direction of movement or act as a thrust anchor.

2.9 SINGLE PIPE SUPPORTS FROM BELOW

A. Single pipes located in a horizontal plane close to the floor shall be Pedestal type: Schedule 40 pipe stanchion, saddle, and anchoring flange.

1. Nonadjustable Saddle: MSS SP 58, Type 37 with U-Bolt

   a. Anvil, Figure 259.
   b. Cooper B-Line, Figure B3090.

2. Adjustable Saddle: MSS SP 58, Type 38 without clamp

   a. Anvil, Figure 264.
   b. Cooper B-Line, Figure B3093.

B. Pipes less than 3 inch in diameter

1. Hold in position by supports fabricated from steel C channel, welded post base similar to Unistrut, Figure P2072A, where use of steel is allowed; and pipe clamps similar to Unistrut, Figures P1109 through 26.
2. Where required to assure adequate support, fabricate supports using two vertical members and post bases connected by horizontal member of sufficient load capacity to support pipe.
3. Fasten supports to nearby walls or other structural member to provide horizontal rigidity.
4. More than one pipe may be supported from a common fabricated support.

C. Pipes 3 inch in diameter and larger

1. Support by adjustable stanchions.
2. Provide at least 4 inch adjustment
3. Flange mount to floor.

D. Use yoked saddles for piping whose centerline elevation is 18 inch or greater above the floor and for all exterior installations.

E. Pipe roller type supports shall be used where required to accommodate thermal movement in conjunction with axial supports.

2.10 WALL SUPPORTED SINGLE AND MULTIPLE PIPES

A. Single or multiple pipes located adjacent to walls, columns, or other structural members shall be supported using welded steel wall brackets, where use of steel is allowed, as manufactured by Carpenter and Patterson, Figure No. 69, 84, or 139.

B. Where noted, multiple pipes may be supported on C-channel with steel brackets similar to Unistrut pipe clamps; with pipe anchor chairs; or equal.

C. Individual pipes, up to 8-in diameter, where noted, may use MSS Type 8 pipe clamps as noted on the Drawings.

D. Securely fasten all members to wall, column, etc., using double-expansion shields or other method as approved by the Engineer. Provide additional wall bearing plates as required.

2.11 BASE ANCHOR SUPPORT

A. Bend Support: Where pipes change direction from horizontal to vertical via a bend, install a welded or cast base bend support to carry the load. Fasten to the floor, pipe stanchion, or concrete pedestal using expansion anchors or other method as approved by the Engineer.

B. Concrete Supports: Where indicated, securely fasten pipe bends to concrete supports with suitable metal bands as required and approved by the Engineer. Isolate piping from poured concrete with a neoprene insert.

2.12 VERTICAL PIPE SUPPORTS

A. Where vertical pipes are not supported by a Unistrut type system as specified, they shall be supported in one of the following methods.

1. For pipes 1/4 to 2 inch in diameter,

    a. Provide extension hanger ring with an extension rod and hanger flange.
    b. The rod diameter shall be as recommended by the manufacturer for the type of pipe to be supported.
    c. Where use of steel is allowed, the hanger ring shall be steel- or PVC-clad depending on the supported pipe material of construction. The hanger ring shall be equal to Carpenter & Patterson, Figure Nos. 81.
    d. Where use of steel is allowed, the anchor flange shall be galvanized malleable iron similar to Carpenter and Patterson, Figure No. 85.

2. For pipes equal to or greater than 2 inch in diameter,

    a. extended pipe clamps similar to Carpenter & Patterson, Figure No. 267 may be used.
    b. Attach hanger to concrete structures using double expansion shields,

c. Attach hanger to metal support members using welding lugs similar to Carpenter & Patterson, Figure No. 114.

B. Pipe supports shall be provided for closely spaced vertical piping systems required to provide a rigid installation. The interval of vertical support spacing shall be as specified, but in no case shall vertical interval exceed 12 feet. The support system shall consist of a framework suitably anchored to floors, ceilings, or roofs.

C. Unless otherwise specified, shown, or specifically approved by the Engineer, vertical runs exceeding 12 feet shall be supported by base elbows/tees, clamps, brackets, wall rests, and pipe collars, all located as required to ensure a rigid installation.

D. Pipe riser clamps, per MSS SP58, shall be used to support all vertical pipes extending through floor slabs. Where use of steel is allowed, riser clamps shall be galvanized steel manufactured by:

1. Carpenter & Patterson, Figure No. 128.
2. Anvil, Figure 261.
3. Cooper B-Line, Figure B3373.
4. Or equal.

E. Copper-clad or PVC-coated clamps shall be used on copper pipes. Insulation shall be removed from insulated pipes prior to installing riser clamps. Insulation shall not be damaged by clamp installation.

2.13 SPECIAL SUPPORTS

A. Frame work supports

1. Vertical and horizontal supporting members shall be U-shaped channels similar to Unistrut, Series P1000. Vertical piping shall be secured to the horizontal members by pipe clamps or pipe straps. See pipe clamp and strap requirements.
2. For piping 3 inch and smaller, framework shall be as manufactured by:

   a. the Unistrut Corporation;
   b. Power-Strut (or Ackinstrut where fiberglass systems are specified);
   c. Multi-Strut by Carpenter-Paterson
   d. or equal.

3. For piping larger than 3 inch, the support frame shall be fabricated from structural stainless steel or steel shapes, depending upon the support location, and secured through the use of drop in, adhesive or expansion anchors.
4. The assemblies shall be furnished complete with all nuts, bolts, and fittings required for a complete assembly including end caps for all Unistrut members.
5. Electrical Conduit Support: Under Division 16.
6. The design of each individual framing system shall be the responsibility of the Contractor. Submit shop drawings, and show all details of the installation, including dimensions and types of supports. In all instances the completed frame shall be

adequately braced to provide a complete rigid structure when all the piping has been attached. See also Article Support and Restraint.

B. Supports not otherwise described in this Section shall be fabricated or constructed from standard structural stainless steel or steel shapes in accordance with applicable provisions of Section 05502 "Metal Fabrications," or Unistrut-type frame; have anchor hardware similar to items previously specified herein; shall meet the minimum requirements listed below; and be subject to the approval of the Engineer.

C. Additional Pipe Support Situations

1. Supporting Multiple Chemical and Related Piping:

a. Location: indicated on Drawings or otherwise required, especially adjacent to chemical pumps.
b. Use: framework support.
c. Materials: FRP, with proper local stress protection.

2.14 SHOP FACTORY FINISHING

A. Prepare and prime metallic (except stainless steel) supports in accordance with Division 09.

2.15 ACCESSORIES

A. Insulation Shield: Install on insulated non-steel piping. Oversize the rollers and supports, as required. Manufacturers:

1. Anvil, Figure 167;
2. Cooper B-Line, Series B3151.

B. Welding Insulation Saddle: Install on insulated metal pipe. Oversize the rollers and supports, as required. Manufacturers:

1. Anvil, Figure 160;
2. Cooper B-Line, Series B3160

C. Vibration Isolation Pad: Install under base flange of pedestal type pipe supports adjacent to equipment, and where required to isolate vibration.

1. Isolation pads to be neoprene, waffle type.
2. Manufacturers:

a. Mason Industries, Type W;
b. Korfund.

D. Dielectric Barrier

1. Install between carbon steel members and copper or stainless steel pipe.
2. Install between stainless steel supports and non-stainless steel ferrous metal piping.
3. All stainless steel piping shall be isolated from all ferrous materials, including galvanized steel by use of neoprene sheet material and protection shields.

E. Electrical Isolation: Install 1/4 by 3 inch neoprene rubber wrap between submerged metal pipe and oversized clamps.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 01301 “Administrative Requirements”: Requirements for installation examination.

B. Verify field dimensions as indicated on Drawings.

3.2 INSTALLATION

A. Obtain permission from Engineer before using powder-actuated anchors.

B. Obtain permission from Engineer before drilling or cutting structural members.

C. Inserts:

1. Install inserts for placement in concrete forms. Before setting inserts, all drawings and figures shall be checked that have a direct bearing on the pipe location. Responsibility for the proper location of pipe supports is included under this Section.
2. Install inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
3. Provide hooked rod to concrete reinforcement section for inserts carrying pipe 4 in and larger.

D. Pipe Hangers and Supports:

1. Install according to: ASME B31.3.
2. Support horizontal piping as indicated on Drawings, depending upon pipe size.
3. Install hangers with minimum 1/2 in space between finished covering and adjacent Work.
4. Place hangers within 12 in of each horizontal elbow.
5. Use hangers with 1-1/2 in minimum vertical adjustment.
6. Support horizontal cast iron pipe adjacent to each hub, with 5 ft maximum spacing between hangers.
7. Where piping is installed in parallel and at same elevation, provide multiple pipe or trapeze hangers.
8. Support riser piping independently of connected horizontal piping.

9. Design hangers for pipe movement without disengagement of supported pipe.
10. Support piping independently so that equipment is not stressed by piping weight or expansion in piping system.
11. Support large or heavy valves, fittings, and appurtenances independently of connected piping.
12. Provide welded steel brackets where piping is to be run adjacent to building walls or columns.
13. Use beam clamps where piping is to be suspended from building steel.
14. Insulated Piping: Provide two bolted clamps designed to accommodate insulated piping.
15. Use offset clamps where pipes are indicated as offset from wall surfaces.
16. Proceed with installation of piping and supports only after any building structural work has been completed and new concrete has reached its 28-day compressive strength.
17. The installation of pipe support systems shall not interfere with the operation of any overhead bridge cranes, monorails, access hatches, etc. No piping shall be supported from stairs, other pipes, ladders, and walkways unless authorized by the Engineer.
18. Repair mounting surfaces to original condition after attachments are made.
19. Brace horizontal pipe movements by both longitudinal and lateral sway bracing.
20. Where supports are required in areas to receive chemical resistant seamless flooring, install supports prior to application of flooring system.

E. Equipment Bases and Supports:

1. Provide housekeeping pads as detailed on Drawings.
2. Using templates furnished with equipment, install anchor bolts and accessories for mounting and anchoring equipment.

F. Prime Coat:

1. Prime coat exposed steel hangers and supports.
2. Conform to Section 09910 “Painting”.
3. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.

3.3 FIELD QUALITY CONTROL

A. All pipe support systems shall be tested after installation in conjunction with the respective piping pressure tests. If any part of the pipe support system proves to be defective or inadequate, it shall be repaired, augmented or replaced to the satisfaction of the Engineer.

B. After the work is installed, but before it is filled for start-up and testing, the Support System Design Engineer shall inspect the work and shall certify its complete adequacy. Each system shall be inspected and certified in the same way.

C. Submit a report, including all field modifications and including all certificates.

1. Insert state where project is located

2. The report shall bear the stamp of a professional engineer registered in State of Florida and shall be subject to the review of the Engineer.

END OF SECTION

SECTION 15075

IDENTIFICATION FOR PROCESS PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Nameplates.
2. Tags.
3. Stencils.
4. Pipe markers.
5. Ceiling tacks.
6. Labels.
7. Lockout devices.

B. Related Requirements:

1. Section 09910 “Painting”: Requirements for painting as specified by this Section.
2. Section 15108 “Process Valves”: Basic materials and methods for valves.

1.2 SUBMITTALS

A. Section 01300 “Submittals”: Requirements for submittals.

B. Product Data: Submit manufacturer's catalog literature for each specified product.

C. Shop Drawings:

1. Indicate list of wording, symbols, letter size, spacing of labels, and color-coding for mechanical identification and valve chart and schedule.
2. Indicate valve tag number, location, function, and valve manufacturer's name and model number.

D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

E. Manufacturer Instructions: Submit detailed instructions on installation requirements, including storage and handling procedures.

F. Qualifications Statement:

1. Submit qualifications for manufacturer.

1.3 SUSTAINABLE DESIGN SUBMITTALS

A. Manufacturer's Certificate:

1. Certify that products meet or exceed specified sustainable design requirements.
2. Materials Resources Certificates:

    a. Certify source and origin for salvaged and reused products.
    b. Certify recycled material content for recycled content products.
    c. Certify source for regional materials and distance from Project Site.

B. Product Cost Data:

1. Submit cost of products to verify compliance with Project sustainable design requirements.
2. Exclude cost of labor and equipment to install products.
3. Provide cost data for following products:

    a. Salvaged, refurbished, and reused products.
    b. Products with recycled material content.
    c. Regional products.

1.4 CLOSEOUT SUBMITTALS

A. Section 01701 “Project Closeout”: Requirements for submittals.

B. Project Record Documents: Record actual locations of tagged valves; include valve tag numbers.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Section 01701 “Project Closeout”: Requirements for maintenance materials.

1.6 QUALITY ASSURANCE

A. Piping Color Scheme and Lettering Size: Comply with ASME A13.1.

B. Perform Work according to Clay County Utility Authority preferences.

C. Comply with recommended wastewater treatment facility color coding from the latest version of Ten State Standards unless otherwise requested by Owner.

1.7 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum three years' experience.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Section 01600 “Materials and Equipment”: Requirements for transporting, handling, storing, and protecting products.

B. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.

C. Store materials according to manufacturer instructions.

D. Protection:

1. Protect materials from moisture and dust by storing in clean, dry location remote from construction operations areas.
2. Provide additional protection according to manufacturer instructions.

PART 2 - PRODUCTS

2.1 NAMEPLATES

A. Manufacturers:

1. Craftmark Pipe Markers,
2. Kolbi Pipe Marker Co.,
3. Pipemarker.com (Brimar Industries, inc.),
4. Seton Identification Products
5. Substitutions: As approved by Owner.

B. Description: Laminated three-layer plastic with engraved black letters on light, contrasting background color.

2.2 TAGS

A. Metal Tags:

1. Manufacturers:

a. Brady ID,
b. Craftmark Pipe Markers,
c. Kolbi Pipe Marker Co,
d. Marking Services, Inc.,
e. Pipemarker.com (Brimar Industries, Inc.),
f. R&R Identification Co.
g. Seton Identification Products
h. Substitutions: As approved by Owner.

2. Description:

a. Stainless-steel construction; stamped letters.
b. Minimum Tag Size and Configuration: 2 inches; diameter with finished edges.
c. Provide with brass hooks suitable for attaching the tag to the valve operator.
d. Stamp or etch tags with the valve number and information on the valve schedule coded in a system provided by the Owner.

2.3 STENCILS

A. Manufacturers:

1. Kolbi Pipe Marker Co,
2. Marking Services, Inc.,
3. Pipemarker.com (Brimar Industries, Inc.),
4. R&R Identification Co.
5. Seton Identification Products
6. Substitutions: As approved by Owner.

B. Description:

1. Quality: Clean-cut symbols.
2. Letters:

OUTSIDE DIAMETER OF PIPE	SIZE OF LETTERS
3/4-in to 1-1/4-in	1/2-in
1-1/2-in to 2-in	3/4-in
2-1/2-in to 6-in	1-1/2-in
8-in to 10-in	2-1/2-in
Over 10-in	3-in

C. Stencil Paint:

1. Description: Semigloss enamel.
2. As specified in Section 09910 “Painting”.

2.4 PIPE MARKERS

A. Plastic Pipe Markers:

1. Manufacturers:

a. Brady ID,

b. Craftmark Pipe Markers,
c. Marking Services, Inc.,
d. R&R Identification Co.,
e. Seton Identification Products Substitutions: As approved by Owner.

2. Description:

a. Factory-fabricated, flexible, and semi-rigid plastic.
b. Preformed to fit around pipe or pipe covering.
c. Larger sizes may be of maximum sheet size, with spring fastener.
d. Letter sizes per Paragraph 2.3B.
e. Color shall be white or black depending on background color.

B. Plastic Tape Pipe Markers:

1. Manufacturers:

a. Brady ID,
b. Craftmark Pipe Markers,
c. Kolbi Pipe Marker Co.,
d. Marking Services, Inc.,
e. Pipemarker.com (Brimar Industries, Inc.),
f. Seton Identification Products
g. Substitutions: As Approved by Owner.

2. Description:

a. Flexible, 3.5 mil vinyl ilm tape with pressure-sensitive adhesive backing and printed markings.
b. Letter sizes per Paragraph 2.3B.
c. Color shall be white or black depending on background color.

C. Plastic Underground Pipe Markers:

1. Manufacturers:

a. Kolbi Pipe Marker Co.,
b. Marking Services, Inc.,
c. Pipemarker.com (Brimar Industries, Inc.),
d. Rhino Marking and Protection System,
e. Seton Identification Products
f. Substitutions: As approved by Owner.

2. Description:

a. Brightly colored, continuously printed plastic ribbon tape.
b. Minimum Size: 6 inches wide by 4 mils thick.
c. Manufactured for direct burial service.
d. Letter sizes per Paragraph 2.3B.

2.5 LOCKOUT DEVICES

A. Lockout Hasps:

1. Manufacturers:

a. Brady ID,
b. Master Lock Company, LLC
c. Substitutions: As approved by Owner..

2. Description:

a. Material: Anodized aluminum.
b. Furnish hasp with erasable label surface.
c. Minimum Size: 7-1/4 by 3 inches.

B. Valve Lockout Devices:

1. Manufacturers:

a. Brady ID,
b. Master Lock Company, LLC
c. Substitutions: As approved by Owner.

2. Description:

a. Material: Steel.
b. Furnish device to restrict access to valve operator and to accept lock shackle.

PART 3 - EXECUTION

3.1 PREPARATION

A. Degrease and clean surfaces to receive adhesive for identification materials.

B. Stencil Painting: Prepare surfaces as specified in Section 09910 “Painting”.

3.2 INSTALLATION

A. According to manufacturer instructions.

B. Apply stencil painting as specified in Section 09910 “Painting”.

C. Install identifying devices after completion of coverings and painting.

D. Install plastic nameplates with corrosion-resistant mechanical fasteners or adhesive.

E. Labels:

1. Install labels with sufficient adhesive for permanent adhesion and seal with clear lacquer.
2. For unfinished covering, apply paint primer before applying labels.
3. Titles:

    a. Locate a maximum 26 feet apart.
    b. Locate directly adjacent to pipeline breaches on each side wall.
    c. Locate adjacent to each side of the valve regulator, flow meter, strainer, cleanout and all pieces of equipment.
    d. Identify the contents by complete name at least once in each room or space and thereafter may be labeled by generally recognized abbreviations.

F. Tags:

1. Identify valves in main and branch piping with tags.
2. Install tags using corrosion-resistant chain.
3. Number tags consecutively by location.

G. Install underground plastic pipe markers 6 to 8 inches below finished grade, directly above buried pipe.

H. Piping:

1. Identify piping, concealed or exposed, with plastic pipe markers.
2. Use tags on piping 3/4-inch diameter and smaller.
3. Identify service, flow direction, and pressure.
4. Install in clear view and align with axis of piping.
5. Locate identification not to exceed 20 feet on straight runs, including risers and drops, adjacent to each valve and tee, at each side of penetration of structure or enclosure, and at each obstruction.

END OF SECTION

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SECTION 15093

HVAC PIPING INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes insulation for HVAC piping systems.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory and field applied if any).

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
2. Detail attachment and covering of heat tracing inside insulation.
3. Detail insulation application at pipe expansion joints for each type of insulation.
4. Detail insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
5. Detail removable insulation at piping specialties.
6. Detail application of field-applied jackets.
7. Detail application at linkages of control devices.

C. Samples: For each type of insulation and jacket indicated. Identify each Sample, describing product and intended use.

1. Preformed Pipe Insulation Materials: 12 inches long by NPS 2.
2. Sheet Form Insulation Materials: 12 inches square.
3. Jacket Materials for Pipe: 12 inches long by NPS 2.
4. Sheet Jacket Materials: 12 inches square.
5. Manufacturer's Color Charts: For products where color is specified, show the full range of colors available for each type of finish material.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer.

B. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets, with requirements indicated. Include dates of tests and test methods employed.

C. Field quality-control reports.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.

B. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products in accordance with ASTM E84, by a testing agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.

1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.7 COORDINATION

A. Coordinate sizes and locations of supports, hangers, and insulation shields.

B. Coordinate clearance requirements with piping Installer for piping insulation application. Before preparing piping Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

C. Coordinate installation and testing of heat tracing.

1.8 SCHEDULING

A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.

B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

A. Comply with requirements in "Piping Insulation Schedule, General," "Indoor Piping Insulation Schedule," "Outdoor, Aboveground Piping Insulation Schedule," and "Outdoor, Underground Piping Insulation Schedule" articles for where insulating materials shall be applied.

B. Products shall not contain asbestos, lead, mercury, or mercury compounds.

C. Products that come into contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested in accordance with ASTM C871.

D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable in accordance with ASTM C795.

E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

F. Flexible Elastomeric: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C534/C534M, Type I for tubular materials, Type II for sheet materials.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Aeroflex USA.
b. Armacell LLC.
c. K-Flex USA.

2.2 INSULATING CEMENTS

A. Mineral-Fiber Insulating Cement: Comply with ASTM C195.

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

a. Ramco Insulation, Inc.

B. Expanded or Exfoliated Vermiculite Insulating Cement: Comply with ASTM C196.

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

a. Ramco Insulation, Inc.

C. Mineral-Fiber, Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C449.

2.3 ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.

B. Cellular-Glass Adhesive: Two-component, thermosetting urethane adhesive containing no flammable solvents, with a service temperature range of minus 100 to plus 200 deg F.

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

a. Foster Brand; H. B. Fuller Construction Products.

C. Flexible Elastomeric and Polyolefin Adhesive: Solvent-based adhesive.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Aeroflex USA.
b. Armacell LLC.
c. K-Flex USA.

2. Flame-spread index shall be 25 or less and smoke-developed index shall be 50 or less as tested in accordance with ASTM E84.
3. Wet Flash Point: Below 0 deg F.
4. Service Temperature Range: 40 to 200 deg F.
5. Color: Black.

D. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Childers Brand; H. B. Fuller Construction Products.
b. Foster Brand; H. B. Fuller Construction Products.

E. ASJ Adhesive and FSK and PVDC Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A, for bonding insulation jacket lap seams and joints.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Childers Brand; H. B. Fuller Construction Products.
    b. Foster Brand; H. B. Fuller Construction Products.

F. PVC Jacket Adhesive: Compatible with PVC jacket.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Johns Manville; a Berkshire Hathaway company.
    b. The Dow Chemical Company.

2.4 MASTICS AND COATINGS

A. Materials shall be compatible with insulation materials, jackets, and substrates.

B. Vapor-Retarder Mastic, Water Based: Suitable for indoor use on below-ambient services.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Childers Brand; H. B. Fuller Construction Products.
    b. Foster Brand; H. B. Fuller Construction Products.

2. Water-Vapor Permeance: Comply with ASTM E96/E96M or ASTM F1249.
3. Service Temperature Range: Minus 20 to plus 180 deg F.
4. Comply with MIL-PRF-19565C, Type II, for permeance requirements.
5. Color: White.

C. Vapor-Retarder Mastic, Solvent Based, Indoor Use: Suitable for indoor use on below-ambient services.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Childers Brand; H. B. Fuller Construction Products.
    b. Foster Brand; H. B. Fuller Construction Products.

2. Water-Vapor Permeance: Comply with ASTM E96/E96M or ASTM F1249.
3. Service Temperature Range: 0 to 180 deg F.
4. Color: White.

D. Vapor-Retarder Mastic, Solvent Based, Outdoor Use: Suitable for outdoor use on below-ambient services.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Childers Brand; H. B. Fuller Construction Products.
b. Foster Brand; H. B. Fuller Construction Products.

2. Water-Vapor Permeance: Comply with ASTM E96/E96M or ASTM F1249.
3. Service Temperature Range: Minus 50 to plus 220 deg F.
4. Color: White.

2.5 LAGGING ADHESIVES

A. Adhesive shall comply with MIL-A-3316C, Class I, Grade A and shall be compatible with insulation materials, jackets, and substrates.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Childers Brand; H. B. Fuller Construction Products.
b. Foster Brand; H. B. Fuller Construction Products.

2. Fire-resistant, water-based lagging adhesive and coating for use indoors to adhere fire-resistant lagging cloths over pipe insulation.
3. Service Temperature Range: 0 to plus 180 deg F.
4. Color: White.

2.6 SEALANTS

A. Materials shall be as recommended by the insulation manufacturer and shall be compatible with insulation materials, jackets, and substrates.

B. Joint Sealants:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Childers Brand; H. B. Fuller Construction Products.
b. Foster Brand; H. B. Fuller Construction Products.

2. Permanently flexible, elastomeric sealant.

a. Service Temperature Range: Minus 100 to plus 300 deg F.
b. Color: White or gray.

C. FSK and Metal Jacket Flashing Sealants:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Childers Brand; H. B. Fuller Construction Products.
b. Foster Brand; H. B. Fuller Construction Products.

2. Fire- and water-resistant, flexible, elastomeric sealant.
3. Service Temperature Range: Minus 40 to plus 250 deg F.
4. Color: Aluminum.

D. ASJ Flashing Sealants and PVDC, and PVC Jacket Flashing Sealants:

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

a. Childers Brand; H. B. Fuller Construction Products.

2. Fire- and water-resistant, flexible, elastomeric sealant.
3. Service Temperature Range: Minus 40 to plus 250 deg F.
4. Color: White.

2.7 FACTORY-APPLIED JACKETS

A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:

1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C1136, Type I.
2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C1136, Type I.
3. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C1136, Type II.

2.8 FIELD-APPLIED FABRIC-REINFORCING MESH

A. Woven Glass-Fiber Fabric: Approximately 2 oz./sq. yd. with a thread count of 10 strands by 10 strands/sq. in. for covering pipe and pipe fittings.

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

a. Childers Brand; H. B. Fuller Construction Products.

B. Woven Polyester Fabric: Approximately 1 oz./sq. yd. with a thread count of 10 strands by 10 strands/sq. in., in a Leno weave, for pipe.

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

a. Foster Brand; H. B. Fuller Construction Products.

2.9 FIELD-APPLIED CLOTHS

A. Woven Glass-Fiber Fabric: Comply with MIL-C-20079H, Type I, plain weave, and presized a minimum of 8 oz./sq. yd..

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

a. Alpha Associates, Inc.

2.10 FIELD-APPLIED JACKETS

A. Field-applied jackets shall comply with ASTM C1136, Type I, unless otherwise indicated.

B. FSK Jacket: Aluminum-foil-face, fiberglass-reinforced scrim with kraft-paper backing.

C. Metal Jacket:

1. Aluminum Jacket: Comply with ASTM B209, Alloy 3003, 3005, 3105, or 5005, Temper H-14.

a. Sheet and roll stock ready for shop or field sizing.
b. Finish and thickness are indicated in field-applied jacket schedules.
c. Moisture Barrier for Indoor Applications: 1-mil-thick, heat-bonded polyethylene and kraft paper.
d. Moisture Barrier for Outdoor Applications: 3-mil-thick, heat-bonded polyethylene and kraft paper.
e. Factory-Fabricated Fitting Covers:

1) Same material, finish, and thickness as jacket.
2) Preformed two-piece or gore, 45- and 90-degree, short- and long-radius elbows.
3) Tee covers.
4) Flange and union covers.
5) End caps.
6) Beveled collars.
7) Valve covers.
8) Field fabricate fitting covers only if factory-fabricated fitting covers are not available.

D. Underground Direct-Buried Jacket: 125-mil-thick vapor barrier and waterproofing membrane consisting of a rubberized bituminous resin reinforced with a woven-glass fiber or polyester scrim and laminated aluminum foil.

E. Self-Adhesive Outdoor Jacket: 60-mil-thick, laminated vapor barrier and waterproofing membrane for installation over insulation located aboveground outdoors; consisting of a rubberized bituminous resin on a cross-laminated polyethylene film covered with white aluminum-foil facing.

2.11 TAPES

A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C1136.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Ideal Tape Co., Inc., an American Biltrite Company.
b. Knauf Insulation.

2. Width: 3 inches.
3. Thickness: 11.5 mils.
4. Adhesion: 90 ounces force/inch in width.
5. Elongation: 2 percent.
6. Tensile Strength: 40 lbf/inch in width.
7. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.

B. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C1136.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. 3M Industrial Adhesives and Tapes Division.
b. Avery Dennison Corporation, Specialty Tapes Division.
c. Knauf Insulation.

2. Width: 3 inches.
3. Thickness: 6.5 mils.
4. Adhesion: 90 ounces force/inch in width.
5. Elongation: 2 percent.
6. Tensile Strength: 40 lbf/inch in width.
7. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.

C. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Ideal Tape Co., Inc., an American Biltrite Company.
b. Knauf Insulation.

2. Width: 2 inches.
3. Thickness: 3.7 mils.
4. Adhesion: 100 ounces force/inch in width.
5. Elongation: 5 percent.
6. Tensile Strength: 34 lbf/inch in width.

2.12 SECUREMENTS

A. Bands:

1. Stainless Steel: ASTM A240/A240M, Type 316; 0.015 inch thick, 1/2 inch 3/4 inch wide with wing seal or closed seal.
2. Aluminum: ASTM B209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 1/2 inch wide with wing seal.
3. Springs: Twin spring set constructed of stainless steel with ends flat and slotted to accept metal bands. Spring size is determined by manufacturer for application.

B. Staples: Outward-clinching insulation staples, nominal 3/4-inch-wide, stainless steel or Monel.

C. Wire: 0.062-inch soft-annealed, stainless steel.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.

1. Verify that systems to be insulated have been tested and are free of defects.
2. Verify that surfaces to be insulated are clean and dry.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

B. Clean and prepare surfaces to be insulated. Before insulating, apply a corrosion coating to insulated surfaces as follows:

1. Stainless Steel: Coat 300 series stainless steel with an epoxy primer 5 mils thick and an epoxy finish 5 mils thick if operating in a temperature range between 140 and 300 deg F. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.
2. Carbon Steel: Coat carbon steel operating at a service temperature of between 32 and 300 deg F with an epoxy coating. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.

C. Coordinate insulation installation with the tradesman installing heat tracing. Comply with requirements for heat tracing that apply to insulation.

D. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless steel surfaces, use demineralized water.

3.3 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping including fittings, valves, and specialties.

B. Install insulation materials, forms, vapor barriers or retarders, jackets, and of thicknesses required for each item of pipe system as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Install insulation with longitudinal seams at top and bottom of horizontal runs.

E. Install multiple layers of insulation with longitudinal and end seams staggered.

F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.

G. Keep insulation materials dry during storage, application, and finishing. Replace insulation materials that get wet.

H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

I. Install insulation with least number of joints practical.

J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.

1. Install insulation continuously through hangers and around anchor attachments.
2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends attached to structure with vapor-barrier mastic.
3. Install insert materials and insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.

K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

L. Install insulation with factory-applied jackets as follows:

1. Draw jacket tight and smooth.

2. Cover circumferential joints with 3-inch-wide strips, of same material as insulation jacket. Secure strips with adhesive and outward-clinching staples along both edges of strip, spaced 4 inches o.c.
3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward-clinching staples along edge at 2 inches o.c.

    a. For below-ambient services, apply vapor-barrier mastic over staples.

4. Cover joints and seams with tape, in accordance with insulation material manufacturer's written instructions, to maintain vapor seal.
5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.

M. Cut insulation in a manner to avoid compressing insulation more than 25 percent of its nominal thickness.

N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches in similar fashion to butt joints.

P. For above-ambient services, do not install insulation to the following:

1. Vibration-control devices.
2. Testing agency labels and stamps.
3. Nameplates and data plates.

3.4 PENETRATIONS

A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.
4. Seal jacket to roof flashing with flashing sealant.

B. Insulation Installation at Underground Exterior Wall Penetrations: Terminate insulation flush with sleeve seal. Seal terminations with flashing sealant.

C. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
4. Seal jacket to wall flashing with flashing sealant.

D. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

E. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.

3.5 GENERAL PIPE INSULATION INSTALLATION

A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.

B. Insulation Installation on Fittings, Valves, Strainers, Flanges, Mechanical Couplings, and Unions:

1. Install insulation over fittings, valves, strainers, flanges, mechanical couplings, unions, and other specialties with continuous thermal and vapor-retarder integrity unless otherwise indicated.
2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as that of adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as that used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as that used for adjacent pipe. Overlap adjoining pipe insulation by not less than 2 times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as that used for adjacent pipe. Overlap adjoining pipe insulation by not less than 2 times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement.

Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below-ambient services, provide a design that maintains vapor barrier.

6. Insulate flanges, mechanical couplings, and unions using a section of oversized preformed pipe insulation to fit. Overlap adjoining pipe insulation by not less than 2 times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Stencil or label the outside insulation jacket of each union with the word “union” matching size and color of pipe labels.
7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below-ambient services and a breather mastic for above-ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
8. For services not specified to receive a field-applied jacket, except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing, using PVC tape.

C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.

D. Install removable insulation covers at locations indicated. Installation shall conform to the following:

1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as that of adjoining pipe insulation.
2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union at least 2 times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless steel or aluminum bands. Select band material compatible with insulation and jacket.
3. Construct removable valve insulation covers in same manner as for flanges, except divide the two-part section on the vertical center line of valve body.
4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.
5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

3.6 INSTALLATION OF FLEXIBLE ELASTOMERIC INSULATION

A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

B. Insulation Installation on Pipe Flanges:

1. Install pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of same thickness as that of pipe insulation.
4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install mitered sections of pipe insulation.
2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed valve covers manufactured of same material as that of pipe insulation when available.
2. When preformed valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.
4. Secure insulation to valves and specialties, and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.7 FIELD-APPLIED JACKET INSTALLATION

A. Where glass-cloth jackets are indicated, install directly over bare insulation or insulation with factory-applied jackets.

1. Draw jacket smooth and tight to surface with 2-inch overlap at seams and joints.
2. Embed glass cloth between two 0.062-inch-thick coats of lagging adhesive.
3. Completely encapsulate insulation with coating, leaving no exposed insulation.

B. Where FSK jackets are indicated, install as follows:

1. Draw jacket material smooth and tight.
2. Install lap or joint strips with same material as jacket.
3. Secure jacket to insulation with manufacturer's recommended adhesive.
4. Install jacket with 1-1/2-inch laps at longitudinal seams and 3-inch-wide joint strips at end joints.
5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-barrier mastic.

C. Where PVC jackets are indicated and for horizontal applications, install with 1-inch overlap at longitudinal seams and end joints. Seal with manufacturer's recommended adhesive.

1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.

D. Where metal jackets are indicated, install with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless steel bands 12 inches o.c. and at end joints.

E. Where PVDC jackets are indicated, install as follows:

1. Apply three separate wraps of filament tape per insulation section to secure pipe insulation to pipe prior to installation of PVDC jacket.
2. Wrap factory-presized jackets around individual pipe insulation sections, with one end overlapping the previously installed sheet. Install presized jacket with an approximate overlap at butt joint of 2 inches over the previous section. Adhere lap seal using adhesive or SSL, and then apply 1-1/4 circumferences of appropriate PVDC tape around overlapped butt joint.
3. Continuous jacket can be spiral-wrapped around a length of pipe insulation. Apply adhesive or PVDC tape at overlapped spiral edge. When electing to use adhesives, refer to manufacturer's written instructions for application of adhesives along this spiral edge to maintain a permanent bond.
4. Jacket can be wrapped in cigarette fashion along length of roll for insulation systems with an outer circumference of 33-1/2 inches or less. The 33-1/2-inch-circumference limit allows for 2-inch-overlap seal. Using the length of roll allows for longer sections of jacket to be installed at one time. Use adhesive on the lap seal. Visually inspect lap seal for "fishmouthing," and use PVDC tape along lap seal to secure joint.
5. Repair holes or tears in PVDC jacket by placing PVDC tape over the hole or tear and wrapping a minimum of 1-1/4 circumferences to avoid damage to tape edges.

3.8 FINISHES

A. Insulation with ASJ, Glass-Cloth, or Other Paintable Jacket Material: Paint jacket with paint system identified below.

1. Flat Acrylic Finish: Two finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.

a. Finish Coat Material: Interior, flat, latex-emulsion size.

B. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.

C. Color: Final color as selected by Engineer. Vary first and second coats to allow visual inspection of the completed Work.

D. Do not field paint aluminum or stainless steel jackets.

3.9 FIELD QUALITY CONTROL

A. Owner will engage a qualified testing agency to perform tests and inspections.

B. Engage a qualified testing agency to perform tests and inspections.

C. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

D. Perform tests and inspections with the assistance of a factory-authorized service representative.

E. Tests and Inspections: Inspect pipe, fittings, strainers, and valves, randomly selected by Engineer, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to three locations of straight pipe, three locations of threaded fittings, three locations of welded fittings, two locations of threaded strainers, two locations of welded strainers, three locations of threaded valves, and three locations of flanged valves for each pipe service defined in the "Piping Insulation Schedule, General" Article.

F. All insulation applications will be considered defective if they do not pass tests and inspections.

G. Prepare test and inspection reports.

3.10 PIPING INSULATION SCHEDULE, GENERAL

A. Insulation conductivity and thickness per pipe size shall comply with schedules in this Section or with requirements of authorities having jurisdiction, whichever is more stringent.

B. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.

3.11 INDOOR PIPING INSULATION SCHEDULE

A. Condensate and Equipment Drain Water below 60 Deg F:

1. All Pipe Sizes: Insulation shall be one of the following:

   a. Cellular Glass: 1-1/2 inches thick.
   b. Flexible Elastomeric: 1 inch thick.
   c. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.

B. Refrigerant Liquid Piping:

1. All Pipe Sizes: Insulation shall be one of the following:

a. Cellular Glass: 1-1/2 inches thick.
b. Flexible Elastomeric: 1 inch thick.
c. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.

3.12 OUTDOOR, ABOVEGROUND PIPING INSULATION SCHEDULE

A. Refrigerant Liquid Piping:

1. All Pipe Sizes: Insulation shall be one of the following:

a. Flexible Elastomeric: 2 inches thick.
b. Flexible Elastomeric: 2 inches thick.

3.13 INDOOR, FIELD-APPLIED JACKET SCHEDULE

A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.

B. If more than one material is listed, selection from materials listed is Contractor's option.

C. Piping, Concealed:

1. Aluminum, Smooth: 0.016 inch thick.

D. Piping, Exposed:

1. Aluminum, Smooth: 0.016 inch thick.

3.14 OUTDOOR, FIELD-APPLIED JACKET SCHEDULE

A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.

B. If more than one material is listed, selection from materials listed is Contractor's option.

C. Piping, Concealed:

1. Aluminum, Smooth: 0.016 inch thick.
2. Aluminum, Smooth with Z-Shaped Locking Seam: 0.016 inch thick.

3.15 UNDERGROUND, FIELD-APPLIED INSULATION JACKET

A. For underground direct-buried piping applications, install underground direct-buried jacket over insulation material.

END OF SECTION

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SECTION 15108

PROCESS VALVES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Common requirements for valves.
2. Valve tags.
3. Valve Schedule.

B. Related Requirements:

1. Section 03300 “Cast-in-Place Concrete” for execution requirements for placement of concrete as required by this Section.
2. Section 05502 “Metal Fabrications” for miscellaneous metalwork and fasteners specified by this Section.
3. Section 09901 “Shop Priming” for product and execution requirements for painting specified by this Section.
4. Section 15065 “Hangers and Supports for Process Piping” for product and execution requirements for valve supports specified by this Section.
5. Section 16000 “Electrical Work - General” for electrical connections for equipment specified in this Section.

C. CCUA Standard Technical Specifications are included in Drawing G-2. Contractor shall conform to the latest standards from CCUA for process valves.

1.2 COORDINATION

A. Section 01301 “Administrative Requirements”: Requirements for coordination.

1.3 ACTION SUBMITTALS

A. Section 01300 “Submittals” for submittal requirements.

B. Valve Schedule:

1. Submit valve schedule populated with all process valves specified for this project.
2. Approval of valve schedule submittal to precede all individual valve submittals. All subsequent individual valve submittals to include the approved valve tag number or group on the submittal cover sheet.

C. Valve Tags:

1. Materials, dimensions and thickness of tags, materials and gauge of cable and splicing hardware.
2. Color palate for Owner selection.
3. Full scale drawing of sample with lettering dimensions and scribe depth.
4. Valve tag lettering provided with Valve Schedule above.

D. Shop Drawings: Valve model number and size, valve parts list, materials of each part including material standard designation (ASTM or other).

E. Provide certified hydrostatic test data, per manufacturer's standard procedure or MSS-SP-61 for all valves.

1.4 INFORMATIONAL SUBMITTALS

A. Source Quality-Control Submittals: Indicate results of integrators facility tests and manufacturers factory tests and inspections.

B. Field Quality-Control Submittals: Indicate results of Contractor-furnished tests and inspections.

C. Qualifications Statement:

1. Submit qualifications for manufacturer.

1.5 CLOSEOUT SUBMITTALS

A. Section 01701 “Project Closeout” for submittal requirements.

B. Section 01720 “Record Documents” for record actual locations of valves and actuators.

1.6 QUALITY ASSURANCE

A. Maintain clearances as indicated on Drawings and Shop Drawings.

B. Ensure that materials of construction of wetted parts are compatible with process liquid.

C. Mate valves to actuators at manufacturer’s or integrator’s facility. Fully test assembled product and certify ready for installation prior to shipment to the job site.

1. Only in special cases for extremely large assemblies where installation requires disassembly, may actuators be mounted to the valves in the field.

D. Furnish affidavit of compliance with testing and manufacturing standards referred in this specification.

E. Obtain Manufacturer’s Certificate of Compliance for Specified valves and valve assemblies.

F. Perform Work according to Clay County Utility Authority standards.

G. Maintain copy of each standard affecting Work of this Section on Site.

1.7 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing valves and actuators with minimum ten years' experience.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Section 01600 “Material and Equipment” for requirements for transporting, handling, storing, and protecting products.

B. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.

C. Deliver factory mated power actuated valves on rigid wooden skids, fully braced and strapped to prevent damage to valve, actuator or coupling system.

D. Store materials according to manufacturer instructions.

E. Protection:

1. Protect materials from moisture and dust by storing in clean, dry location remote from construction operations areas.
2. Protect valve ends from entry of foreign materials by providing temporary covers and plugs.
3. Provide additional protection according to manufacturer instructions.

1.9 EXISTING CONDITIONS

A. Field Measurements:

1. Verify field measurements prior to materials ordering or any fabrication.
2. Indicate field measurements on Shop Drawings.

1.10 WARRANTY

A. Section 01740 “Warranties and Bonds”: Requirements for warranties.

B. Furnish five-year manufacturer's warranty for valves and actuators.

PART 2 - PRODUCTS

2.1 VALVES

A. Description: Valves, operator, actuator, handwheel, chainwheel, extension stem, floor stand, worm and gear operator, operating nut, chain, wrench, and other accessories as required.

B. All valves of the same type shall be the product of one manufacturer

C. Valve Ends: Compatible with adjacent piping system.

D. Operation:

1. Close by turning clockwise.
2. Cast directional arrow on valve or actuator with OPEN and CLOSE cast on valve in appropriate location.

E. Valve Marking and Labeling:

1. Marking: Comply with MSS SP-25.
2. Labeling (valve tags):

a. Fiberglass reinforced plastic, ASTM D709, 70 mil thick, 2 1/2-inch diameter or 2 1/2-inch by 1 ¼-inch.
b. Lettering 1/16-inch thick of silk screening or other permanent embedment of subsurface printed graphics, permanently sealed.
c. Colors of lettering and backing as selected by Owner.
d. Two, 1/4-inch clear opening 316 stainless steel grommets at each end, center of hole 3/8-inch from tag edge.
e. 3/32-inch 316 SS cable and splice hardware.

F. Van Stone flanges shall not be used with pinch valves, industrial butterfly valves; elastomer bellows style expansion joints or other piping system components having an elastomer liner (rubber seat) that is used as a gasket.

2.2 ECCENTRIC PLUG VALVES

A. Manufacturers: DeZurik; M&H Valve

B. Substitutions: Owner approved equal.

C. Description

1. Type:

a. Offset disc type
b. Non-lubricated

c. Serviceable (able to be repacked) under full line pressure
d. Eccentric.
e. Capable of sealing in both directions at the rated pressure
f. Unobstructed flow path when open
g. Drop tight shut-off to the full valve rating with pressure on either side of the plug.

D. Body:

1. 30,000-psi tensile strength
2. Top entry, bolted bonnet
3. Body shall be cast with integral piping connections

E. Plug:

1. To be removable without removing the valve from the line.
2. To have an integral upper and lower shaft:
3. Seals on the upper and lower journals to prevent entrance of solids into the journals.
4. One piece for all valves.
5. Bearings: Permanently lubricated

F. Minimum Working Pressure: 250 psig at 80 deg. F.

1. At the above rated minimum working pressures, certified by the manufacturer as permitting zero leakage for a 5-minute duration with full pressure applied in either direction.

G. Maximum Process Fluid Temperature: 90 deg. F.

H. Ports:

1. Configuration: Round.
2. Minimum Port Area: 80 percent of nominal pipe area for valves 20 inches (500 mm) and smaller; 70 percent for valves larger than 20 inches (500 mm).

I. Seats:

1. Full 360 degree seating by contact of a resilient seating material on the plug mating with welded-in seating surface in the body.
2. Screw in body seats not acceptable.
3. Resilient and of the continuous interface type having consistent opening and closing torques.
4. Non-jamming in the closed position.

J. Stem Bearings: Self-lubricating.

K. Stem Seals:

1. Type: V-ring.

2. Externally adjustable and repackable without removing the bonnet from the valve, or self adjusting.

L. Packing and Gland: Accessible and externally adjustable.

M. End Connections:

1. Mechanical Joint: Comply with ANSI/AWWA C111/A21.11
2. Flanged: Comply with ASME B16.1 and B16.42.

N. Operation:

1. A suitably sized steel actuator mounting bracket shall be provided to provide an air gap between the actuator and the valve stem seal. Under no circumstance shall the gear box be mounted directly to the top body flange such that leakage could directly enter the gear box.
2. Provide adjustable limit stops for both opening and closing and a clearly marked position indicator.
3. 4 Inches and Smaller: Manual, provided with its own securely attached lever.
4. Greater Than 4 Inches: Worm gear manual operators with handwheel.
5. Furnish chain wheel operators for valves mounted over 7 feet above operating floor.

O. Materials:

1. Body:

a. Cast iron, AWWA C517 or Ductile iron, ASTM A536.
b. Lining: Elastomer, as recommended by valve manufacturer for service conditions.

2. Plug:

a. Ductile iron, ASTM A536, Grade 65-45-12 or Cast iron ASTM A126, Grade B.
b. Lining: Resilient coating, as recommended by valve manufacturer for service conditions.

3. Seats: Stainless steel.
4. Stem: Type 316 stainless steel.
5. Stem Bearings: Stainless steel.
6. Seals: PTFE.
7. Connecting Hardware: Type 316 stainless steel

2.3 ROUND, FULL PORT PLUG VALVES

A. Manufacturers: VAG/GA ECO Centric, Pratt Ballcentric, Milliken

B. Substitutions: As approved by Owner.

C. Round full port plug valves shall be equal in all respects as eccentric plug valves except plug shape shall provide for a round, 100% open area viewing the open valve from the end.

2.4 FINISHES

A. Valve Coating: Comply with AWWA C550.

B. Factory finishes are included in individual valve sections.

C. Exposed Valves: As specified in Section 09910 “Painting”.

D. Stainless Body Valves: Do not coat.

E. Do not coat flange faces of valves unless otherwise specified.

2.5 SOURCE QUALITY CONTROL

A. Section 01400 “Quality Control”: Requirements for testing, inspection, and analysis.

B. Testing: Test valves according to manufacturer's standard testing protocol, including hydrostatic, seal, and performance testing.

C. Owner Witnessing:

1. Notify Owner at least seven days before inspections and tests are scheduled.

D. Certificate of Compliance:

1. If manufacturer is approved by authorities having jurisdiction, submit certificate of compliance indicating Work performed at manufacturer's facility conforms to Contract Documents.
2. Specified shop tests are not required for Work performed by approved manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that piping system is ready for valve installation.

B. Fully examine valves for debris, damage and interior finish blemishes prior to installation. Do not install valves with soiled interior or any visible damage to seats, discs or interior finish.

C. Identify any piping, plant or equipment clearance issues prior to installation, bring to Engineer’s attention via job meetings, submittal process or request for information process.

3.2 INSTALLATION

A. Install valves, actuators, extensions, valve boxes, and accessories according to manufacturer instructions.

B. Inspect valve interiors before line closure for the presence of debris. At the option of the Engineer, internal inspection of valve and appurtenances may be required any time that the likelihood of debris is a possibility. Clean connecting pipes prior to installation, testing, disinfection and final acceptance.

C. Rigidly support valves to avoid stresses on piping.

D. Coat studs, bolts and nuts with anti-seizing lubricant.

E. Dielectric Fittings: Provide between dissimilar metals.

F. Clean field welds of slag and splatter to provide a smooth surface.

G. Mate, adjust and fully test gearboxes, electric, hydraulic and pneumatic actuators to valves at manufacturer's or integrator's facility.

1. Only in special cases for extremely large assemblies where installation requires disassembly may actuators be mounted to the valves in the field. These circumstances require preinstallation meetings.

H. In no case shall stems be installed vertically downward.

I. Unless otherwise indicated on the Drawings:

1. Install Gate, Globe, Ball valves with stem vertical in the 12 o'clock position.
2. Install Plug valves with stem horizontal and plug opening to the top of the body unless position will not allow proper actuator access, in which case stem may be vertical in the 12 o'clock position.
3. Install Control valves in horizontal pipelines with top works vertically upward.
4. Horizontal Piping: Stem horizontal, Plug opening to crown of body.
5. Vertical Piping: Plug at top when closed.
6. Plugs: On top when open and on pressure side when closed.

J. Install all brackets, extension rods, guides, the various types of operators and appurtenances as indicated. Before properly setting these items, check all drawings and figures which have a direct bearing on their location.

K. Inspect all materials for defects in construction and materials. Clean debris and foreign material out of openings, etc. Valve flange covers shall remain in place until connected piping is in place. Verify operability of all operating mechanisms for proper functioning. Check all nuts and bolts for tightness. Repaired or replace valves and other equipment which do not operate easily or are otherwise defective.

L. Where installation is covered by a referenced standard, installation shall be in accordance with that standard, except as herein modified, and the Contractor shall certify such. Also note additional requirements in other parts of this Section.

M. Unless otherwise noted, joints for valves and appurtenances shall be made up utilizing the same procedures as specified under the applicable type connecting pipe joint. Install valves and other items as recommended by the manufacturer. Verify manufacturers' torqueing requirements for all valves.

N. Coordinate direction of flow through offset type and shaped butterfly valve discs with the mated actuator torque capacity.

O. Rotate valve operators and indicators to display toward normal operation locations. Consult with Engineer prior to installing valves with handwheels to confirm final position of handwheel.

P. Vertically center floor boxes, valve boxes, extension stems, and low floor stands over the operating nut, with couplings as required.

1. Adjust elevation of the box top to conform to the elevation of the finished floor surface or grade at the completion of the Contract.
2. Support boxes and stem guides during concrete placement to maintain vertical alignment.

Q. Install brass male adapters on each side of valves in copper-piped system and solder adapters to pipe.

R. Install 1-inch ball valves with cap for drains at main shutoff valves, low points of piping, bases of vertical risers, and equipment.

S. Install valves with clearance for installation of insulation and to allow access.

T. Provide access where valves and fittings are not accessible.

U. Pipe Hangers and Supports: As specified in Section 15065 “Hangers and Supports for Process Piping”.

V. Installation Standards: Install Work according to Clay County Utility Authority standards.

3.3 FIELD QUALITY CONTROL

A. Section 01400 “Quality Control”- Requirements for inspecting and testing.

B. Valve Field Testing:

1. Test for proper alignment.
2. If specified, field test equipment to demonstrate operation without undue noise, vibration, or overheating.
3. Engineer will witness field testing.
4. Functional Test:

a. Prior to system startup, inspect valves and actuators for proper alignment, quiet operation, proper connection and satisfactory performance.
b. After installation, open and close all manual valves in the presence of the Engineer to show the valve operates smoothly from full open to full close and without leakage.
c. Cycle valves equipped with electric, pneumatic or hydraulic actuators 5 times from full open to full closed in the presence of the Engineer to exhibit operation without vibration, jamming, leakage, or overheating.
d. Operate pressure control and pressure relief valves in the presence of the Engineer to show they perform their specified function at some time prior to placing the piping system in operation and as agreed during construction coordination meetings.

5. Field test pipelines in which the valves and appurtenances are to be installed. During these tests, adjust, remove or replace defective valve or appurtenance, or otherwise make acceptable to the Engineer. Test regulating valves, strainers, or other appurtenances to demonstrate conformance with the specified operational capabilities. Correct deficiencies, replace device or otherwise made acceptable to the Engineer.

END OF SECTION

SECTION 15254

REFRIGERANT PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Refrigerant pipes and fittings.
2. Refrigerant piping valves and specialties.
3. Refrigerants.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of valve, refrigerant piping, and piping specialty.

1. Include pressure drop, based on manufacturer's test data, for the following:

a. Thermostatic expansion valves.
b. Solenoid valves.
c. Hot-gas bypass valves.
d. Filter dryers.
e. Strainers.
f. Pressure-regulating valves.

B. Shop Drawings:

1. Show layout of refrigerant piping and specialties, including pipe, tube, and fitting sizes; flow capacities; valve arrangements and locations; slopes of horizontal runs; oil traps; double risers; wall and floor penetrations; and equipment connection details.
2. Show piping size and piping layout, including oil traps, double risers, specialties, and pipe and tube sizes to accommodate, as a minimum, equipment provided, elevation difference between compressor and evaporator, and length of piping to ensure proper operation and compliance with warranties of connected equipment.
3. Show interface and spatial relationships between piping and equipment.
4. Shop Drawing Scale: 1/4 inch equals 1 foot.

5. Submit letter of acceptance for the refrigeration system design by the equipment manufacturer or their authorized representative.

1.4 INFORMATIONAL SUBMITTALS

A. Welding certificates.

B. Field quality-control reports.

C. Total weight, type and number of refrigerant in system(s).

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For refrigerant valves and piping specialties to include in maintenance manuals.

1.6 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to 2010 ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."

B. Comply with ASHRAE 15, "Safety Code for Refrigeration Systems."

C. Comply with ASME B31.5, "Refrigeration Piping and Heat Transfer Components."

1.7 PRODUCT STORAGE AND HANDLING

A. Store piping with end caps in place to ensure that piping interior and exterior are clean when installed.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Line Test Pressure for Refrigerant R-410A:

1. Suction Lines for Air-Conditioning Applications: 300 psig.
2. Suction Lines for Heat-Pump Applications: 535 psig.
3. Hot-Gas and Liquid Lines: 535 psig.

2.2 COPPER TUBE AND FITTINGS

A. Copper Tube: ASTM B88, Type K or ASTM B280, Type ACR.

B. Wrought-Copper Fittings: ASME B16.22.

C. Wrought-Copper Unions: ASME B16.22.

D. Solder Filler Metals: ASTM B32. Use 95-5 tin antimony or alloy HB solder to join copper socket fittings on copper pipe.

E. Brazing Filler Metals: AWS A5.8/A5.8M.

F. Flexible Connectors:

1. Body: Tin-bronze bellows with woven, flexible, tinned-bronze-wire-reinforced protective jacket.
2. End Connections: Socket ends.
3. Offset Performance: Capable of minimum 3/4-inch misalignment in minimum 7-inch-long assembly.
4. Working Pressure Rating: Factory test at minimum 500 psig.
5. Maximum Operating Temperature: 250 deg F.

2.3 VALVES AND SPECIALTIES

A. Diaphragm Packless Valves:

1. Body and Bonnet: Forged brass or cast bronze; globe design with straight-through or angle pattern.
2. Diaphragm: Phosphor bronze and stainless steel with stainless-steel spring.
3. Operator: Rising stem and hand wheel.
4. Seat: Nylon.
5. End Connections: Socket, union, or flanged.
6. Working Pressure Rating: 500 psig.
7. Maximum Operating Temperature: 275 deg F.

B. Packed-Angle Valves:

1. Body and Bonnet: Forged brass or cast bronze.
2. Packing: Molded stem, back seating, and replaceable under pressure.
3. Operator: Rising stem.
4. Seat: Nonrotating, self-aligning polytetrafluoroethylene.
5. Seal Cap: Forged-brass or valox hex cap.
6. End Connections: Socket, union, threaded, or flanged.
7. Working Pressure Rating: 500 psig.
8. Maximum Operating Temperature: 275 deg F.

C. Check Valves:

1. Body: Ductile iron, forged brass, or cast bronze; globe pattern.
2. Bonnet: Bolted ductile iron, forged brass, or cast bronze; or brass hex plug.
3. Piston: Removable polytetrafluoroethylene seat.

4. Closing Spring: Stainless steel.
5. Manual Opening Stem: Seal cap, plated-steel stem, and graphite seal.
6. End Connections: Socket, union, threaded, or flanged.
7. Maximum Opening Pressure: 0.50 psig.
8. Working Pressure Rating: 500 psig.
9. Maximum Operating Temperature: 275 deg F.

D. Service Valves:

1. Body: Forged brass with brass cap including key end to remove core.
2. Core: Removable ball-type check valve with stainless-steel spring.
3. Seat: Polytetrafluoroethylene.
4. End Connections: Copper spring.
5. Working Pressure Rating: 500 psig.

E. Solenoid Valves: Comply with AHRI 760 and UL 429; listed and labeled by a National Recognized Testing Laboratory (NRTL).

1. Body and Bonnet: Plated steel.
2. Solenoid Tube, Plunger, Closing Spring, and Seat Orifice: Stainless steel.
3. Seat: Polytetrafluoroethylene.
4. End Connections: Threaded.
5. Electrical: Molded, watertight coil in NEMA 250 enclosure of type required by location with 1/2-inch conduit adapter, and 24-V ac coil.
6. Working Pressure Rating: 400 psig.
7. Maximum Operating Temperature: 240 deg F.

F. Safety Relief Valves: Comply with 2010 ASME Boiler and Pressure Vessel Code; listed and labeled by an NRTL.

1. Body and Bonnet: Ductile iron and steel, with neoprene O-ring seal.
2. Piston, Closing Spring, and Seat Insert: Stainless steel.
3. Seat: Polytetrafluoroethylene.
4. End Connections: Threaded.
5. Working Pressure Rating: 400 psig.
6. Maximum Operating Temperature: 240 deg F.

G. Thermostatic Expansion Valves: Comply with AHRI 750.

1. Body, Bonnet, and Seal Cap: Forged brass or steel.
2. Diaphragm, Piston, Closing Spring, and Seat Insert: Stainless steel.
3. Packing and Gaskets: Non-asbestos.
4. Capillary and Bulb: Copper tubing filled with refrigerant charge.
5. Suction Temperature: 40 deg F.
6. Superheat: Adjustable.
7. Reverse-flow option (for heat-pump applications).
8. End Connections: Socket, flare, or threaded union.
9. Working Pressure Rating: 700 psig.

H. Hot-Gas Bypass Valves: Comply with UL 429; listed and labeled by an NRTL.

1. Body, Bonnet, and Seal Cap: Ductile iron or steel.
2. Diaphragm, Piston, Closing Spring, and Seat Insert: Stainless steel.
3. Packing and Gaskets: Non-asbestos.
4. Solenoid Tube, Plunger, Closing Spring, and Seat Orifice: Stainless steel.
5. Seat: Polytetrafluoroethylene.
6. Electrical: Molded, watertight coil in NEMA 250 enclosure of type required by location with 1/2-inch conduit adapter and 24-V ac coil.
7. End Connections: Socket.
8. Throttling Range: Maximum 5 psig.
9. Working Pressure Rating: 500 psig.
10. Maximum Operating Temperature: 240 deg F.

I. Straight-Type Strainers:

1. Body: Welded steel with corrosion-resistant coating.
2. Screen: 100-mesh stainless steel.
3. End Connections: Socket or flare.
4. Working Pressure Rating: 500 psig.
5. Maximum Operating Temperature: 275 deg F.

J. Angle-Type Strainers:

1. Body: Forged brass or cast bronze.
2. Drain Plug: Brass hex plug.
3. Screen: 100-mesh monel.
4. End Connections: Socket or flare.
5. Working Pressure Rating: 500 psig.
6. Maximum Operating Temperature: 275 deg F.

K. Moisture/Liquid Indicators:

1. Body: Forged brass.
2. Window: Replaceable, clear, fused glass window with indicating element protected by filter screen.
3. Indicator: Color coded to show moisture content in parts per million (ppm).
4. Minimum Moisture Indicator Sensitivity: Indicate moisture above 60 ppm.
5. End Connections: Socket or flare.
6. Working Pressure Rating: 500 psig.
7. Maximum Operating Temperature: 240 deg F.

L. Replaceable-Core Filter Dryers: Comply with AHRI 730.

1. Body and Cover: Painted-steel shell with ductile-iron cover, stainless-steel screws, and neoprene gaskets.
2. Filter Media: 10 micron, pleated with integral end rings; stainless-steel support.
3. Desiccant Media: Activated alumina.
4. Designed for reverse flow (for heat-pump applications).

5. End Connections: Socket.
6. Access Ports: NPS 1/4 connections at entering and leaving sides for pressure differential measurement.
7. Maximum Pressure Loss: 2 psig.
8. Working Pressure Rating: 500 psig.
9. Maximum Operating Temperature: 240 deg F.

M. Permanent Filter Dryers: Comply with AHRI 730.

1. Body and Cover: Painted-steel shell.
2. Filter Media: 10 micron, pleated with integral end rings; stainless-steel support.
3. Desiccant Media: Activated alumina.
4. Designed for reverse flow (for heat-pump applications).
5. End Connections: Socket.
6. Access Ports: NPS 1/4 connections at entering and leaving sides for pressure differential measurement.
7. Maximum Pressure Loss: 2 psig.
8. Working Pressure Rating: 500 psig.
9. Maximum Operating Temperature: 240 deg F.

N. Receivers: Comply with AHRI 495.

1. Comply with 2010 ASME Boiler and Pressure Vessel Code; listed and labeled by an NRTL.
2. Comply with UL 207; listed and labeled by an NRTL.
3. Body: Welded steel with corrosion-resistant coating.
4. Tappings: Inlet, outlet, liquid level indicator, and safety relief valve.
5. End Connections: Socket or threaded.
6. Working Pressure Rating: 500 psig.
7. Maximum Operating Temperature: 275 deg F.

O. Liquid Accumulators: Comply with AHRI 495.

1. Body: Welded steel with corrosion-resistant coating.
2. End Connections: Socket or threaded.
3. Working Pressure Rating: 500 psig.
4. Maximum Operating Temperature: 275 deg F.

2.4 REFRIGERANTS

A. ASHRAE 34, R-410A: Pentafluoroethane/Difluoromethane.

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS FOR REFRIGERANT R-134a

A. Suction Lines NPS 1-1/2 and Smaller for Conventional Air-Conditioning Applications: Copper, Type ACR, annealed-temper tubing and wrought-copper fittings with brazed or soldered joints.

B. Suction Lines NPS 4 and Smaller NPS 2 to NPS 4 for Conventional Air-Conditioning Applications: Copper, Type ACR Type L, drawn-temper tubing and wrought-copper fittings with brazed or soldered joints.

C. Hot-Gas and Liquid Lines, and Suction Lines for Heat-Pump Applications: Copper, Type ACR, annealed-temper tubing and wrought-copper fittings with brazed or soldered joints.

D. Hot-Gas and Liquid Lines, and Suction Lines for Heat-Pump Applications: Copper, Type ACR, Type K, drawn-temper tubing and wrought-copper fittings with soldered joints.

E. Hot-Gas and Liquid Lines, and Suction Lines for Heat-Pump Applications:

1. NPS 1-1/2 and Smaller: Copper, Type ACR, annealed-temper tubing and wrought-copper fittings with brazed or soldered joints.
2. NPS 1-1/2 and Smaller: Copper, Type ACR Type K, drawn-temper tubing and wrought-copper fittings with brazed or soldered joints.
3. NPS 4: Copper, Type ACR Type K, drawn-temper tubing and wrought-copper fittings with brazed or soldered joints.

F. Safety-Relief-Valve Discharge Piping: Schedule 40, black-steel and wrought-steel fittings with welded joints.

G. Safety-Relief-Valve Discharge Piping: Copper, Type ACR Type K, drawn-temper tubing and wrought-copper fittings with soldered joints.

H. Safety-Relief-Valve Discharge Piping: Schedule 40, black-steel and wrought-steel fittings with welded joints

I. Safety-Relief-Valve Discharge Piping: Copper, Type ACR Type K, drawn-temper tubing and wrought-copper fittings with soldered joints.

3.2 PIPING APPLICATIONS FOR REFRIGERANT R-407C

A. Suction Lines NPS 1-1/2 and Smaller for Conventional Air-Conditioning Applications: Copper, Type ACR, annealed-temper tubing and wrought-copper fittings with brazed or soldered joints.

B. Suction Lines NPS 4 and Smaller for Conventional Air-Conditioning Applications: Copper, Type ACR, drawn-temper tubing and wrought-copper fittings with brazed or soldered joints.

C. Hot-Gas and Liquid Lines, and Suction Lines for Heat-Pump Applications: Copper, Type ACR, annealed-temper tubing and wrought-copper fittings with brazed or soldered joints.

D. Hot-Gas and Liquid Lines, and Suction Lines for Heat-Pump Applications: Copper, Type ACR, drawn-temper tubing and wrought-copper fittings with soldered joints.

E. Hot-Gas and Liquid Lines, and Suction Lines for Heat-Pump Applications:

1. NPS 1 and Smaller: Copper, Type ACR, annealed-temper tubing and wrought-copper fittings with brazed or soldered joints.
2. NPS 1 and Smaller: Copper, Type ACR, drawn-temper tubing and wrought-copper fittings with brazed or soldered joints.
3. NPS 1-1/4 to NPS 2: Copper, Type K, annealed- or drawn-temper tubing and wrought-copper fittings with brazed or soldered joints.
4. NPS 4: Copper, Type ACR Type K, drawn-temper tubing and wrought-copper fittings with soldered joints.

F. Safety-Relief-Valve Discharge Piping: Schedule 40, black-steel and wrought-steel fittings with welded joints.

G. Safety-Relief-Valve Discharge Piping: Copper, Type ACR Type K, drawn-temper tubing and wrought-copper fittings with soldered joints.

3.3 VALVE AND SPECIALTY APPLICATIONS

A. Install diaphragm packless valves in suction and discharge lines of compressor.

B. Install service valves for gage taps at inlet and outlet of hot-gas bypass valves and strainers if they are not an integral part of valves and strainers.

C. Install a check valve at the compressor discharge and a liquid accumulator at the compressor suction connection.

D. Except as otherwise indicated, install diaphragm packless valves on inlet and outlet side of filter dryers.

E. Install a full-size, three-valve bypass around filter dryers.

F. Install solenoid valves upstream from each expansion valve and hot-gas bypass valve. Install solenoid valves in horizontal lines with coil at top.

G. Install thermostatic expansion valves as close as possible to distributors on evaporators.

1. Install valve so diaphragm case is warmer than bulb.
2. Secure bulb to clean, straight, horizontal section of suction line using two bulb straps. Do not mount bulb in a trap or at bottom of the line.
3. If external equalizer lines are required, make connection where it will reflect suction-line pressure at bulb location.

H. Install safety relief valves where required by 2010 ASME Boiler and Pressure Vessel Code. Pipe safety-relief-valve discharge line to outside according to ASHRAE 15.

I. Install moisture/liquid indicators in liquid line at the inlet of the thermostatic expansion valve or at the inlet of the evaporator coil capillary tube.

J. Install strainers upstream from and adjacent to the following unless they are furnished as an integral assembly for the device being protected:

1. Solenoid valves.
2. Thermostatic expansion valves.
3. Hot-gas bypass valves.
4. Compressor.

K. Install filter dryers in liquid line between compressor and thermostatic expansion valve, and in the suction line at the compressor.

L. Install receivers sized to accommodate pump-down charge.

M. Install flexible connectors at compressors.

3.4 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems; indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping where indicated.

B. Install refrigerant piping according to ASHRAE 15.

C. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

F. Install piping adjacent to machines to allow service and maintenance.

G. Install piping free of sags and bends.

H. Install fittings for changes in direction and branch connections.

I. Select system components with pressure rating equal to or greater than system operating pressure.

J. Install piping as short and direct as possible, with a minimum number of joints, elbows, and fittings.

K. Install refrigerant piping in protective conduit where installed belowground.

L. Install refrigerant piping in rigid or flexible conduit in locations where exposed to mechanical injury.

M. Slope refrigerant piping as follows:

1. Install horizontal hot-gas discharge piping with a uniform slope downward away from compressor.
2. Install horizontal suction lines with a uniform slope downward to compressor.
3. Install traps and double risers to entrain oil in vertical runs (a properly sized refrigerant riser may be used if only on/off compressor operation is used.
4. Liquid lines may be installed level.

N. When brazing or soldering, remove solenoid-valve coils and sight glasses; also remove valve stems, seats, and packing, and accessible internal parts of refrigerant specialties. Do not apply heat near expansion-valve bulb.

O. Before installation of steel refrigerant piping, clean pipe and fittings using the following procedures:

1. Shot blast the interior of piping.
2. Remove coarse particles of dirt and dust by drawing a clean, lintless cloth through tubing by means of a wire or electrician's tape.
3. Draw a clean, lintless cloth saturated with trichloroethylene through the tube or pipe. Continue this procedure until cloth is not discolored by dirt.
4. Draw a clean, lintless cloth, saturated with compressor oil, squeezed dry, through the tube or pipe to remove remaining lint. Inspect tube or pipe visually for remaining dirt and lint.
5. Finally, draw a clean, dry, lintless cloth through the tube or pipe.
6. Safety-relief-valve discharge piping is not required to be cleaned but is required to be open to allow unrestricted flow.

P. Install piping with adequate clearance between pipe and adjacent walls and hangers or between pipes for insulation installation.

Q. Identify refrigerant piping and valves.

R. Install sleeves for piping penetrations of walls, ceilings, and floors.

S. Install sleeve seals for piping penetrations of concrete walls and slabs.

T. Install escutcheons for piping penetrations of walls, ceilings, and floors.

3.5 PIPE JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

C. Fill pipe and fittings with an inert gas (nitrogen or carbon dioxide), during brazing or welding, to prevent scale formation.

D. Soldered Joints: Construct joints according to ASTM B828 or CDA's "Copper Tube Handbook."

E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," Chapter "Pipe and Tube."

1. Use Type BCuP (copper-phosphorus) alloy for joining copper socket fittings with copper pipe.
2. Use Type BAg (cadmium-free silver) alloy for joining copper with bronze or steel.

F. Threaded Joints: Thread steel pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and to restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads unless dry-seal threading is specified.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

G. Steel pipe can be threaded, but threaded joints must be seal brazed or seal welded.

H. Welded Joints: Construct joints according to AWS D10.12M/D10.12.

I. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

3.6 INSTALLATION OF HANGERS AND SUPPORTS

A. Suction line hangers shall be sized for pipe insulation outside diameter.

B. Install the following pipe attachments:

1. Adjustable steel clevis hangers for individual horizontal runs less than 20 feet long.
2. Roller hangers and spring hangers for individual horizontal runs 20 feet or longer.
3. Pipe Roller: MSS SP-58, Type 44 for multiple horizontal piping 20 feet or longer, supported on a trapeze.
4. Spring hangers to support vertical runs.

5. Copper-clad hangers and supports for hangers and supports in direct contact with copper pipe.

C. Install hangers for copper tubing and steel piping, with maximum horizontal spacing and minimum rod diameters, to comply with MSS-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

D. Support horizontal piping within 12 inches of each fitting.

E. Support vertical runs of copper tubing and steel piping to comply with MSS-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

3.7 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Comply with ASME B31.5, Chapter VI.
2. Test refrigerant piping, specialties, and receivers. Isolate compressor, condenser, evaporator, and safety devices from test pressure if they are not rated above the test pressure.
3. Test high- and low-pressure side piping of each system separately at not less than the pressures indicated in "Performance Requirements" Article.

    a. Fill system with nitrogen to the required test pressure.
    b. System shall maintain test pressure at the manifold gage throughout duration of test.
    c. Test joints and fittings with electronic leak detector or by brushing a small amount of soap and glycerin solution over joints.
    d. Remake leaking joints using new materials, and retest until satisfactory results are achieved.

B. Prepare test and inspection reports.

3.8 SYSTEM CHARGING

A. Charge system using the following procedures:

1. Install core in filter dryers after leak test but before evacuation.
2. Evacuate entire refrigerant system with a vacuum pump to 500 micrometers. If vacuum holds for 12 hours, system is ready for charging.
3. Break vacuum with refrigerant gas, allowing pressure to build up to 2 psig.
4. Charge system with a new filter-dryer core in charging line.

3.9 ADJUSTING

A. Adjust thermostatic expansion valve to obtain proper evaporator superheat.

B. Adjust high- and low-pressure switch settings to avoid short cycling in response to fluctuating suction pressure.

C. Adjust set-point temperature of air-conditioning or chilled-water controllers to the system design temperature.

D. Perform the following adjustments before operating the refrigeration system, according to manufacturer's written instructions:

1. Open shutoff valves in condenser water circuit.
2. Verify that compressor oil level is correct.
3. Open compressor suction and discharge valves.
4. Open refrigerant valves except bypass valves that are used for other purposes.
5. Check open compressor-motor alignment and verify lubrication for motors and bearings.

E. Replace core of replaceable filter dryer after system has been adjusted and after design flow rates and pressures are established.

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SECTION 15816

DUCTLESS SPLIT-SYSTEM AIR-CONDITIONERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes split-system air-conditioning and heat-pump units consisting of separate evaporator-fan and compressor-condenser components.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, and furnished specialties and accessories. Include performance data in terms of capacities, outlet velocities, static pressures, sound power characteristics, motor requirements, and electrical characteristics.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
2. Wiring Diagrams: For power, signal, and control wiring.

1.4 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

B. Warranty: Sample of special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For split-system air-conditioning units to include in emergency, operation, and maintenance manuals.

1.6 QUALITY ASSURANCE

A. 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.

B. ASHRAE Compliance:

1. Fabricate and label refrigeration system to comply with ASHRAE 15, "Safety Standard for Refrigeration Systems."

C. AHRI Certified Performance:

1. Performance certification in accordance with AHRI Standard 210/240.

1.7 COORDINATION

A. Coordinate sizes and locations of concrete bases with actual equipment provided. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork are specified in Section 033000 "Cast-in-Place Concrete."

1.8 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of split-system air-conditioning units that fail in materials or workmanship within specified warranty period.

1. Warranty Period:

a. For Compressor: Seven year(s) from date of Substantial Completion.
b. For Parts: Five year(s) from date of Substantial Completion.
c. For Labor: Two year(s) from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. Daikin.
2. LG.
3. Mitsubishi Electric & Electronics USA, Inc.
4. Samsung HVAC.

2.2 PERFORMANCE REQURIEMENTS

A. Outdoor unit Sound rating: not to exceed 55 dB(A).

B. Indoor unit Sound rating: not to exceed 50 dB(A).

C. Minimum allowable indoor and outdoor vertical separation: 98 feet.

D. Minimum allowable line set length: 98 feet.

E. Cooling operating temperature range:

1. Outdoor: 0 to 115 deg F with or without the addition of wind baffle accessory.
2. Indoor: 67 to 90 deg F Heating operating temperature range:

G. Testing: Indoor and outdoor units individually run tested at the factory.

2.3 WALL MOUNTED INDOOR UNIT

A. Description: Factory-assembled complete unit with components, piping, wiring, and controls required for mating to piping, power, and control board with field connections.

B. Cabinet:

1. Material: High impact plastic chassis and fascia.
2. Mounting: Manufacturer-designed provisions for field installation. Wall mounted with front panel access to the filter.
3. Internal Access: Removable panels of adequate size for field access to internal components for inspection, cleaning, service, and replacement.
4. Outside Air Intake: Knockout panel for outside ventilation air.

C. DX Coil Assembly:

1. Construction: Nonferrous construction, aluminum fins coated on copper tubing.
2. Coil Tubes: Copper with internal grooves.
3. Internal Tubing: Copper tubing with brazed joints.
4. Internal Tubing Insulation: Manufacturer's standard insulation, of thickness to prevent condensation.
5. Field Piping Connections: Manufacturer's standard.
6. Factory Charge: Dehydrated air or nitrogen.
7. Testing: Factory pressure tested and verified to be without leaks.

D. Drain Assembly:

1. Pan: Non-ferrous material, with bottom sloped to low point drain connection.
2. Condensate Removal: Unit-mounted condensate pump with check valve, with a maximum vertical lift of 29 inches.
3. Condensate Float Switch: Disable unit operation in the event of condensate overflow.
4. Field Piping Connection: Non-ferrous material.

E. Fan and Motor Assembly:

1. Fan: Direct-drive fan(s) driven by a single motor statically and dynamically balanced.
2. Construction: Fabricated from non-ferrous components.
3. Motor: Brushless dc or electronically commutated with permanently lubricated bearings.
4. Motor Protection: Integral protection against thermal, overload, and voltage fluctuations.
5. Speed Settings and Control: Three or more speed settings with a speed range of least 50 percent.

F. Filter Assembly:

1. Access: Included with fascia panel, to accommodate filter replacement without the need for tools.
2. Efficiency: Manufacturer recommended.

G. Unit Electrical:

1. Enclosure: Manufacturer's standard, and suitable for indoor locations.
2. Field Connection: Single point connection to power entire unit and integral controls, 208/230 V, single phase, 60 hertz.
3. Control Transformer: Manufacturer's standard, factory installed.
4. Wiring: Manufacturer's standard with each connection labeled and corresponding to a unit-mounted wiring diagram.

2.4 OUTDOOR UNITS

A. Description: Factory-assembled and -tested complete unit with components, piping, wiring, and controls required for mating to piping, power, and controls field connections.

B. Cabinet:

1. Galvanized steel, with a powder coated baked enamel finish.
2. Piping Connections: Make pipe connections inside the outdoor unit chassis. Refrigerant pipes can exit through the front, side, rear, or bottom sides of the outdoor unit.

C. Compressor and Motor Assembly:

1. Twin positive-displacement, inverter driven, scroll compressors.
2. Vibration Control: Integral isolation to dampen vibration transmission.
3. Accumulator: Systems shall have an accumulator with accumulator return valve control.
4. Expansion Valve: Electronic modulating type with linear or proportional characteristics, to control refrigerant flow to the indoor unit.
5. Protection: Systems shall have a high pressure safety switch, fuse, over-current protection, over-voltage protection, temperature limit protection logic, compressor overload sensing.

D. Condenser Coil Assembly: Aluminum, flat fin, micro-channel with integral guard.

E. Condenser Fan and Motor Assembly:

1. Fans: One or two, propeller type.

    a. Horizontal discharge airflow.
    b. Direct-drive arrangement.
    c. Fabricated from non-ferrous components or ferrous components with corrosion protection finish to match performance indicated for condenser coil.

2. Fan Guards: Raised guards to protect moving parts.
3. Motor(s): Brushless dc with permanently lubricated bearings and rated for outdoor duty.
4. Motor Protection: Integral protection against thermal, overload, and voltage fluctuations.

F. Unit Electrical:

1. Enclosure: Metal, similar to enclosure, and suitable for unprotected outdoor locations.
2. Field Connection: Single point connection to power entire unit and integral controls.
3. Control Transformer: Manufacturer's standard.
4. Wiring: Manufacturer's standard with each connection labeled and corresponding to a unit-mounted wiring diagram.

G. Unit Piping:

1. Unit Tubing: Copper tubing with brazed joints.
2. Unit Tubing Insulation: Manufacturer's standard insulation, of thickness to prevent condensation.
3. Field Piping Connections: Manufacturer's standard.
4. Factory Charge: Dehydrated air or nitrogen.
5. Testing: Factory pressure tested and verified to be without leaks.

2.5 REMOTE CONTROLLER

A. Description: Wall mounted controller with LCD display and built-in temperature sensor where system operating parameters are observed and input.

B. Casing: Suitable for indoor dry locations.

2.6 SYSTEM CONTROLS

A. Description: Each indoor unit and outdoor unit contain a microprocessor and are associated with a remote controller connected by communications cable.

B. Indoor unit microprocessor capabilities:

1. Monitoring return air temperature and indoor coil temperature.
2. Receiving and processing commands from a remote controller.

3. Operating the system without a remote controller.
4. Controlling the outdoor unit.

C. Outdoor unit microprocessor capabilities:

1. Receiving and processing commands from the indoor unit controller.
2. Controlling the components of the outdoor unit.

2.7 REFRIGERANT

A. ASHRAE 34, Class A1 refrigerant classification.

B. Refrigerant: A full charge of R-410A is included for the condensing unit by system manufacturer for lines sets up to 25 feet. Provide additional refrigerant based on diameters and lengths of system liquid refrigerant lines, and indoor equipment model and quantity.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install units level and plumb.

B. Install evaporator-fan components using manufacturer's standard mounting devices securely fastened to building structure.

C. Equipment Mounting:

1. Install ground-mounted, compressor-condenser components on cast-in-place concrete equipment base(s). Comply with requirements for equipment bases and foundations as specified on the Drawings.
2. Install ground-mounted, compressor-condenser components on polyethylene mounting base.

D. Install and connect pre-charged refrigerant tubing to component's quick-connect fittings. Install tubing to allow access to unit.

3.2 CONNECTIONS

A. Piping installation requirements are specified in other Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Where piping is installed adjacent to unit, allow space for service and maintenance of unit.

3.3 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:

1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
2. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

C. Remove and replace malfunctioning units and retest as specified above.

D. Prepare test and inspection reports.

3.4 STARTUP SERVICE

A. Perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.
2. Insert startup steps if any.

3.5 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain units.

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SECTION 15905

TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Balancing Air Systems:

a. Constant-volume air systems.

2. Balancing steam systems.
3. Testing, Adjusting, and Balancing Equipment:

a. Condensing units.
b. Heat-transfer coils.

4. Testing, adjusting, and balancing existing systems and equipment.
5. Sound tests.
6. Vibration tests.
7. Control system verification.

1.3 DEFINITIONS

A. AABC: Associated Air Balance Council.

B. BAS: Building automation systems.

C. NEBB: National Environmental Balancing Bureau.

D. TAB: Testing, adjusting, and balancing.

E. TABB: Testing, Adjusting, and Balancing Bureau.

F. TAB Specialist: An independent entity meeting qualifications to perform TAB work.

G. TDH: Total dynamic head.

1.4 PREINSTALLATION MEETINGS

A. TAB Conference: If requested by the Owner, conduct a TAB conference at Project site after approval of the TAB strategies and procedures plan to develop a mutual understanding of the details. Provide a minimum of 14 days' advance notice of scheduled meeting time and location.

1. Minimum Agenda Items:

a. The Contract Documents examination report.
b. The TAB plan.
c. Needs for coordination and cooperation of trades and subcontractors.
d. Proposed procedures for documentation and communication flow.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: Within 60 days of Contractor's Notice to Proceed, submit documentation that the TAB specialist and this Project's TAB team members meet the qualifications specified in "Quality Assurance" Article.

B. Contract Documents Examination Report: Within 30 days of Contractor's Notice to Proceed, submit the Contract Documents review report as specified in Part 3.

C. Strategies and Procedures Plan: Within 30 days of Contractor's Notice to Proceed, submit TAB strategies and step-by-step procedures as specified in "Preparation" Article.

D. System Readiness Checklists: Within 30 days of Contractor's Notice to Proceed, submit system readiness checklists as specified in "Preparation" Article.

E. Examination Report: Submit a summary report of the examination review required in "Examination" Article.

F. Certified TAB reports.

G. Sample report forms.

H. Instrument calibration reports, to include the following:

1. Instrument type and make.
2. Serial number.
3. Application.
4. Dates of use.
5. Dates of calibration.

1.6 QUALITY ASSURANCE

A. TAB Specialists Qualifications: Certified by AABC.

1. TAB Field Supervisor: Employee of the TAB specialist and certified by AABC.
2. TAB Technician: Employee of the TAB specialist and certified by AABC as a TAB technician.

B. TAB Specialists Qualifications: Certified by NEBB or AABC.

1. TAB Field Supervisor: Employee of the TAB specialist and certified by NEBB or AABC.
2. TAB Technician: Employee of the TAB specialist and certified by NEBB or AABC as a TAB technician.

C. Instrumentation Type, Quantity, Accuracy, and Calibration: Comply with requirements in ASHRAE 111, Section 4, "Instrumentation."

D. ASHRAE/IES 90.1 Compliance: Applicable requirements in ASHRAE/IES 90.1, Section 6.7.2.3 - "System Balancing."

1.7 FIELD CONDITIONS

A. Full Owner Occupancy: Owner will occupy the site and existing building during entire TAB period. Cooperate with Owner during TAB operations to minimize conflicts with Owner's operations.

B. Partial Owner Occupancy: Owner may occupy completed areas of building before Substantial Completion. Cooperate with Owner during TAB operations to minimize conflicts with Owner's operations.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems designs that may preclude proper TAB of systems and equipment.

B. Examine installed systems for balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers. Verify that locations of these balancing devices are applicable for intended purpose and are accessible.

C. Examine the approved submittals for HVAC systems and equipment.

D. Examine design data including HVAC system descriptions, statements of design assumptions for environmental conditions and systems output, and statements of philosophies and assumptions about HVAC system and equipment controls.

E. Examine ceiling plenums and underfloor air plenums used for supply, return, or relief air to verify that they are properly separated from adjacent areas. Verify that penetrations in plenum walls are sealed and fire-stopped if required.

F. Examine equipment performance data including fan and pump curves.

1. Relate performance data to Project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.
2. Calculate system-effect factors to reduce performance ratings of HVAC equipment when installed under conditions different from the conditions used to rate equipment performance. To calculate system effects for air systems, use tables and charts found in AMCA 201, "Fans and Systems," or in SMACNA's "HVAC Systems - Duct Design." Compare results with the design data and installed conditions.

G. Examine system and equipment installations and verify that field quality-control testing, cleaning, and adjusting specified in individual Sections have been performed.

H. Examine test reports specified in individual system and equipment Sections.

I. Examine HVAC equipment and verify that bearings are greased, belts are aligned and tight, filters are clean, and equipment with functioning controls is ready for operation.

J. Examine terminal units, such as variable-air-volume boxes, and verify that they are accessible, and their controls are connected and functioning.

K. Examine strainers. Verify that startup screens have been replaced by permanent screens with indicated perforations.

L. Examine control valves for proper installation for their intended function of throttling, diverting, or mixing fluid flows.

M. Examine heat-transfer coils for correct piping connections and for clean and straight fins.

N. Examine system pumps to ensure absence of entrained air in the suction piping.

O. Examine operating safety interlocks and controls on HVAC equipment.

P. Report deficiencies discovered before and during performance of TAB procedures. Observe and record system reactions to changes in conditions. Record default set points if different from indicated values.

3.2 PREPARATION

A. Prepare a TAB plan that includes the following:

1. Equipment and systems to be tested.
2. Strategies and step-by-step procedures for balancing the systems.
3. Instrumentation to be used.
4. Sample forms with specific identification for all equipment.

B. Perform system-readiness checks of HVAC systems and equipment to verify system readiness for TAB work. Include, at a minimum, the following:

1. Airside:

a. Verify that leakage and pressure tests on air distribution systems have been satisfactorily completed.
b. Duct systems are complete with terminals installed.
c. Volume, smoke, and fire dampers are open and functional.
d. Clean filters are installed.
e. Fans are operating, free of vibration, and rotating in correct direction.
f. Variable-frequency controllers' startup is complete, and safeties are verified.
g. Automatic temperature-control systems are operational.
h. Ceilings are installed.
i. Windows and doors are installed.
j. Suitable access to balancing devices and equipment is provided.

3.3 GENERAL PROCEDURES FOR TESTING AND BALANCING

A. Perform testing and balancing procedures on each system according to the procedures contained in AABC's "National Standards for Total System Balance" or NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems" and in this Section.

B. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary for TAB procedures.

1. After testing and balancing, patch probe holes in ducts with same material and thickness as used to construct ducts.

C. Mark equipment and balancing devices, including damper-control positions, valve position indicators, fan-speed-control levers, and similar controls and devices, with paint or other suitable, permanent identification material to show final settings.

D. Take and report testing and balancing measurements in inch-pound (IP) units.

3.4 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS

A. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Cross-check the summation of required outlet volumes with required fan volumes.

B. Prepare schematic diagrams of systems' "as-built" duct layouts.

C. For variable-air-volume systems, develop a plan to simulate diversity.

D. Determine the best locations in main and branch ducts for accurate duct-airflow measurements.

E. Check airflow patterns from the outdoor-air louvers and dampers and the return- and exhaust-air dampers through the supply-fan discharge and mixing dampers.

F. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.

G. Verify that motor starters are equipped with properly sized thermal protection.

H. Check dampers for proper position to achieve desired airflow path.

I. Check for airflow blockages.

J. Check condensate drains for proper connections and functioning.

K. Check for proper sealing of air-handling-unit components.

3.5 PROCEDURES FOR CONSTANT-VOLUME AIR SYSTEMS

A. Adjust fans to deliver total indicated airflows within the maximum allowable fan speed listed by fan manufacturer.

1. Measure total airflow.

    a. Set outside-air, return-air, and relief-air dampers for proper position that simulates minimum outdoor-air conditions.
    b. Where duct conditions allow, measure airflow by Pitot-tube traverse. If necessary, perform multiple Pitot-tube traverses to obtain total airflow.
    c. Where duct conditions are not suitable for Pitot-tube traverse measurements, a coil traverse may be acceptable.
    d. If a reliable Pitot-tube traverse or coil traverse is not possible, measure airflow at terminals and calculate the total airflow.

2. Measure fan static pressures as follows:

    a. Measure static pressure directly at the fan outlet or through the flexible connection.
    b. Measure static pressure directly at the fan inlet or through the flexible connection.

c. Measure static pressure across each component that makes up the air-handling system.
d. Report artificial loading of filters at the time static pressures are measured.

3. Review Record Documents to determine variations in design static pressures versus actual static pressures. Calculate actual system-effect factors. Recommend adjustments to accommodate actual conditions.
4. Obtain approval from Engineer for adjustment of fan speed higher or lower than indicated speed. Comply with requirements in HVAC Sections for air-handling units for adjustment of fans, belts, and pulley sizes to achieve indicated air-handling-unit performance.
5. Do not make fan-speed adjustments that result in motor overload. Consult equipment manufacturers about fan-speed safety factors. Modulate dampers and measure fan-motor amperage to ensure that no overload occurs. Measure amperage in full-cooling, full-heating, economizer, and any other operating mode to determine the maximum required brake horsepower.

B. Adjust volume dampers for main duct, submain ducts, and major branch ducts to indicated airflows.

1. Measure airflow of submain and branch ducts.
2. Adjust submain and branch duct volume dampers for specified airflow.
3. Re-measure each submain and branch duct after all have been adjusted.

C. Adjust air inlets and outlets for each space to indicated airflows.

1. Set airflow patterns of adjustable outlets for proper distribution without drafts.
2. Measure inlets and outlets airflow.
3. Adjust each inlet and outlet for specified airflow.
4. Re-measure each inlet and outlet after they have been adjusted.

D. Verify final system conditions.

1. Re-measure and confirm that minimum outdoor, return, and relief airflows are within design. Readjust to design if necessary.
2. Re-measure and confirm that total airflow is within design.
3. Re-measure all final fan operating data, rpms, volts, amps, and static profile.
4. Mark all final settings.
5. Test system in economizer mode. Verify proper operation and adjust if necessary.
6. Measure and record all operating data.
7. Record final fan-performance data.

3.6 PROCEDURES FOR MOTORS

A. Motors 1/2 HP and Larger: Test at final balanced conditions and record the following data:

1. Manufacturer's name, model number, and serial number.
2. Motor horsepower rating.

3. Motor rpm.
4. Phase and hertz.
5. Nameplate and measured voltage, each phase.
6. Nameplate and measured amperage, each phase.
7. Starter size and thermal-protection-element rating.
8. Service factor and frame size.

B. Motors Driven by Variable-Frequency Controllers: Test manual bypass of controller to prove proper operation.

3.7 PROCEDURES FOR CONDENSING UNITS

A. Verify proper rotation of fans.

B. Measure entering- and leaving-air temperatures.

C. Record fan and motor operating data.

3.8 PROCEDURES FOR HEAT-TRANSFER COILS

A. Measure, adjust, and record the following data for each water coil:

1. Entering- and leaving-water temperature.
2. Water flow rate.
3. Water pressure drop for major (more than 20 gpm) equipment coils, excluding unitary equipment such as reheat coils, unit heaters, and fan-coil units.
4. Dry-bulb temperature of entering and leaving air.
5. Wet-bulb temperature of entering and leaving air for cooling coils.
6. Airflow.

B. Measure, adjust, and record the following data for each electric heating coil:

1. Nameplate data.
2. Airflow.
3. Entering- and leaving-air temperature at full load.
4. Voltage and amperage input of each phase at full load.
5. Calculated kilowatt at full load.
6. Fuse or circuit-breaker rating for overload protection.

C. Measure, adjust, and record the following data for each steam coil:

1. Dry-bulb temperature of entering and leaving air.
2. Airflow.
3. Inlet steam pressure.

D. Measure, adjust, and record the following data for each refrigerant coil:

1. Dry-bulb temperature of entering and leaving air.
2. Wet-bulb temperature of entering and leaving air.
3. Airflow.

3.9 SOUND TESTS

A. After the systems are balanced and construction is Substantially Complete, measure and record sound levels at 5 locations as designated by the Engineer.

B. Instrumentation:

1. The sound-testing meter shall be a portable, general-purpose testing meter consisting of a microphone, processing unit, and readout.
2. The sound-testing meter shall be capable of showing fluctuations at minimum and maximum levels and measuring the equivalent continuous sound pressure level (LEQ).
3. The sound-testing meter must be capable of using 1/3 octave band filters to measure mid-frequencies from 31.5 Hz to 8000 Hz.
4. The accuracy of the sound-testing meter shall be plus or minus one decibel.

C. Test Procedures:

1. Perform test at quietest background noise period. Note cause of unpreventable sound that affects test outcome.
2. Equipment should be operating at design values.
3. Calibrate the sound-testing meter prior to taking measurements.
4. Use a microphone suitable for the type of noise levels measured that is compatible with meter. Provide a windshield for outside or in-duct measurements.
5. Record a set of background measurements in dBA and sound pressure levels in the eight un-weighted octave bands 63 Hz to 8000 Hz (NC) with the equipment off.
6. Take sound readings in dBA and sound pressure levels in the eight un-weighted octave bands 63 Hz to 8000 Hz (NC) with the equipment operating.
7. Take readings no closer than 36 inches from a wall or from the operating equipment and approximately 60 inches from the floor, with the meter held or mounted on a tripod.
8. For outdoor measurements, move sound-testing meter slowly and scan area that has the most exposure to noise source being tested. Use A-weighted scale for this type of reading.

D. Reporting:

1. Report shall record the following:

a. Location.
b. System tested.
c. dBA reading.
d. Sound pressure level in each octave band with equipment on and off.

2. Plot sound pressure levels on NC worksheet with equipment on and off.

3.10 VIBRATION TESTS

A. After systems are balanced and construction is Substantially Complete, measure and record vibration levels on equipment having motor horsepower equal to or greater than 10.

B. Instrumentation:

1. Use portable, battery-operated, and microprocessor-controlled vibration meter with or without a built-in printer.
2. The meter shall automatically identify engineering units, filter bandwidth, amplitude, and frequency scale values.
3. The meter shall be able to measure machine vibration displacement in mils of deflection, velocity in inches per second, and acceleration in inches per second squared.
4. Verify calibration date is current for vibration meter before taking readings.

C. Test Procedures:

1. To ensure accurate readings, verify that accelerometer has a clean, flat surface and is mounted properly.
2. With the unit running, set up vibration meter in a safe, secure location. Connect transducer to meter with proper cables. Hold magnetic tip of transducer on top of the bearing, and measure unit in mils of deflection. Record measurement, then move transducer to the side of the bearing and record in mils of deflection. Record an axial reading in mils of deflection by holding nonmagnetic, pointed transducer tip on end of shaft.
3. Change vibration meter to velocity (inches per second) measurements. Repeat and record above measurements.
4. Record CPM or rpm.
5. Read each bearing on motor, fan, and pump as required. Track and record vibration levels from rotating component through casing to base.

D. Reporting:

1. Report shall record location and the system tested.
2. Include horizontal-vertical-axial measurements for tests.
3. Verify that vibration limits follow Specifications, or, if not specified, follow the General Machinery Vibration Severity Chart or Vibration Acceleration General Severity Chart from the AABC National Standards. Acceptable levels of vibration are normally "smooth" to "good."
4. Include in report General Machinery Vibration Severity Chart, with conditions plotted.

3.11 DUCT LEAKAGE TESTS

A. Witness the duct pressure testing performed by Installer.

B. Verify that proper test methods are used and that leakage rates are within specified tolerances.

C. Report deficiencies observed.

3.12 CONTROLS VERIFICATION

A. In conjunction with system balancing, perform the following:

1. Verify temperature control system is operating within the design limitations.
2. Confirm that the sequences of operation are in compliance with Contract Documents.
3. Verify that controllers are calibrated and function as intended.
4. Verify that controller set points are as indicated.
5. Verify the operation of lockout or interlock systems.
6. Verify the operation of valve and damper actuators.
7. Verify that controlled devices are properly installed and connected to correct controller.
8. Verify that controlled devices travel freely and are in position indicated by controller: open, closed, or modulating.
9. Verify location and installation of sensors to ensure that they sense only intended temperature, humidity, or pressure.

B. Reporting: Include a summary of verifications performed, remaining deficiencies, and variations from indicated conditions.

3.13 TOLERANCES

A. Set HVAC system's airflow rates and water flow rates within the following tolerances:

1. Supply, Return, and Exhaust Fans and Equipment with Fans: Plus or minus 10 percent.
2. Air Outlets and Inlets: Plus or minus 10 percent.

B. Maintaining pressure relationships as designed shall have priority over the tolerances specified above.

3.14 PROGRESS REPORTING

A. Initial Construction-Phase Report: Based on examination of the Contract Documents as specified in "Examination" Article, prepare a report on the adequacy of design for systems balancing devices. Recommend changes and additions to systems balancing devices to facilitate proper performance measuring and balancing. Recommend changes and additions to HVAC systems and general construction to allow access for performance measuring and balancing devices.

B. Status Reports: Prepare monthly progress reports to describe completed procedures, procedures in progress, and scheduled procedures. Include a list of deficiencies and problems found in systems being tested and balanced. Prepare a separate report for each system and each building floor for systems serving multiple floors.

3.15 FINAL REPORT

A. General: Prepare a certified written report; tabulate and divide the report into separate sections for tested systems and balanced systems.

1. Include a certification sheet at the front of the report's binder, signed and sealed by the certified testing and balancing engineer.
2. Include a list of instruments used for procedures, along with proof of calibration.
3. Certify validity and accuracy of field data.

B. Final Report Contents: In addition to certified field-report data, include the following:

1. Fan curves.
2. Manufacturers' test data.
3. Field test reports prepared by system and equipment installers.
4. Other information relative to equipment performance; do not include Shop Drawings and Product Data.

C. General Report Data: In addition to form titles and entries, include the following data:

1. Title page.
2. Name and address of the TAB specialist.
3. Project name.
4. Project location.
5. Engineer's name and address.
6. Engineer's name and address.
7. Contractor's name and address.
8. Report date.
9. Signature of TAB supervisor who certifies the report.
10. Table of Contents with the total number of pages defined for each section of the report. Number each page in the report.
11. Summary of contents including the following:

    a. Indicated versus final performance.
    b. Notable characteristics of systems.
    c. Description of system operation sequence if it varies from the Contract Documents.

12. Nomenclature sheets for each item of equipment.
13. Data for terminal units, including manufacturer's name, type, size, and fittings.
14. Notes to explain why certain final data in the body of reports vary from indicated values.
15. Test conditions for fans and pump performance forms including the following:

    a. Settings for outdoor-, return-, and exhaust-air dampers.
    b. Conditions of filters.
    c. Cooling coil, wet- and dry-bulb conditions.
    d. Face and bypass damper settings at coils.
    e. Fan drive settings including settings and percentage of maximum pitch diameter.
    f. Inlet vane settings for variable-air-volume systems.

g. Settings for supply-air, static-pressure controller.
h. Other system operating conditions that affect performance.

D. System Diagrams: Include schematic layouts of air and hydronic distribution systems. Present each system with single-line diagram and include the following:

1. Quantities of outdoor, supply, return, and exhaust airflows.
2. Water and steam flow rates.
3. Duct, outlet, and inlet sizes.
4. Pipe and valve sizes and locations.
5. Terminal units.
6. Balancing stations.
7. Position of balancing devices.

E. Air-Handling-Unit Test Reports: For air-handling units with coils, include the following:

1. Unit Data:

a. Unit identification.
b. Location.
c. Make and type.
d. Model number and unit size.
e. Manufacturer's serial number.
f. Unit arrangement and class.
g. Discharge arrangement.
h. Sheave make, size in inches, and bore.
i. Center-to-center dimensions of sheave and amount of adjustments in inches.
j. Number, make, and size of belts.
k. Number, type, and size of filters.

2. Motor Data:

a. Motor make, and frame type and size.
b. Horsepower and rpm.
c. Volts, phase, and hertz.
d. Full-load amperage and service factor.
e. Sheave make, size in inches, and bore.
f. Center-to-center dimensions of sheave and amount of adjustments in inches.

3. Test Data (Indicated and Actual Values):

a. Total airflow rate in cfm.
b. Total system static pressure in inches wg.
c. Fan rpm.
d. Discharge static pressure in inches wg.
e. Filter static-pressure differential in inches wg.
f. Preheat-coil static-pressure differential in inches wg.
g. Cooling-coil static-pressure differential in inches wg.
h. Heating-coil static-pressure differential in inches wg.

i. Outdoor airflow in cfm.
j. Return airflow in cfm.
k. Outdoor-air damper position.
l. Return-air damper position.
m. Vortex damper position.

F. Apparatus-Coil Test Reports:

1. Coil Data:

a. System identification.
b. Location.
c. Coil type.
d. Number of rows.
e. Fin spacing in fins per inch o.c.
f. Make and model number.
g. Face area in sq. ft..
h. Tube size in NPS.
i. Tube and fin materials.
j. Circuiting arrangement.

2. Test Data (Indicated and Actual Values):

a. Airflow rate in cfm.
b. Average face velocity in fpm.
c. Air pressure drop in inches wg.
d. Outdoor-air, wet- and dry-bulb temperatures in deg F.
e. Return-air, wet- and dry-bulb temperatures in deg F.
f. Entering-air, wet- and dry-bulb temperatures in deg F.
g. Leaving-air, wet- and dry-bulb temperatures in deg F.
h. Water flow rate in gpm.
i. Water pressure differential in feet of head or psig.
j. Entering-water temperature in deg F.
k. Leaving-water temperature in deg F.
l. Refrigerant expansion valve and refrigerant types.
m. Refrigerant suction pressure in psig.
n. Refrigerant suction temperature in deg F.
o. Inlet steam pressure in psig.

G. Electric-Coil Test Reports: For electric furnaces, duct coils, and electric coils installed in central-station air-handling units, include the following:

1. Unit Data:

a. System identification.
b. Location.
c. Coil identification.
d. Capacity in Btu/h.
e. Number of stages.

f. Connected volts, phase, and hertz.
g. Rated amperage.
h. Airflow rate in cfm.
i. Face area in sq. ft..
j. Minimum face velocity in fpm.

2. Test Data (Indicated and Actual Values):

a. Heat output in Btu/h.
b. Airflow rate in cfm.
c. Air velocity in fpm.
d. Entering-air temperature in deg F.
e. Leaving-air temperature in deg F.
f. Voltage at each connection.
g. Amperage for each phase.

H. Fan Test Reports: For supply, return, and exhaust fans, include the following:

1. Fan Data:

a. System identification.
b. Location.
c. Make and type.
d. Model number and size.
e. Manufacturer's serial number.
f. Arrangement and class.
g. Sheave make, size in inches, and bore.
h. Center-to-center dimensions of sheave and amount of adjustments in inches.

2. Motor Data:

a. Motor make, and frame type and size.
b. Horsepower and rpm.
c. Volts, phase, and hertz.
d. Full-load amperage and service factor.
e. Sheave make, size in inches, and bore.
f. Center-to-center dimensions of sheave, and amount of adjustments in inches.
g. Number, make, and size of belts.

3. Test Data (Indicated and Actual Values):

a. Total airflow rate in cfm.
b. Total system static pressure in inches wg.
c. Fan rpm.
d. Discharge static pressure in inches wg.
e. Suction static pressure in inches wg.

I. Instrument Calibration Reports:

1. Report Data:

a. Instrument type and make.
b. Serial number.
c. Application.
d. Dates of use.
e. Dates of calibration.

3.16 VERIFICATION OF TAB REPORT

A. The TAB specialist's test and balance engineer shall conduct the inspection in the presence of Construction Manager.

B. Construction Manager shall randomly select measurements, documented in the final report, to be rechecked. Rechecking shall be limited to either 10 percent of the total measurements recorded or the extent of measurements that can be accomplished in a normal 8-hour business day.

C. If rechecks yield measurements that differ from the measurements documented in the final report by more than the tolerances allowed, the measurements shall be noted as "FAILED."

D. If the number of "FAILED" measurements is greater than 10 percent of the total measurements checked during the final inspection, the testing and balancing shall be considered incomplete and shall be rejected.

E. If TAB work fails, proceed as follows:

1. TAB specialists shall recheck all measurements and make adjustments. Revise the final report and balancing device settings to include all changes; resubmit the final report and request a second final inspection.
2. If the second final inspection also fails, Owner may contract the services of another TAB specialist to complete TAB work according to the Contract Documents and deduct the cost of the services from the original TAB specialist's final payment.
3. If the second verification also fails, Engineer may contact AABC Headquarters regarding the AABC National Performance Guaranty.

F. Prepare test and inspection reports.

3.17 ADDITIONAL TESTS

A. Within 90 days of completing TAB, perform additional TAB to verify that balanced conditions are being maintained throughout and to correct unusual conditions.

B. Seasonal Periods: If initial TAB procedures were not performed during near-peak summer and winter conditions, perform additional TAB during near-peak summer and winter conditions.

END OF SECTION

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SECTION 16000

ELECTRICAL WORK - GENERAL

PART 1 - GENERAL

1.01 Description of Work

A. In general, the work specified in this division of the specifications includes the furnishing of all labor, material, auxiliaries, and services necessary to install complete and properly operating electrical systems, including all fees, charges, and permits necessary.

B. The Contractor shall furnish and install all wire, cables, conduits, wiring, wiring devices, lighting fixtures, motor controllers, safety switches, relays, control equipment, and all other apparatus and accessories indicated, specified, or required for complete lighting, power, control and instrumentation systems for the project facilities.

C. The Contractor shall refer to every section of these specifications for installation and coordination requirements applicable to the work specified in this division. The Contractor shall furnish and install all wiring and connections to all electrical equipment furnished under other sections of these specifications, except where specified or indicated otherwise.

D. The Contractor shall coordinate all electrical work with other project construction trades, installation requirements, sequence of construction schedule, etc., including coordination and installation of required conduit sleeves and supporting devices.

E. The Contractor shall be required to coordinate all electrical system connections with each appropriate utility company and shall furnish and install all equipment or material necessary to provide complete electrical services in accordance with all utility company requirements.

F. Unless otherwise indicated, the basic materials and methods included in this section of the specifications shall be applicable throughout the project.

1.02 General Requirements

A. Design drawings are diagrammatic and intended to show approximate installation and equipment locations. All dimensions shall be verified in the field and coordinated with shop drawings issued. Equipment schedules are intended to serve as a guide only and do not relieve the Contractor of the responsibility for the complete furnishing and installation of all wiring, cable, conduits, or additional apparatus required.

B. The Contractor shall furnish, install, maintain, and remove upon completion of the project, all temporary service required for construction and testing. The service shall be for general power and lighting and shall include distribution system, panelboards, grounding, branch circuits, general lighting, and receptacles as required.

C. The Contractor shall furnish and install reinforced concrete pads, for electrical equipment, of size as shown on the drawings or required. Unless noted otherwise, pads for indoor equipment shall be 4 inches high and exceed the equipment dimensions by 6 inches on all sides not flush to a wall; pads for outdoor equipment shall be a minimum of 12 inches thick and exceed the equipment dimensions by 2-1/2 feet on sides equipped with door access and 6 inches on all remaining sides. Motor control centers, switchboards, etc., located indoors and equipped with a wireway at the base, shall be centered on a continuous reinforced concrete curb, minimum 6 inches high and 8 inches wide.

D. The Contractor shall furnish a covered, weather-protected facility, providing a clean, dry, non-corrosive environment for storage of all electrical and instrumentation equipment incorporated into this project in accordance with the provisions of the General Conditions.

E. The Contractor shall furnish and install a system of engraved, laminated nameplates (black lettering on a white background), designed to identify each major piece of equipment.

F. Motors will be furnished with the equipment they drive unless indicated otherwise. Motors shall be premium efficiency design. Motors located outdoors or within corrosive environments shall be severe duty construction.

G. The Contractor shall remove all existing electrical equipment within areas to be demolished and shall return all reusable material to the Owner. Equipment feeder conductors shall be removed up to the first remaining circuit disconnect.

H. Existing receptacles, light switches, lighting fixtures, etc., which become inaccessible or nonfunctional as a result of the new construction, shall be relocated to become accessible and functional. Replace or reroute the existing branch circuits as required to accommodate the relocated devices.

I All electrical apparatus and lighting equipment shall be in compliance with the Florida Building Code Fifth Edition (2014) Energy Conservation, and the Federal Energy Policy Act of 2005, including all subsequent updates, revisions, and replacements.

J. All electrical equipment exposed in wet wells, on treatment structures, in direct exposure to process, chlorine, or chemical atmospheres, or otherwise subject to accelerated corrosion, shall be furnished as specified for "corrosive atmospheres".

K. All electrical equipment and installation within hazardous areas shall comply with the requirements of the National Electrical Code for Class I, Division 1, Hazardous Locations.

1.03 Submittals

A. For each individual section of this division, there shall be submitted for approval a single, complete shop drawing submission. All elementary and schematic diagrams shall be provided with indication of system coordination and complete description of sequence of operation. Deviations from the contract documents shall be clearly identified. One copy of each shop drawing submittal shall be provided in PDF format.

B. Complete operation and maintenance instruction manuals, including system schematics which reflect "as-built" modifications, shall be provided. All wire terminations shall be numbered and identified on as-built drawings included as part of the operations and maintenance manuals. All drawings included within the operation and maintenance manuals shall be reduced to a maximum dimension of 17 inches x 11 inches and shall be legible and reproducible. Special maintenance requirements particular to the system shall be clearly defined along with special calibration and test procedures. One copy of each operation and maintenance manual submittal shall be provided in PDF format.

C. Following approval of the operation and maintenance instruction manual submittals, an electronic copy of all as-built electrical apparatus drawings, schematic diagrams, control wiring diagrams, instrumentation drawings, etc. shall be provided. A drawing index, identifying each electronic drawing file name and a description of the contents, shall be included within the operation and maintenance instruction manuals.

1. Unless otherwise approved prior to submittal, all electronic drawings shall be provided on compact disk in both PDF and AutoCAD 2017 format.

D. One complete set of design drawings shall be neatly marked daily as a record of job progression and "as-built" installation. The drawings shall reflect the actual installed locations of all equipment and indicate the exact routing and elevations of all concealed conduits. Upon completion of the project, the drawings shall be coordinated with the as-built drawings and submitted to the Engineer. One copy of the final as-built drawings shall be provided in PDF format.

E. The Contractor shall maintain a record of all construction documentation including construction survey data, inspection reports, test reports, startup logs, etc. Upon completion of the project, copies of all construction documentation shall be submitted to the engineer. One copy of the final construction documentation shall be provided in PDF format.

PART 2 - PRODUCTS

2.01 Materials

A. All material shall be new and shall conform with the standards of the Underwriter's Laboratories, Inc., American National Standards Institute, National Electrical Manufacturers' Association, Insulated Power Cable Engineers Association, and Institute of Electrical and Electronic Engineers in every case where such a standard has been established for the particular type of materials in question.

B. The use of a manufacturer's trade name and catalog number is not intended to indicate preference but only the type and quality of the product desired. Products of reputable manufacturers of equal quality and functional type will be acceptable. Substitutes which tend to lower the quality of the work will not be permitted.

C. Acceptance of alternate equipment does not relieve the Contractor of the responsibility of compliance with the performance and accuracy requirements of these specifications. Where such substitutions alter the design or space requirements indicated on the Contract Drawings, detailed drawings shall be prepared and submitted by the Contractor delineating any changes in or additions to the work shown on the Contract Drawings, and such drawings and changes or additions to the work shall be made by the Contractor at no additional expense to the Owner. In all cases, the burden of proof that the material or equipment offered for substitution is equal in construction, efficiency, and service to that named on the Contract Drawings and in these Contract Documents shall rest on the Contractor and, unless the proof is satisfactory to the Engineer, the substitution will not be approved.

D. Wherever possible, equipment items having the same or similar rated capacity or function shall be identical.

E. All equipment and apparatus shall be the manufacturer’s latest proven design, neither presently scheduled for obsolescence nor developmental prototype.

2.02 Raceways

A. Metallic Conduit (Aluminum): All conduit shall be heavy wall rigid aluminum of standard pipe weight unless noted otherwise.

1. Couplings, conduit unions, conduit fittings, etc., shall be aluminum, shall have conventional trade dimensions, and shall be internally threaded with a tapered thread at each end to fit the tapered thread specified for the corresponding size conduit. Conduit outlet body covers shall be cast construction.

2. All conduits, couplings, and fittings run exposed to corrosive atmospheres, and all conduit elbows and risers within concrete encasement shall have a gray or black factory-applied PVC coating, or field applied heat shrink jacket, of not less than 20 mils thickness. Damaged PVC coatings shall be repaired with an approved compound. Conduit supports, channels, and mounting apparatus shall be type 316 stainless steel.

B. Flexible Conduit: All flexible conduit shall be Type LTA liquid-tight flexible aluminum conduit made with flexible aluminum core covered with an extruded PVC jacket, unless noted otherwise. Fittings shall be the type specifically designed for flexible conduit use and shall form watertight connections. Flexible conduit fittings shall be aluminum construction.

1. Flexible conduit shall only be used for connections from conduits, junction boxes, or motor controllers to mechanical equipment or where the location of the connection is such that it is impractical to make a rigid conduit connection, where vibration isolation is required, or where specifically called for on the drawings. Flexible conduit shall be used for connection to all motors.

2. Flexible conduit for use in hazardous areas shall be Crouse-Hinds EC Series, Appleton EX Series, or equal.

C. Non-Metallic Conduit: Non-metallic conduit, couplings, and fittings shall be Schedule 40 PVC unless noted otherwise. All PVC conduit joints shall be solvent-welded in accordance with the manufacturer's recommendations.

1. Underground conduits and conduit embedded within slabs on grade shall be non-metallic; however, conversion shall be made to rigid metallic conduit before conduit runs exit encasement. Conversion elbows, fittings and risers within the concrete encasement shall be PVC coated rigid metallic conduit.

2. Underground conduits shall be installed not less than 24 inches below grade.

3. Underground pull boxes shall be provided for all miscellaneous underground conduit runs over 200 feet long.

4. A minimum 3-inch wide polyethylene warning tape, yellow for electrical and orange for telephone, with imprinted legend, shall be installed in the backfill above all underground conduits. Warning Tape shall be Allen Terra Tape, or equal and shall be guaranteed not to discolor. Unless indicated otherwise, the tape shall be 12 inches below the finished ground grade.

2.03 Wires And Cable

A. Low Voltage Cable: Low voltage wire and cable shall be 600 volt, single-conductor copper, rated 90 degrees C dry and 75 degrees C wet. Unless indicated otherwise, low voltage building wire shall have XHHW-2 insulation.

1. Low voltage multi-conductor power and control cable shall be 600 volt, Type XHHW copper conductors with an overall neoprene jacket, rated 90 degrees C dry and 75 degrees C wet and shall be suitable for cable tray installation.

B. VFD Cable: VFD power cables shall be shielded, flexible motor supply cable for variable speed drives subject to non-linear power distortions. VFD cable shall be used to interconnect AC variable frequency drives or control systems, to compatible AC motors. VFD cables shall be 1000V rated UL flexible motor supply cable, 3 stranded tinned copper circuit conductors with XLPE insulation, 1 stranded tinned copper ground wire with PVC insulation, overall combination tinned copper braid and foil shield, and black PVC jacket; Belden VFD cable, or equal.

1. VFD cables are subject to a harsh operating environment characterized by high voltage spikes, high noise levels and adverse environmental conditions. VFD cables shall be specifically designed to overcome the shortcomings of single conductor lead wire installed in conduit, unshielded tray cables, or continuously welded armored cable typically used for this application.

C. Instrumentation Cable: Instrumentation cable shall be single twisted pair, 600 volt, stranded, tinned copper conductors with cross-linked polyethylene primary insulation, overall foil shield with tinned copper braid, and chlorinated polyethylene jacket; Belden 3072F.

D. Inner Panel Wiring: Wiring for instrumentation and control panels shall be single conductor, 600 volt, 125 °C rated UL Type AWM stranded tinned copper conductors with cross-linked polyethylene insulation, Belden 356 series.

E. Fiber Optic Cable: Unless otherwise indicated or required to meet the specific installation requirements, fiber optic cables shall be UL listed, OFNR-rated, UV, water and fungus resistant, all dielectric, tight buffered construction, consisting of tight buffered optical fibers with acrylate fiber coating, central strength member, aramid yarn strength member, ripcord, and PVC outer jacket.

1. Single-Mode optical fibers shall be minimum 9 micron core, 125 micron clad, 900 micron buffer glass fiber conductors. Fiber optic cables shall be Optical Cable Corporation DX-DSLX9YR.

2. Multi-mode optical fibers shall be minimum 62.5 micron core, 125 micron clad, 900 micron buffer glass fiber conductors. Fiber optic cables shall be Optical Cable Corporation DX-DWLX9OR.

3. Fiber optic cable termination interface patch panels shall be provided at all termination points.

4. Each cable fiber shall be terminated with connector type as required by the utilization equipment.

5. Fiber optic jumper cables shall be provided from patch panels to the utilization equipment.

6. Fiber optic cable test report shall be provided following installation.

7. All fiber optic cable installations within patch panels, control panels, etc., including all terminations and testing, shall be performed by a Fiber Optic Association, Inc. Certified Fiber Optic Specialist, or pre-approved equal. Documentation of certification shall be included as part of fiber optic cable materials submittal.

2.04 Terminal Blocks And Wire Marking

A. Terminal blocks for power conductors shall be 600 volt, three pole unit construction type with high pressure solderless connectors, headless socket screws, and ampere rating equal to or greater than the ampacity of the maximum conductor size to be terminated; Square D Type LBC, or equal.

B. Terminal blocks for control and instrumentation conductors shall be 600 volt, sectional rail mounted terminal blocks with plastic pre-printed terminal numbering markers on both the inside and outside tracks, and provisions for center terminal bridge jumper cross connections with no loss of space on terminal or rail; Siemens 8WA1 011-1DF11, or equal. Terminal blocks for general control connections shall be feed-through terminal blocks; terminal blocks for instrumentation signal circuits shall be knife type test/disconnect terminal blocks; and terminal blocks for cable shield termination and grounding shall be ground blocks.

C. Cable and conductor markers shall be heat shrinkable sleeve markers with permanent legible machine printed markings.

2.05 Boxes

A. General: Boxes shall be installed at all locations necessary to facilitate proper installation and equipment connection, including each conduit/cable transition.

1. Minimum dimensions of boxes shall not be less than NEC requirements and shall be increased if necessary, for practical reasons or where required to suit job condition.

2. Boxes shall have only the holes necessary to accommodate the conduits at point of installation. All boxes shall have lugs or ears to secure covers.

3. All boxes shall be rigidly secured in position. All boxes, except on unfinished ceilings and walls, and where conduit is run exposed, shall be so set that the front edge of box shall be flush with or recessed not more than 1/4-inch behind the finished wall or ceiling line.

B. Outlet Boxes: The location of outlets as shown on the drawings will be considered as approximate only. It shall be the work of this Section to study all plans with relation to spaces surrounding each outlet in order that the work may fit and that when fixtures or other fittings are installed, they shall be symmetrically located to best suit each condition. All outlets shall be coordinated with the work of other sections of these specifications to prevent outlets or fixtures from being covered by pipe, duct, etc.

1. Where conduit is exposed, outlet boxes shall be cast aluminum one piece hub type standard gang boxes with rubber gaskets.

   a. Wiring device boxes shall be equipped with cast screw-type covers; Crouse-Hinds Series FS or equal.
   b. Fixture boxes shall be of sufficient diameter to provide a seat for the fixture canopy; Crouse-Hinds Series GRF or equal.

C. Pull Boxes: Pull boxes, including junction boxes and terminal boxes, shall be installed at all necessary points, whether indicated or not, to prevent injury to the insulation or other damage that might result from pulling resistance or other reasons during installation.

1. Unless indicated otherwise, pull boxes shall be NEMA 12 construction with gasketed screw covers and gray baked enamel over a rust-inhibiting primer finish. Pull boxes installed outdoors or in corrosive atmospheres shall be NEMA 4X aluminum or 316 stainless.

2. Pull boxes in excess of 36 inches x 36 inches x 12 inches shall be fabricated from code gauge aluminum or 316 stainless steel, suitably reinforced to provide a rigid, self-supporting construction. Each large pull box shall be equipped with a gasketed hinged cover fastened with screws on three sides. Dimension and installation details, for each large pull box, shall be approved prior to fabrication.

3. Pull boxes in hazardous areas shall be explosion proof, cast aluminum construction with hinged, threaded, screw-on covers. Explosion proof pull boxes shall be equipped with threaded conduit openings as required for the initial installation, all identified future connections, and a minimum of one spare conduit opening sized to match the largest otherwise required conduit opening.

4. Branch circuit pull boxes shall be appropriate outlet boxes with blank covers.

D. Wireways: Wireways, as indicated on the drawings or approved for installation, shall be NEMA 12 construction with gasketed screw covers and gray baked enamel over a rust-inhibiting primer finish. Wireways installed outdoors on in corrosive atmospheres shall be NEMA 4X aluminum or type 316 stainless steel.

1. Wireways shall be furnished and installed with required conduit knockouts only.

E. Underground Pull Boxes: Underground pull boxes shall be minimum 30-inch x 17-inch x 18-inch deep composolite service boxes constructed of reinforced polymer concrete suitable for light traffic loading, with locking cover and molded logo; Quazite Composolite, or equal.

1. Unless otherwise indicated underground pull boxes shall have solid bottoms. Where open bottom pull boxes are indicated or approved for installation, a bed of gravel, minimum 12" thick and exceeding the pull box footprint by 6" on all sides, shall be placed beneath each open bottom pull box.

F. Floor Boxes: Floor boxes shall be cast iron, watertight, fully-adjustable, under-floor type with appropriate round, flush, aluminum, screw-type covers.

2.06 Wiring Devices

A. Wall Switches: Wall switches shall be specification grade, totally-enclosed, toggle switches rated 20 ampere, 120/277 volt. Switches shall be single pole, double-pole, 3-way, or 4-way as indicated; GE-5951 through 5954, Hubbell 1221 through 1224, Leviton 1221 through 1224, or equal.

1. Wall switches shall be furnished with suitable plates. The material, colors, and finishes of switch plates shall be as directed to harmonize with the surroundings. In general, standard switches shall be brown with stainless steel plates. Indoor FS switch box covers shall be aluminum; Appleton FSK-1TS-A, or equal.

2. Unless specified otherwise, wall switches installed outdoors or in corrosive atmospheres shall be weatherproof and vapor-tight. Weatherproof and vapor-tight switches shall consist of standard wall switches as previously specified, enclosed

in Series FS condulets equipped with vapor-tight gasketed covers; Appleton Series FSK-1VTS-A, or equal.

3. Switches requiring pilot lights shall be similar in quality and construction to the standard switches previously specified with neon pilot light in lexan handle; Hubbell 1221-PL, GE-SP121-8G, or equal.

4. Unless indicated otherwise, time switches shall be main spring-operated, 0-60-minute cycle with hold feature, rated 20 ampere 120 volt; Mark-Time 90,000 Series or equal.

B. Receptacles: Receptacles shall be specification grade, grounding type, totally-enclosed, duplex receptacles rated 20 ampere, 125 volt; GE 8300-9, Hubbell 5362-GRY, Leviton 5362-GY, or equal.

1. Each receptacle shall be provided with a single gang plate for flush mounting. The materials, colors, and finishes of the plates shall be as directed to harmonize with the surroundings. In general, receptacles shall be gray with stainless steel plates. Indoor FS receptacle box covers shall be aluminum; Appleton FSK-1DR-A, or equal.

2. Unless specified otherwise, receptacles installed outdoors or in corrosive atmospheres shall be weatherproof. Weatherproof receptacles shall each consist of standard duplex receptacles as previously specified, enclosed in Series FS condulet equipped with a weatherproof cover; Crouse-Hinds WLRD or equal. Outdoor receptacle covers shall be aluminum in-use covers; Crouse-Hinds WIUMV, or equal. Outdoor receptacles installed on circuits without ground fault protection shall be type GFCI.

3. The Contractor shall connect the grounding terminal in each receptacle to the inside of the metal enclosure.

2.07 Motor Starters

A. Manual Motor Starters: Manual motor starters shall be 600 volt, toggle-type suitable for installation within standard outlet boxes. Enclosures for all starters not installed in outlet boxes, and all starters located outdoors, or in corrosive atmospheres, shall be NEMA 4X aluminum or type 316 stainless steel.

1. Where required, starters shall be equipped with overload protection on each pole.

2. Starters located in hazardous areas shall be front-operated explosion-proof, manual motor starting switch condulets; Crouse-Hinds Series EDS, Appleton EDS, or equal.

3. Each starter for automatic control shall be equipped with an H-O-A selector switch.

B. Magnetic Motor Starters: Unless indicated or required otherwise, each motor starter shall be of the combination type complete with molded case motor circuit protector; full-voltage magnetic starter; manual resetting, 3-pole, bimetallic thermal overload relay; individual 120 volt control power transformer; enclosure door-mounted pilot control devices; and all required accessory control components.

1. Motor starter enclosures shall have oil-resistant gasket and external operating handle. Unless otherwise indicated, motor starter enclosures located indoors shall be NEMA 12 construction. Motor starter enclosures located outdoors, or in corrosive atmospheres, shall be NEMA 4X type 316 stainless steel.

2. Motor starters for submersible motors shall be equipped with ambient-compensated, bi-metallic, quick-trip type overloads.

3. Unless indicated otherwise, motor starters for all motors 25 hp and above shall be of the solid state reduced voltage type.

2.08 Panelboards

A. Lighting and power distribution panelboards shall be dead-front type equipped with main circuit breaker or main lugs only, as indicated on the drawings. Lighting panelboards shall be suitable for 120/208 volt, 3 phase, 4-wire, or 120/240 volt, 1 phase, 3-wire installation as indicated. Power distribution panelboards shall be suitable for 277/480 volt, 3 phase, 4-wire installation.

1. Panelboards shall be constructed with reinforced galvanized steel frames, sequence phasing, copper or tin-plated aluminum bus bars, code-gauge galvanized steel boxes with adequate wiring gutters, and code-gauge steel front panels with gray enamel finish over a rust-inhibitor. All connections shall be anti-turn solderless mechanical type and each panelboard shall be provided with a solid neutral bar. Front panels shall be provided with hinged doors equipped with semi-concealed hinges, directory card holder, and flush type combination catch and lock (all locks keyed alike with a minimum of 3 keys for each panel). Panelboard enclosures located outdoors or in corrosive atmospheres shall be 316 stainless steel or fiberglass NEMA 4X.

2. Main and branch breakers shall be bolt-on, quick-make, quick-break, thermal magnetic, molded case, trip-free type containing thermal inverse time delay and magnetic instantaneous over-current trip elements. Automatic tripping shall be indicated by the breaker handle assuming a clearly distinct mid-position. Branch

breakers shall be interchangeable and shall be removable from the front of the panel without disturbing adjacent units. Multi-pole breakers shall incorporate internal trip bar and a single external handle.

3. Breakers supplying receptacles located in restrooms, locker rooms, shower rooms, etc., or outdoors, or weatherproof receptacles located indoors, shall be GFCI. Breakers supplying unswitched lighting circuits shall be rated SWD. Breakers supplying heating, air conditioning and refrigeration equipment shall be rated HACR.

4. Equipment ratings as indicated on the drawings shall be approximate. Panelboard and breaker ratings shall be coordinated with the installed service and the loads supplied. Unless indicated otherwise, breakers shall be rated not less than 10,000 amperes RMS symmetrical for 120/240 volts and 22,000 for 277/480 volts.

2.09 Dry Type Transformers

A. Dry type transformers for general power and lighting shall be 2-winding, self-cooled, power transformers with ratings as indicated on the drawings. Unless indicated otherwise, transformers 3 KVA and above shall be provided with 4 fully rated taps, two 2-1/2% above and two 2-1/2% below rated primary voltage. Each unit shall be provided with a 220 degrees C insulation system incorporating a maximum 150 degrees C temperature rise above 40 degrees C ambient and shall be designed for continuous operation at rated KVA.

1. Transformer core shall be of high quality, cold-rolled, grain-oriented steel, annealed by the manufacturer for low loss and exciting current. Laminations shall be formed to eliminate burrs and annealed to reduce losses to a minimum. Winding conductors shall be annealed and insulated by the transformer manufacturer. Conductor surfaces shall be free from slivers, burrs, and other irregularities. Core and coil assembly shall be vacuum-impregnated for maximum resistance to moisture.

2. Enclosures shall be drip-proof and rodent-proof; all units installed outdoors shall be 316 stainless steel weatherproof construction.

3. All materials used in the transformers shall be flame-retardant and self-extinguishing and design shall incorporate vibration dampening systems.

4. Overload level, sound level, and BIL ratings shall meet or exceed NEMA and ANSI Standards.

5. Transformer energy efficiency shall meet or exceed the 2016 DOE efficiency standards.

2.10 Disconnect Switches

A. Disconnect switches shall be 600 volt rated heavy-duty safety switches with full cover interlocks and quick-make, quick-break mechanisms. Switches shall be fused or non-fused, of capacities noted; Square-D Type HD or equal.

1. Unless indicated otherwise, disconnect switches located indoors shall have NEMA 12 enclosures with gray baked enamel over a rust-inhibiting primer finish. Disconnect switches located outdoors, or in corrosive atmospheres, shall have NEMA 4X type 316 stainless steel enclosures.

2. Unless indicated otherwise, fuses shall be Mersen type TRS-R Class RK5 current limiting time-delay fuses.

2.11 Circuit Breakers

A. Circuit breakers shall be 600 volt thermal magnetic, quick-make, quick-break molded case air circuit breakers, with trip-free operation, incorporating an internal trip bar and a single external handle. Circuit breaker ratings shall be coordinated with the installed service and loads supplied. Unless indicated otherwise, circuit breakers shall be rated not less than 25,000 amperes RMS symmetrical.

1. Unless indicated otherwise, enclosed circuit breakers located indoors shall have NEMA 12 enclosures with gray baked enamel over a rust-inhibiting primer finish. Enclosed circuit breakers located outdoors, or in corrosive atmospheres, shall have NEMA 4X type 316 stainless steel enclosures.

2. Circuit breakers used as a service disconnecting device shall be 100% rated and UL service entrance rated; shall be equipped with long time, short-time, instantaneous and ground fault adjustments for system selectivity; and shall be fully rated for the maximum fault current, without the use of current limiters.

2.12 Support Systems

A. Groups of two or more conduits, and all boxes and equipment, shall be mounted on a system of minimum 1-5/8-inch x 1-5/8-inch heavy wall aluminum or 316 stainless steel channel with a minimum of 25% unused capacity.

B. Overhead conduits shall be supported on trapeze hangers from approved concrete inserts and shall be grouped with pipes wherever possible.

C. Support system hardware, including hanger rods, shall be aluminum or stainless steel.

2.13 Lighting Fixtures

A. Lighting fixtures shall be of specification grade and listed or labeled by Underwriters Laboratories (UL) or an approved Nationally Recognized Testing Laboratory (NRTL).

B. LED fixtures shall comply with the following:

1. UL Standard 8750 “Light Emitting Diode Equipment for Use in Lighting Products”

2. IES Standard LM-79 “Electrical and Photometric Measurements of Solid-State Lighting Products”

3. IES Standard LM-80 “Measuring Lumen Maintenance of LED Light Sources”

4. IES Standard TM-21 “Projecting Long Term Lumen Maintenance of LED Light Sources”.

5. ANSI C78.377 “Specifications for the Chromaticity of Solid State Lighting Products” with LEDs binned within a maximum three-step MacAdam Ellipse to ensure color consistency amongst luminaries of the same type.

C. For LED fixtures, lamps, drivers, and components, provide a complete warranty for parts and labor for a minimum of five years from the date of Substantial Completion.

D. Provide only LED fixtures with a Design Lights Consortium (DLC) listing, a U.S. Department of Energy (DOE) “LED Lighting Facts” label, or a U.S. Environmental Protection Agency (EPA) ENERGY STAR label, which have demonstrated third-party testing verification.

E. Recessed lighting fixtures shall be thermally protected.

F. LED fixtures shall be modular and allow for separate replacement of LED lamps and drivers. User serviceable LED lamps and drivers shall be replaceable from the room side.

G. Dimmable LED fixtures shall have either a 0-10 volt, 3-wire dimming driver, or a two-step (50%-100%) line voltage, two switch controlled dimming driver, as shown on the drawings.

H. Unless otherwise indicated, LED lamps shall have a color temperature of 3500 degrees K, a CRI of 80 minimum, and a lumen maintenance L70 rating of 50,000 hours minimum.

I. LED drivers shall be electronic-type, labeled as compliant with radio frequency interference (RFI) requirements of FCC Title 47 Part 15, and comply with NEMA SSL 1 "Electronic Drivers for LED Devices, Arrays, or Systems". LED drivers shall have a sound rating of "A", have a minimum efficiency of 85%, and be rated for a THD of less than 20 percent at all input voltages.

J. Dimmable LED drivers shall be 0-10V type. Dimmable LED drivers shall be capable of dimming without LED strobing or flicker across their full dimming range.

K. Battery-backed LED emergency lighting fixtures shall consist of a normal LED fixture with some or all of the LEDs connected to a battery and charger. The battery shall be nickel cadmium and sized for a minimum of 90 minutes of fixture operation. The charger shall be solid-state and provide overload, short circuit, brownout and low battery voltage protection. The battery and charger shall include self-diagnostic and self-exercising circuitry to exercise and test itself for 5 minutes every month and for 30 minutes every 6 months. The fixture shall include a test/monitor module with LED status indicating lights mounted so as to be visible to the public. The fixture shall not contain an audible alarm.

L. Lighting contactors shall be electrically-operated, mechanically-held, suitable for panelboard mounting, and fully rated as indicated for tungsten and ballast lighting; Square D Type L and S, ASCO 917 and 920, or equal.

1. Contactors shall be provided with fused control circuits and 120 volt operating coils. Contactors shall be furnished with control power transformers where required.
2. Contactors shall be panelboard-mounted, or mounted in separate enclosures, as indicated. Contactor enclosures for interior locations shall be NEMA 1 code-gauge steel with gray baked enamel over a rust-inhibiting primer finish. Enclosures for exterior locations shall be NEMA 4 seam-welded aluminum. Enclosures located in corrosive atmospheres shall be type 316 stainless steel.

PART 3 - EXECUTION

3.01 Codes, Permits, And Inspections

A. The installations shall be in accordance with the regulations of the latest editions of the National Electrical Code, National Electrical Safety Code, applicable city, state, and local codes and regulations and other applicable codes, including utility company codes.

B. All permits required by state or local ordinances shall be obtained and after completion of the work, a certificate of final inspection and approval from the electrical inspector shall be furnished to the Owner. All permits for installation, inspections, connections, etc., shall be taken out and paid for as part of the work under this Section.

3.02 Conduit Installation

A. Unless otherwise indicated, exposed conduit shall be rigid aluminum, underground conduit and conduit encased in concrete shall be Schedule 40 PVC. Conduit transitions from underground or encased to exposed shall be PVC coated rigid aluminum, including the transition elbows and risers.

B. All conduits shall be run in such a manner as to cause the least interference with other trades. Conduits shall be joined by means of couplings or 3-piece coupling type conduit unions. Joints shall be set up tight. Runs shall be straight and true; elbows, offsets, and bends shall be uniform and symmetrical. Installation workmanship shall be of the best quality and skill.

C. Conduits shall be of sizes required to accommodate the number of conductors in accordance with the tables given in the current edition of National Electrical Code or as noted on the drawings. The minimum size of conduit shall be 3/4-inch.

D. Conduit runs shall terminate below the particular section of the motor control center or equipment to which their respective circuits run. Concealed conduits shall be run in as direct a line as possible. Exposed conduits shall be run parallel to or at right angles with the lines of the building. All bends shall be made with standard conduit ells, conduit bent to not less than the same radius, or aluminum conduit outlet bodies with gasketed cast iron covers. Adjacent conduit runs shall be installed with concentric bends. All bends shall be free from dents or flattenings. Not more than the equivalent of four quarter bends shall be used in any one run between terminals at cabinets, outlets, and junction or pull boxes. Boxes shall be located in accessible locations.

E. Conduit shall be continuous from outlet to outlet and from outlets to cabinets, junctions, or pull boxes and shall enter and be secured to all boxes in such a manner that each system shall be electrically continuous from point of service to all outlets. Insulated grounding bushings shall be used on all metallic conduit. Terminals of all conduits shall be plugged with an approved cap to prevent the entrance of foreign materials when exposed during construction.

F. As far as practicable, all exposed conduits shall be run without traps. Where dips are unavoidable, a pull box or approved conduit outlet body shall be placed at each low point. Conduit systems shall be completed before conductors are drawn in. Where conduits must be run exposed, except as indicated in the drawings, locations of the runs shall be subject to approval.

G. Where exposed conduit needs clamping to the structures, clamps shall consist of aluminum 1-hole pipe straps and pipe spacers, stainless steel bolts of appropriate size to fill the holes in the straps and spacers, and approved expansion shields. Clamps used with

aluminum conduit, and clamps located outdoors or in “corrosive atmospheres”, shall be PVC coated, aluminum or type 316 stainless steel. Clamps shall be bolted to the structure or where necessary to intermediate type 316 stainless steel brackets. Spacing between conduit supports shall not exceed the recommendations published by the National Electrical Code. No deformed, split, or otherwise defective conduit or fitting shall be installed. Conduit shall be installed with a minimum number of joints.

H. Aluminum Myers hubs shall be used for all threaded conduit connections to enclosures that do not contain integral threaded conduit hubs. Conduit connections to enclosures located outdoors shall only enter the bottom of the enclosure.

I. Where conduit has been cut in the field, it shall be cut square using a hand or power hacksaw or approved pipe cutter using cutting knives. The use of pipe cutters with cutter wheels will not be permitted. The cut ends of the field-cut conduit shall be reamed to remove burrs and sharp edges. Where threads have to be cut on conduit, the threads shall have the same effective length and shall have the same thread dimensions and taper as specified for factory-cut threads on conduit. Conduits installed in the work with threads not complying with these requirements shall be removed and replaced.

J. Where conduit installed in concrete or masonry extends across building joints, expansion joints with approved type grounding straps and clamps shall be installed. Expansion joints shall be Type XJ as manufactured by Crouse-Hinds, Appleton, or equal. Where conduit enters a building through the concrete foundation, below final grade, approved type FSK entrance seals shall be used.

K. All conduit shall be cleaned, prior to pulling in wire and cable, by pulling a stiff wire brush of the size of the conduit through it. This cleaning shall remove all foreign matter, including water, from the conduit. All boxes in which the conduit terminates shall be cleaned of all concrete, mortar, or other foreign matter and all threads in boxes shall be left clean and true upon completion of the work.

L. All spare, future, or empty conduits shall be equipped with a pull wire prior to capping.

M. All conduits, fittings, and electrical equipment used within hazardous areas shall comply with requirements of the National Electrical Code for the type of hazardous location encountered and shall be furnished as specified for "corrosive atmospheres".

1. In such hazardous locations, conduits terminating at boxes enclosing electric switching, or circuit opening equipment, shall be sealed at the entrance to the enclosure with approved, compound-filled, sealing fittings to prevent passage of explosive or combustible gases through the conduits.

2. All conduits exiting from such hazardous locations or entering said locations shall be similarly sealed at point of exit or entrance.

3.03 Wire And Cable Installation

A. The installation of wires and cables includes all splicing of these wires and cables to each other and connecting them to receptacles, switches, control boxes, lighting fixtures, motors, and all other electrical apparatus installed under this Contract. All cable installation methods shall correspond to manufacturer's recommendations.

B. Wire and cable shall be suitably protected from weather or damage during storage and handling and it shall be first-class condition when installed.

C. The minimum size of wire or cable conductor shall be No. 12, unless indicated otherwise on the drawings. Wire sizes No. 8 and larger, and all wire sizes utilized for control or instrumentation, shall be stranded. All sizes called for in the specifications or shown on the drawings are American Wire Gauge sizes.

1. No wire smaller than No. 12 shall be used for any branch circuit unless noted otherwise on the drawings. Larger sizes shall be used where required or indicated on the drawings. If the single distance from the panelboard to the first device exceeds 50 feet, the minimum size for this run shall be No. 10 AWG with the minimum between devices as No. 12 AWG.

D. All sizes of wire and cable furnished and installed under these specifications shall be color-coded with a separate color for each phase and neutral used consistently throughout. Each conductor shall have factory color-coded insulation. As an alternative, wire sizes No.8 and larger shall have black insulation and shall be color-coded with waterproof phasing tape at each termination, junction box, pull box, etc. All 277/480 volt wiring shall be color-coded yellow, brown, and orange for hot legs (Phase A, B, and C, respectively). All 120/208-240 volt wiring shall be color-coded black, blue, and red for hot legs (Phase A, B, and C, respectively). The grounded neutral conductor of each circuit shall be color-coded white. Grounding conductors shall be color-coded green.

E. All wires and cables shall, as far as practicable in the judgment of the Engineer, be continuous from origin to destination without running splices in intermediate pull boxes, junction boxes, or wireways. At the ends of these wires and cables, only sufficient slack shall be left as may be required for making proper connections. There shall be no unnecessary slack.

F. In connecting wires and cables to apparatus, various methods shall be used depending upon the local conditions as detailed on the drawings. In general, solderless pressure connectors shall be used for terminals, taps, and splices for all wires and cables. Solderless pressure connectors or vinyl-covered steel spring-type connectors shall be securely fastened and shall not loosen under vibration or normal strain. All connections

shall be in accordance with manufacturer's recommendations and shall be with connectors approved for the particular connection conditions.

G. Where wires and cables are connected to metallic surfaces, the coated surfaces of the metal shall be polished before installing the mechanical connector. The lacquer coating of the conduits shall be removed where a ground clamp is to be installed.

H. All soldered joints shall be made mechanically strong before soldering and shall be carefully soldered without the use of acid and shall be taped with insulating tape to a thickness equal to that of the insulation.

I. The installation of wires and cables shall include the furnishing and installing of all hangers, racks, cable cleats, and supports that may be necessary to make a neat and substantial wiring installation in all pull boxes, wireways, cable channels, and in such other locations as may be required. Plastic ties shall be used to hold the wires and cables together and to the racks or supports.

J. Each junction box, terminal box, control cabinet, or other terminal location containing a total of 4 or more conductor terminations or splices, shall be equipped with 1 or more terminal boards, as required, for connecting each wire including the spare wires. Each wire terminal shall be permanently marked throughout the entire system using, wherever possible, the notation of the wires given on the manufacturer's wiring diagrams. Sufficient terminal blocks shall be provided to terminate all wires routed to the enclosure including all spare conductors. In addition, the greater of 20 percent or four unused spare terminals shall be provided. All connections for future functions shall be wired to numbered terminal blocks, grouped separate from the terminal blocks in use. Terminal blocks shall be grouped to isolate power conductors from control conductors and to separate AC circuits from DC circuits.

K. Each control, instrumentation, and power cable and conductor shall be marked with the proper feeder symbol or termination number in each manhole, handhole, pull box, wireway, terminal cabinet, panelboard, switchboard and all additional locations required to provide positive identification. Each conductor shall be marked at each point of termination following final installation.

L. The electrical installation shall maintain suitable isolation between power, control and instrumentation conductors. Approved isolation barriers shall be provided within each pull box, terminal box, wireway, cable tray, handhole, manhole, etc.

3.04 Testing

A. Upon completion, the Contractor shall provide all necessary instruments and special apparatus to thoroughly test the complete installation and shall conduct all tests that may be required to insure system is free of all improper grounds and short circuits, and that all

the feeders are properly balanced. All electrical equipment shall be tested to determine proper polarity, phasing, relay settings, and operation. System shall be checked for quality and completeness in accordance with the provisions of the General Conditions. Any objectionable noise, heating, voltage drop, or excessive current draw, after in operation, shall be identified and corrected.

B. Prior to energization, the electrical system ground resistance shall be tested. Additionally, the insulation resistance of all electrical gear, power feeders, and electric motors shall be measured. Upon completion of all corrective measures required, certified acceptance reports, including tabulations of all initial and final resistance measurements, shall be submitted for approval in accordance with the provisions of the General Conditions.

C. Each motor starter overload element, and each motor circuit protector, shall be selected and adjusted to coordinate with the nameplate full-load current and service factor of the actual motors installed. Improper units shall be replaced. Upon completion of all corrective measures required, certified compliance reports, including tabulation of the actual full load current and voltage measurements for each phase of each motor, together with the nameplate current rating, overload element rating, and motor circuit protector setting, shall be submitted for approval in accordance with the provisions of the General Conditions.

D. System testing shall include complete circuit breaker tests for each power circuit breaker and complete thermal surveys of all new and existing electrical apparatus. Upon completion of all corrective measures required, certified acceptance reports, including satisfactory infrared photographs, shall be submitted for approval.

3.05 Spare Parts

A. The Contractor shall furnish, upon completion of the project, one year's supply of all consumable parts utilized within the electrical system.

B. Spare parts shall include pilot lights (minimum 12 of each part number), fuses (minimum 12 of each part number below 100 amps and 6 of each part number 100 amps and above).

3.06 Guarantees

A. All materials and workmanship shall be guaranteed to be free from defects. Any part of the system considered defective by the Engineer within the guarantee period shall be immediately replaced or corrected to the Engineer's satisfaction without further expense to the Owner.

B. Upon final completion, the Contractor shall furnish certification from each equipment manufacturer that all equipment has been installed in accordance with the requirements of

these specifications, is ready for permanent operation, and that nothing in the installation shall render the warranty null and void.

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SECTION 16150

ELECTRIC MOTORS

PART 1 - GENERAL

1.01 Description Of Work

A. In general, the work specified in this Section of the specifications includes the furnishing of all labor, material, and services necessary for the installation and placing in operation of all electric motors indicated or required for the proper operation of all mechanical equipment installed.

1.02 Submittals

A. Motor manufacturers' product literature, nameplate data, and outline drawings shall be incorporated into the appropriate shop drawing submittals of all associated equipment. Additionally, manufacturers' test reports shall be provided for each motor 100 hp and above.

PART 2 - PRODUCTS

2.01 General Requirements

A. All electric motors shall be built in accordance with current NEMA, IEEE, ANSI, and AFBMA Standards where applicable. Each motor shall be of the type and quality described by these specifications and/or as indicated on the drawings, fully capable of performing in accordance with the manufacturer's nameplate rating and free from defective material and workmanship.

B. Electric motors shall be of sufficient capacity to operate the driven equipment, under all load and operating conditions, without exceeding 85% of the motor's nameplate horsepower rating with service factor, and with-out exceeding its rated temperature limits.

C. Electric motors for variable speed applications shall be designed for operation at the rated maximum speed and at reduced speeds throughout the variable range, without overloading. Each variable speed motor shall be compatible with all associated control equipment and operating conditions including increased electromagnetic noise (harmonics).

1. Each motor for variable speed operation shall be equipped with internal temperature detectors, in addition to all accessory equipment recommended by the variable speed equipment manufacturer.

2. Electric motors for variable frequency drive applications shall be inverter duty rated in accordance with NEMA MG1 Part 31, and shall be capable of being continuously pulsed at the motor terminals with a voltage of 1600 VAC.

D. Unless indicated otherwise or required by the specific application, all electric motors shall be suitable for continuous operation at maximum load and required starting duty, in a 40°C ambient temperature, at an altitude not to exceed 3,300', in a moist and corrosive atmosphere.

E. Where indicated, or necessary to meet noise level requirements, electric motors shall be designed for quiet operation. Unless indicated otherwise, when operated at nameplate voltage and frequency the average overall sound pressure level on the A scale shall not exceed 85 ±3 decibels 5' from the motor, as measured in accordance with NEMA Standards.

F. All motors shall be furnished with permanent, highly visible stainless steel nameplates. Nameplates shall include all motor ratings, special features, and accessories.

G. All motors shall be furnished with oversize main terminal boxes. Motor terminal boxes shall be gasketed and shall allow rotation to accommodate conduit entrance. Motor terminal boxes shall be equipped with grounding lugs.

H. All motors shall be equipped with lifting lugs. All motor enclosures shall be equipped with stainless steel screens for all openings in accordance with NEMA Standards for guarded construction.

I. Motor output shafts shall be suitable for connection as required. Vertical hollow-shaft motors shall be equipped with non-reverse ratchets to prevent backspin.

J. Unless indicated otherwise, AC induction motors shall be manufactured by Baldor, Nidec, Reliance, TECO-Westinghouse, Toshiba, U.S. Motors, or equal.

2.02 Squirrel-Cage Induction Motors

A. General:

1. These specifications are intended to cover the functional requirements, features, and general construction of induction motors of the squirrel-cage, horizontal, vertical solid-shaft, vertical hollow-shaft, normal thrust, and high thrust type.

2. Each motor shall be IEEE-tested, NEMA-rated, premium efficiency energy-saving design, incorporating increased active electrical material and optimum electrical and mechanical design, to provide maximum operating efficiency and power factor. All motors shall be premium efficiency.

B. Rating:

1. When operated at nameplate voltage and frequency, squirrel-cage induction motors shall be rated normal or high starting torque, as required, low starting current not to exceed 600% full load current, low slip, 1.15 service factor, premium efficiency, and continuous duty at rated horsepower and rpm, with open drip-proof, weather-protected Type 1, totally-enclosed, fan-cooled, or explosion-proof construction, as indicated. Temperature rise shall be in accordance with NEMA Standards for the design employed.

2. Unless otherwise indicated, single speed, three phase squirrel-cage induction motors less than 50 HP shall be 200-230/460 volt, 3 phase, 60 hertz. Multi-speed motors, and motors 50 HP and larger shall be single voltage, as required.

3. Single phase squirrel-cage induction motors shall be split-phase or capacitor-start, rated 115/230-208 volt, 1 phase, 60 hertz.

C. Electrical Characteristics:

1. Each motor shall be suitable for full voltage starting and non-injurious heating when operated on power systems with a variation in voltage of not more than ±10% nameplate rating and a variation in frequency of not more than ±5% nameplate rating.

2. Locked rotor torque shall be at least 125% full load torque at 100% rated voltage. Output torque shall exceed the maximum full load torque requirements of the driven equipment by at least 20% throughout the full operating range of the driven equipment, from start to full load. Locked rotor torque, breakdown torque, and locked rotor currents shall be in accordance with NEMA Standards for the design employed.

3. Open drip-proof and WP-1 motors shall have a non-hydroscopic Class B insulation system treated with a minimum of 2 extra dips and bakes using 100% solid epoxy varnish.

4. TEFC and explosion-proof motors shall have a non-hydroscopic Class F insulation system and shall operate with a Class B temperature rise.

D. Mechanical Characteristics:

1. Motors, frames, and end shields shall be cast iron or heavy fabricated steel of such design and proportions as to hold all motor components rigidly in proper position and provide adequate protection for the type of enclosure employed. TEFC and explosion-proof motors shall be severe duty, all cast iron construction.

2. Windings shall be adequately insulated and securely braced to resist failure due to electrical stresses and vibrations. Winding and insulating materials shall consist of one or more of the following as dictated by the motor design: silicone rubber, polyester film, synthetic varnish, or glass cloth.

3. The shaft shall be made of high grade machine steel, or steel forging, of size and design adequate to withstand the load stresses normally encountered in motors of the particular rating. Bearing journals shall be ground and polished.

4. Rotors shall be made from high grade steel laminations adequately fastened together and to the shaft. Rotor squirrel-cage windings may be cast aluminum or bar type construction with brazed end rings.

5. Motors shall be equipped with vacuum degassed anti-friction bearings made to AFBMA Standards and be of ample capacity for the motor rating. The bearing housing shall be large enough to hold sufficient lubricant to minimize the need for frequent lubrication, but facilities shall be provided for adding new lubricant and draining out old lubricant without motor disassembly. The bearing housing shall have long, tight running fits, or rotating seals to protect against the entrance of foreign matter into the bearings or leakage of lubricant out of the bearing cavity. Thrust bearings shall be of ample capacity to carry the maximum thrust load of the driven equipment and the total weight of all revolving parts. Bearings of high thrust motors will be locked for momentary upthrust of 30% downthrust. All bearings shall have a minimum life rating of 5 years in accordance with AFBMA life and thrust values.
   a. For motor speeds 1800 rpm and below, double sealed bearings shall be used. The grease fitting shall be removed, and a plug inserted so that the motor does not get inadvertently greased.
   b. For motor speeds above 1800 rpm, single shielded bearings shall be installed with the shields facing the outboard (grease supply) side and open on the inboard (stator) side. Zert fittings shall be installed at the 12 o'clock position when viewed axially. Grease escape valve or purge plug shall be installed at the 6 o'clock position.
   c. The entry and exit paths for new and purged grease, respectively, shall enter and leave the bearing cavity on the outboard (shielded) side of the bearing (termed *conventional* grease flow design).
   d. The motor manufacturer shall provide a procedure for initial greasing and for re-greasing the motor bearings. Specific intervals with a specified quantity of grease per the bearing manufacturer's recommendations are required.

E. Accessories:

1. Each motor shall be equipped with all necessary accessories as recommended by the manufacturer for the intended service.

2. Where indicated or required, motors shall be equipped with space heaters. Each motor 10 HP and larger shall be equipped with space heaters. Space heaters shall be low voltage, 120 volt, single phase, with the leads brought out to the motor conduit box.

3. Where indicated or required, motors shall be equipped with thermal winding protection. Each motor 10 HP and larger shall be equipped with two normally closed automatic reset thermostats imbedded in the stator winding, between phases, and connected in series. The two leads shall be brought to the motor conduit box.

PART 3 - EXECUTION

3.01 General

A. Electric motors shall be supplied with the driven equipment, unless specified otherwise.

B. All fittings, bolts, nuts, and screws shall be plated to resist corrosion. Bolts and nuts shall have hex heads. All machined surfaces shall be coated with rust-inhibitor for easy disassembly.

C. The entire surface of each motor shall be treated with a final coating of chemical-resistant, corrosion- and fungus-protective epoxy enamel, over a red primer.

3.02 Installation

A. Motor Connections:

1. All motors shall be connected to the conduit system by means of a short section (18" minimum) of liquid tight flexible metallic conduit.

2. All motor feeders shall include a grounding conductor installed within the motor feeder conductor raceway, continuous from the motor starter to the motor conduit box. The motor feeder grounding conductors shall be properly terminated on each end with approved ground lugs and clamps.

3. Insulated mechanical polaris connectors shall be used for all motor feeder conductor connections to the motor leads. Connectors shall be UV rated, abrasion and chemical resistant, and specifically designed for the conductor material, stranding, etc.

3.03 Testing

A. All motors shall be tested prior to shipment in accordance with the standard short commercial test procedures to include the following: no-load current, check-current balance, winding resistance, measure air gap, high potential, and bearing inspections.

B. Upon completion, the Contractor shall provide all necessary instruments and special apparatus to thoroughly test the complete installation and shall conduct all tests that may be required to ensure system is free of all improper grounds and short circuits. All electrical equipment shall be tested to determine proper polarity, phasing, relay settings, and operation.

C. Prior to energization, the insulation resistance of each motor shall be tested in accordance with the motor manufacturer's recommendations. Upon completion of all corrective measures required, certified acceptance reports, including tabulations of all initial and final resistance measurements, shall be submitted for approval.

D. Each motor starter overload element, and each motor circuit protector, shall be selected and adjusted to coordinate with the nameplate full-load current and service factor of the actual motors installed. Improper units shall be replaced. Upon completion of all corrective measures required, certified compliance reports, including tabulation of the actual full load current and voltage measurements for each phase of each motor, together with the nameplate current rating, overload element rating, and motor circuit protector setting, shall be submitted for approval.

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SECTION 16200

ELECTRICAL GENERATION EQUIPMENT

PART 1 - GENERAL

1.01 Description of Work

A. In general, the work specified in this Section includes the furnishing of all labor, material, and services necessary to provide a complete and operable standby auxiliary electric generating set as shown on the drawings and specified hereinafter, including all fees, charges, and permits necessary.

B. The auxiliary electric generating set shall have the following minimum ratings:

1.	Rated RPM	1800	RPM
2.	Standby KW with fan	550	KW
3.	Standby KVA with fan	688	KVA
4.	SKVA with 30% voltage dip	1633	KVA

C. Basis of design: Caterpillar Model C18/LC7034F-PM.

D. Approved generator set manufacturers: Caterpillar, Onan, Tradewinds.

1.02 System Responsibility

A. The auxiliary electric generating set shall be the product of a supplier regularly engaged in the manufacture of this product and shall meet the requirements of the specifications set forth herein. Each auxiliary electric generating set shall be factory assembled and prototype tested. Major exceptions to specifications will be considered sufficient cause for rejection of the item.

B. To best serve the needs and interests of the Owner, it is the intention of these specifications to secure bids only on a standard auxiliary electric generating set which can be properly maintained and serviced without the necessity of the Owner carrying expensive parts stocks or being subjected to the inconvenience of long periods of interrupted service due to lack of available parts.

C. The engine supplier must have 24-hour parts service and factory-trained personnel available in the project's locality and must also be able to offer a full maintenance contract to the Owner. Availability of parts and service will be a factor in making the award.

D. The complete unit shall be sold and serviced from a single source.

1.03 Submittals

A. The Contractor shall furnish complete shop drawing submittals clearly identifying manufacturer's model numbers, equipment ratings, dimensions, weights, etc. for the entire generator set including all accessory equipment.

1. The shop drawings shall include detailed drawings identifying all installation points of connection including fuel lines, exhaust piping, starting battery cables, etc.

2. The shop drawings shall include detailed wiring diagrams and electrical schematic drawings clearing indicating all field connections.

B. The Contractor shall furnish copies of the manufacturer's certified final test records showing the performance of the generating set from no load to maximum load, indicating voltage and frequency regulation of the auxiliary electric generating set, and other information regarding its ability to perform as specified prior to approval.

C. The Contractor shall furnish to the Engineer for the Owner, bound copies of operational instructions and bound copies of the maintenance and overhaul data for the equipment furnished.

PART 2 - PRODUCTS

2.01 General Requirements

A. Each auxiliary electric generating set shall be a packaged power unit in which all necessary components are mounted on a common base with the exception of the instruments which, if indicated, shall be mounted separately.

B. The ratings of the electric set shall be based on standby duty operation of the unit, at rated generator RPM, in an ambient temperature of 110°F when equipped with all necessary operating accessories.

C. All materials and parts comprising the units specified herein shall be new and unused, of current manufacture, of the highest grade, and free from all defects or imperfections affecting performance. Only bids on a new and current model will be accepted.

D. Workmanship shall be of the highest grade in accordance with modern practice.

2.02 Diesel Engine

A. Each electric set shall be driven by a water-cooled, 4-cycle, full compression ignition, diesel-fueled engine. Engines for electric sets rated above 50 kw shall be turbocharged. Engines shall not exceed rated speed.

B. Fuel injection pumps and valves shall be a type not requiring adjustment in service. Fuel injection pumps shall be positive action, constant stroke pumps, actuated by a cam driven by gears from the engine crankshaft. The engine shall be equipped with an individual injection pump and valve for each cylinder. The engine shall be equipped with a built-in gear type, engine-driven fuel transfer pump.

C. Each engine shall be capable of rated operation on commercial grade No. 2 diesel fuel.

D. Each engine shall be equipped with removable wet type cylinder liners of heat-treated, close-grained alloy iron.

E. Each engine shall be equipped with a gear-type lubricating oil pump. Pistons shall be spray-cooled, and a suitable water-cooled, engine-mounted lubricating oil cooler shall be provided.

F. Each engine shall be capable of operation at idle or light loads for extended periods of time and shall provide for precombustion of fuel or a similar means for the prevention of carbonization.

2.03 Generator

A. Each generator shall be continuous duty, 0.8 power factor, brush-less type, with electrical characteristics as indicated. Each generator shall be single bearing construction with Class F insulation. Each generator shall incorporate cross current compensation for parallel operation and shall include a resettable thermal protector for exciter/regulator protection against extended low power factor loads.

B. Each generator shall be equipped with a unit mounted, volts-per-hertz type regulator provided to match the characteristics of the generator and engine. Voltage regulation shall be ±1% from no load to full load. Readily accessible voltage droop, voltage level and voltage gain controls shall be provided. Voltage level adjustment shall be a minimum of ±5%.

C. Each generator shall be a permanent magnet type (PMG) capable of producing 300% rated output for ten seconds on a short circuit condition. Bolt-on series boost options are not an acceptable.

D. Each generator shall be equipped with a 120/240 volt, 1 phase space heater.

E. Each generator shall be equipped with an oversized junction box of sufficient dimensions to facilitate conduit entrance and cable terminations.

2.04 Cooling System

A. Each engine shall be equipped with a cooling system having sufficient capacity for cooling the engine when the electric set is delivering full-rated load in an ambient temperature of 125°F. All cooling system equipment shall be of the type recommended by the engine manufacturer.

B. Each engine shall be equipped with a high capacity radiator and blower fan. Radiators for turbocharged gas engines shall be split-core type.

C. Each engine shall be equipped with an engine-driven centrifugal type water circulating pump and thermostatic valve to maintain the engine at recommended temperature level.

D. Intake louvers shall be sized to provide sufficient intake air for engine combustion and to provide required air flow through the radiator. Intake and discharge louver adequacy shall be verified by the electric set manufacturer prior to installation.

2.05 Accessories

A. Each engine and generator shall be close-coupled and mounted on a common welded steel base. The electric set shall be equipped with spring-type vibration isolators for mounting on a concrete foundation.

B. Unless indicated otherwise, each engine shall be equipped with an electric-sensing governor capable of isochronous frequency regulation from no load to full load.

C. Each engine shall be equipped with an electric starting system of sufficient capacity to crank the engine at a speed which will start the engine under rated operating conditions. The starting system shall provide for 4 crank cycles, 10 seconds on and 10 seconds off, each. The starting pinion shall disengage automatically when the engine starts.

D. Each electric set shall be furnished with a complete automatic battery/charger system including lead acid battery set, battery rack, current limiting battery charger, and all necessary cables, clamps, etc. Battery set shall be of voltage and capacity required for complete operation of the standby electric generating facilities including electric starting system and generator controls station power. Battery charger shall automatically recharge and maintain the battery set at full capacity and shall include a DC ammeter, DC voltmeter, DC low level alarm contact, and AC low level alarm contact. Charger shall be unit mounted and shall be suitable for operation at voltage indicated on the drawings.

E. Each engine shall be provided with anti-freeze and suitable engine-mounted, thermostatically-controlled, jacket water heaters to maintain engine coolant at manufacturer's recommended temperature level. Jacket water heaters shall be suitable for

operation at voltage indicated and shall be installed with isolation valves to facilitate maintenance.

F. Each engine shall be provided with an exhaust silencer of the critical grade. A flexible stainless steel exhaust adapter at least 18" long shall be furnished for the exhaust outlet to the muffler. Each silencer shall be equipped with exhaust elbow and rain cap. Exhaust pipe and silencer shall be sized according to the electric set manufacturer's recommendation, and shall be properly insulated to prevent heat rejection into the generator set operating atmosphere.

G. Each electric set shall be equipped with the following additional accessories:

1. Lubricating oil filters
2. Dry type air filters
3. Replaceable element fuel filters
4. Primary fuel filter/water separators
5. Fuel priming pumps

H. Each electric set shall be equipped with all additional accessories and circuitry modifications required to provide proper operation for supplying power to a high percentage of variable frequency drive equipment.

2.06 Instruments:

A. Each electric set shall be provided with a unit-mounted instrument panel including the following:

1. Fuel pressure gauge
2. Water temperature gauge
3. Lubricating oil pressure gauge

2.07 Controls

A. Each electric set shall be provided with a generator-mounted control panel as indicated. Control panels shall include the following:

1. AC voltmeter
2. AC ammeter
3. Ammeter-voltmeter phase selector switch
4. Frequency meter
5. Elapsed time meter
6. AUTOMATIC-OFF-MANUAL starting controls
7. Failure and alarm indicator lights
8. Main line circuit breaker
9. Single combination starter (remote radiator fans)

B. The automatic starting control system shall be completely interlocked to provide automatic operation, at the control panel, from a single pole contact.

B. Each electric set shall be equipped with a complete engine safety control system which shall provide alarm indication, automatically shut down the engine, and shut trip the main line circuit breaker in the event of any of the following:

1. Low oil pressure
2. High jacket water temperature
3. Overspeed
4. Overcrank

C. Each electric set shall be equipped with additional engine warning system which shall provide alarm indication in the event of any of the following:

1. Low coolant level
2. Low battery charge
3. Low fuel level
4. Fuel leak detection

D. Dry contact for remote “generator fault” alarm shall be provided at the generator control panel monitoring each of the engine safety control and alarm warning signals including generator not in auto and generator breaker not closed. The generator fault relay shall be normally energized from the generator battery power and shall de-energize during a fault condition. Additionally, a dry contact for remote "generator running" indication shall be provided. The generator running relay shall be energized when the generator is running.

E. Main line circuit breakers shall be inverse time delay, instantaneous magnetic trip molded case circuit breakers. Each breaker shall be provided with shunt trip and shall be rated as indicated.

2.08 Weatherproof Enclosure

A. Each generator set to be installed outdoors shall be equipped with A weatherproof enclosure of 16” wide x 0.080” thick x 2” deep marine grade aluminum modular construction, with stainless steel hardware. Roof construction shall be minimum 0.125 aluminum one-piece peaked design with no through bolt holes on a horizontal surface. A drip edge shall be provided on all four sides.

B. Each enclosure shall be equipped with gravity discharge louver and fixed intake louvers. All louvers shall be designed to help prevent the entrance of driving rainwater, but shall have sufficient free area to allow 120% of the total engine generator cooling air requirements.

C. The roof of each enclosure shall be reinforced as required to provide the capability of supporting the largest commercially-available exhaust silencer recommended by the manufacturer for the engine. A rain shield and drip collar shall be provided at each roof exhaust penetration.

D. Enclosure doors shall be strategically located to facilitate ease of maintenance and allow good access to and visibility of instruments, controls, engine gauges, etc. Doors shall be lockable with 3-point latches keyed alike and shall be fitted with bolt-on piano type hinges constructed with stainless steel hinge pins.

E. Each generator set enclosure shall be equipped with bolt-on entrance steps at each door entrance, and rodent screens over each louvered opening.

F. Each generator set enclosure shall be equipped with all required accessory equipment mounted inside the enclosure including two (2) 120 VAC weatherproof LED lighting fixtures with wall switch, two (2) 24 VDC emergency lighting fixtures with off timer, and a 20 amp duplex convenience receptacle.

G. A generator set accessory power distribution mini-power zone transformer and panelboard, rated minimum 10 KVA, 480 volt primary, 120/240 volts, 1 phase secondary, shall be installed inside each enclosure. Accessory panelboards shall be equipped with branch circuit breakers for each generator set accessory including the jacket water heater, battery charger, generator space heater, convenience receptacle, and enclosure interior lighting.

H. Upon final assembly, enclosures shall be prime painted with a minimum of two (2) coats of rust-inhibiting primer. The final finish painting shall be a minimum of two (2) coats of enamel with polar white finish.

PART 3 - EXECUTION

3.01 Tests

A. Before acceptance, each unit shall be given an on-site load bank test, at full load for a minimum of 4 hours, under the supervision of a service representative of the manufacturer during which the unit shall demonstrate its ability to deliver the specified capacity under all conditions which may be imposed in operation without overheating or excess vibration.

B. Proper operation and capability of the automatic transfer switch shall be demonstrated in compliance with the applicable portions of these specifications. Any defects or defective equipment revealed by or noted during the tests shall be corrected or replaced promptly without additional compensation.

C. Tests shall be repeated, if necessary, until results satisfactory to the Engineer are obtained. Any adjustments or corrections to the equipment shall be made by or under the supervision of the manufacturer's service representative.

D. Upon satisfactory completion of the tests, the Contractor shall furnish, certification from the manufacturer that the equipment has been installed in accordance with the requirements of these specifications and is ready for permanent operation and that nothing in the installation shall render the warranty null and void.

E. The entire fuel supply system, including storage tanks, shall be pneumatically tested to 5 psig for 12 hours minimum. The system shall maintain the specified test pressure within a tolerance of ±5% for the specified duration of the test.

3.02 Training

A. Prior to startup, the generator set manufacturer shall conduct a complete training program (minimum 1 day's duration) at the job site for a minimum of 4 Owner-selected operating personnel. The training program shall include operation, tune-up, preventive maintenance, and troubleshooting instructions relative to all aspects of the equipment provided, including associated appurtenances (battery equipment, fuel equipment, etc.).

B. The training program shall be scheduled a minimum of 14 days in advance. Proposed dates shall be submitted in writing for approval. The Owner may exercise the option to audio- or video-tape the entire training program without restriction.

3.03 Spare Parts

A. Each electric set shall be furnished with a set of spare parts and tools regularly supplied with the engine, including all tools of a special nature required to properly service the engine set.

3.04 Guarantee

A. The Contractor shall guarantee the equipment installed to be free from defective materials and workmanship. Any component which proves defective during the guarantee period shall be promptly repaired or replaced without additional compensation. The guarantee shall not apply to items normally consumed in service such as fuel and lubricating oil.

END OF SECTION

SECTION 16400

ELECTRICAL APPARATUS

PART 1 - GENERAL

1.01 Description Of Work

A. In general, the work specified in this Section of the specifications includes the furnishing of all labor, material, and services necessary to install the following material, including all fees, charges, and permits necessary.

1.02 System Responsibility

A. All major components of the electrical system shall be the product of one manufacturer. To ensure coordination, compatibility, and the maximum interchangeability of equipment items, the remaining components shall be provided by the major equipment manufacturer.

B. The manufacturer shall maintain a recognized engineering, servicing, and repair facility in the project locality.

1.03 Submittals

A. Complete wiring diagrams including coordination with instrumentation systems, generation systems, auxiliary control systems, etc., shall be approved prior to manufacture. Drawings shall be clear and carefully prepared to facilitate interconnections with other equipment. Standard drawings revised to indicate applicability shall not be acceptable.

PART 2 - PRODUCTS

2.01 General Requirements

A. All factory wiring shall be permanently numbered every 12".

B. The electrical apparatus shall be manufactured by Eaton, or pre-approved equal.

2.02 Motor Control Centers

A. Unless indicated otherwise motor control centers (MCC) shall be NEMA Class II, Type B, provided in NEMA 12 enclosures with open bottom panels and shall be UL-approved for use as service entrance equipment. Each lineup shall consist of vertical sections nominally 90" high, 20" deep, and 20" wide. Each lineup shall be provided with starter units, feeder units, main breakers, transfer switches, transformers, panelboards, control equipment, etc., as indicated on the drawings. Control equipment shall be provided as specified in Section 16900, Instrumentation and Control.

B. Each vertical section shall be fabricated of code gauge steel, reinforced and bolted together to

form a rigid, free-standing, completely enclosed assembly. Each section shall have a gray baked enamel final coat over a rust-inhibiting prime coat. Enclosure finish shall be suitably touched up, following installation, with a manufacturer's supplied spray. Unless approved otherwise, the final coat shall be ANSI 61 Light Gray.

C. Each vertical section shall be provided with a separate vertical wire trough door, a 12" horizontal wireway at the bottom, and a 6" horizontal wireway at the top. Each section shall have flange-formed covers on the rear and flange-formed doors with concealed hinges and quick release quarter-turn latches in the front. Unless approved otherwise, each vertical section shall be front-mounted only, completely front-accessible, and suitable for mounting against the wall. Each lineup shall be provided with continuous lifting angle and floor sills.

D. Power shall be distributed throughout the lineup by means of a 3-conductor, bolt-connected, edgewise-mounted, tin-plated copper bus bar system. Cable shall not be used on the load side of the main. Each lineup shall be provided with a continuous ground bus and, if indicated, a continuous neutral bus. Each bus shall be braced, and the entire motor control center rated, for the maximum available short-circuit fault current, minimum 42,000 amperes RMS symmetrical. The main horizontal bus shall be enclosed in an isolating compartment at the top of each vertical section. The main bus shall be rated as indicated on the drawings and shall not be rated less than 600 amperes. The vertical bus sections shall be sized for the total connected load and shall not be rated less than 300 amperes. The main horizontal bus, transfer switch bus, cable lugs, etc., and the full height of the vertical bus shall be isolated providing a complete, dead-front installation with glass-reinforced polyester barriers equipped with shutter mechanisms for stab openings. Each ground bus shall be rated for the total capacity of the lineup and shall not be rated less than 300 amperes. When provided, each neutral bus shall have 50% of the full capacity of the main horizontal bus and shall be connected to the ground bus by a removable link.

E. Each unit compartment shall be provided with an individual front door, interlocked mechanically with the unit disconnect device to prevent opening the door with the unit energized, or energizing the unit with the door open. Unit disconnect device handles shall indicate the ON, OFF, TRIPPED, and RESET positions and shall be provided with means for padlocking in the OFF or ON positions. Each unit compartment, including door, shall be individually removable without disturbing adjacent units. Unless approved otherwise, all units shall be of drawout construction with a positive guidance system to insure positive stabbing into the vertical bus. Unit stabs shall be tin-plated copper. Each unit compartment shall be provided with a door-mounted engraved nameplate attached with removable fasteners.

F. Each motor starter unit shall be the combination type complete with molded case motor circuit protector; magnetic starter; manual resetting, 3-pole, bi-metallic thermal overload relay; individual 120 volt control power transformer; door-mounted pilot control devices, indicators, and instruments; and required accessory control relays, alternators, etc.

1. Each motor starter or contactor coil shall be equipped with a transient suppressor to limit high voltage transients.

2. Overload element ratings shall be individually selected and adjusted in the field to coordinate with the equipment connected.

3. Motor starters for submersible motors shall be equipped with ambient-compensated, bi-metallic, quick-trip type overloads.

4. Control power transformers shall be fused on both primary leads and one secondary lead with the remaining lead grounded and shall be sized for the entire control circuit, including motor space heaters and all additional remote auxiliary devices.

5. Motor circuit protectors shall be quick-make, quick-break, molded case air circuit breakers with adjustable instantaneous trip. Instantaneous trip settings shall be individually adjusted in the field to coordinate with the equipment connected.

6. Each unit shall be provided with 2-piece drawout terminal boards, for load and control terminals. The field terminal board component shall be mounted adjacent to the wiring trough.

7. As indicated on the drawings, starters shall be full voltage, across-the-line type, or reduced voltage autotransformer closed transition type, connected on the 65% tap, unless noted otherwise. Starters shall be reversing or non-reversing as indicated.

8. Multi-speed starters shall have compelling relays which require starting at lowest speed and prevent instantaneous transition between speeds.

9. Starter unit size and ratings shall be coordinated with the equipment supplied. Units of the same size shall be interchangeable.

10. In addition to contacts required, all starter units shall be provided with 2 spare N.O. and N.C. auxiliary contacts.

G. Solid-state reduced voltage motor starters shall consist of three sets of two inverse-parallel connected SCR's with a complete microprocessor based electronics package to provide soft start and smooth stepless acceleration to full speed. Unless otherwise indicated, or required by the application, each solid-state reduced voltage starter shall provide individually adjustable acceleration and deceleration control (0 - 120 seconds). Each starter shall provide adjustable pump control algorithm. Each starter shall be equipped with voltage transient protection (thermostat, MOV, and RC protection of each pole), shorted SCR protection, and single phase protection. Each starter shall be equipped with a 3 phase temperature-compensated solid-state motor overload protection relay. Each starter shall be fan-cooled and shall be rated 115% FLA continuous duty and 300% FLA for a minimum of 30 seconds. Each starter shall be equipped with a fault indication pilot light and auxiliary contact for remote indication of fault condition. Unless indicated otherwise, each solid-state motor starter shall include fully rated isolation contactor and bypass shorting contactor. Each solid-state motor starter shall automatically resume normal operation following a power outage.

H. Feeder units shall be equipped with molded case air circuit breakers, unless indicated otherwise. Breakers shall be quick-make, quick-break, with trip-free operation, incorporating an internal trip bar and a single external handle. Breakers shall be thermal magnetic type rated not less than

35,000 amperes RMS symmetrical. Breakers rated above 150 amperes shall be provided with interchangeable trips. Breakers shall be provided with control accessories, such as shunt trip, auxiliary contacts, etc., as indicated or required for proper interlocking and operation.

I. Unless specified otherwise, main breakers shall be as specified for feeder breakers; however, main breakers shall be 100% rated, UL-approved for use as service entrance equipment, and shall be fully rated for the maximum fault current, without the use of current limiters. Each main breaker shall be equipped with a completely self-contained temperature insensitive automatic trip unit with selective tripping characteristics including adjustable long time setting, adjustable long time delay setting, adjustable short time setting, adjustable short time delay setting, adjustable instantaneous setting, and ground fault protection systems. Each main breaker shall be equipped with auxiliary contacts for remote indication of breaker status and overcurrent trip.

J. Power monitoring units shall be complete microprocessor-based circuit monitors for each incoming line, and selected feeders as indicated. Power circuit monitors shall be equipped with data communications port, communications interface modules, protocol converters, etc. as required for remote monitoring from the Owner's standard monitoring system. Power circuit monitors shall continuously monitor and display 3 phase current, voltage, power factor, frequency, watthours, varhours, demand current, and demand power, and shall store historical maximum and minimum data for each parameter monitored.

2.03 Automatic Transfer Switches

A. Automatic transfer switches, with electrical ratings as indicated, shall consist of a power transfer module and a control module, interconnected to provide complete automatic operation. Automatic transfer switches shall be Instantaneous and Short Time rated in accordance with the installation requirements. Each automatic transfer switch shall be mechanically-held and electrically-operated by a simple, over center mechanism energized from the source to which the load is to be transferred. The switch shall be rated for continuous duty, double throw, with mechanically interlocked center off position for load decay. The switch shall provide an adjustable time delay after opening of the closed contacts and before closing of the open contacts for transferring large motor and transformer loads. The automatic transfer switch shall be suitable for use with emergency or auxiliary source provided.

B. Unless otherwise indicated, automatic transfer switches shall be 4-pole with overlapping switched neutral pole. All transfer switch main contacts shall be segmented silver tungsten alloy contacts with separate arcing contacts, arc quenching grids, enclosed arc chambers and wide contact air gap. Sensing and control relays shall be continuous duty, industrial grade type, with a minimum contact rating of 10 amperes. Transfer switches shall utilize solid-state sensing on normal and emergency, including close differential voltage sensing on all phases of the normal source.

C. Transfer switch operation shall be adjusted to coordinate with the emergency source provided. Upon failure of the normal source, a voltage drop below the predetermined (75%-98% adjustable) nominal voltage shall initiate a time delay period (0-5 minutes adjustable) prior to closing the engine start signal contact. When the emergency source builds up to the predetermined (85%-100% adjustable) nominal voltage and (90%-100% adjustable) nominal frequency, the transfer switch shall momentarily transfer to the center open position (0-5 minutes adjustable) then

complete transfer operation to the emergency source. Upon restoration of the normal source, a time delay (0-30 minutes adjustable) shall delay the transfer back to the normal source. Following the re-transfer time delay, the transfer switch shall momentarily transfer to the center off position (0-5 minutes adjustable) then complete re-transfer operation to the normal source. Re-transfer time delay shall be automatically bypassed if emergency source fails. Following the transfer back to the normal source, a timer (0-30 minutes adjustable) shall provide an unloaded engine cool-down period prior to engine shutdown.

D. Each transfer switch shall be provided with the following:

1. Pilot lights to indicate the position of transfer switch.

2. Bypass switch to immediately bypass the time delay in re-transferring to normal.

3. AUTOMATIC-OFF-TEST switch to control operation of emergency source and transfer switch.

4. Engine start contact closes to start emergency electric set.

5. Auxiliary alarm dry contact closes following delay on normal source failure.

6. Auxiliary reversible dry contacts operate when transfer switch is in the normal position. Contacts shall be provided as indicated.

7. Auxiliary reversible dry contacts operate when transfer switch is in the emergency position. Contacts shall be provided as indicated.

8. Auxiliary reversible dry contacts operate when normal source is available. Contacts shall be provided as indicated.

9. Auxiliary reversible dry contacts operate when the emergency source is available. Contacts shall be provided as indicated.

10. Auxiliary time delay relay (0-60 seconds adjustable) with contacts to open each facility motor control circuit prior to operation of the transfer switch in either direction.

11. Generator set exercising timer to automatically operate generator set with load (adjustable 7-day cycle, 15-minute incremental repeat cycle timer).

E. Unless otherwise indicated or required for the specific installation, transfer switch enclosures shall be NEMA 12 enclosures with gray baked enamel over a rust-inhibiting primer finish. Enclosures for transfer switches located outdoors or in corrosive atmospheres shall be NEMA 4X stainless steel.

F. Transfer switches mounted within switchboards or motor control centers shall be bus connected to the normal source bus and load bus.

G. Automatic transfer switches shall be ASCO 7000 ADTS or pre-approved equal.

2.04 Variable Frequency Drives

A. To ensure coordination, compatibility, and maximum interchangeability with the Owner's existing standardized equipment, all variable frequency drive equipment shall be Eaton PowerXL DG1 with 5% DC link choke and 3% output line reactor, or pre-approved equal.

B. Each variable frequency drive shall control the speed of a standard squirrel-cage induction motor by controlling the frequency applied to the motor and shall be designed to operate from a local manual speed potentiometer or remote automatic speed reference signal. The variable frequency drive shall convert incoming 3 phase AC power to a variable potential DC and then to variable frequency AC by use of a full-wave diode bridge converter with line power factor in excess of 0.95 regardless of speed and load, and a 3 phase insulated gate bipolar transistor power module inverter with sine-coded pulse width modulated output.

C. Variable frequency drives shall have a 110% continuous full nameplate current overload rating, and 150% for 60 seconds. Variable frequency drives shall be oversized where necessary to meet these current overload rating requirements.

D. Each drive shall be contained within a gasketed, force-ventilated, free-standing motor control center style enclosure. Enclosures shall be equipped with replaceable filters.

E. Each drive shall be equipped with input circuit breaker, output contactor, 3 phase temperature-compensated solid-state motor overload protection, and fault protection and indication as follows:

1. Softstall
2. Current limit
3. Overcurrent
4. Overvoltage
5. Short-circuit at load
6. Load-side ground fault
7. Undervoltage
8. Momentary power failure
9. Electronic thermal overload protection
10. Overtemperature
11. Overfrequency

F. Each drive shall be equipped with the following system interfaces:

1. Auxiliary dry contacts for indication of drive operation

2. Auxiliary dry contacts for indication of drive fault

3. Isolated process control speed reference signal

4. Digital diagnostic display for indication of drive diagnostic information

5. Addressable serial communications link to allow drive programming, monitoring, and control

G. Each drive shall provide independently adjustable acceleration (6-75 seconds), deceleration (6-75 seconds), minimum speed (70%-90%), maximum speed (75%-100%), and current limit (100%-120% FLA). All programmable parameters shall be adjustable from a door-mounted digital operator keypad.

H. Each drive shall automatically restart and resume normal operation following a power outage.

I. Instrumentation Signal Controlled Systems: Each variable speed pump control system to be controlled by a remote instrumentation signal shall be equipped with all necessary logic and control apparatus to provide the intended automatic mode of operation:

J. All VFDs shall be equipped with drive output line conditioning as required to protect the connected motors from reflected wave high voltage impulses.

K. All VFDs while operating at rated load shall limit harmonic current and voltage distortion in accordance with the recommendations of the latest edition of IEEE 519 for general systems during operation from the utility source and for dedicated systems during operation from the standby generator source. The VFD manufacturer shall provide harmonic filtering equipment required to meet this distortion limit and shall submit calculations to demonstrate compliance for drives operating from both sources.

L. Before shipment, each VFD shall undergo a minimum 24-hour factory burn-in test. Each VFD shall be burned in at 100% inductive or motor load for 24 hours without an unscheduled shutdown. Copies of factory test reports shall be submitted with final drawings.

2.05 Power Systems Study

A. The Contractor shall furnish bound copies of a power system report which shall include the following:

1. Arc Flash Study in accordance with IEEE Standard 1584 and NFPA 70E. The study shall calculate the incident energy and flash protection boundary at all locations within the electrical distribution system (motor control centers, automatic transfer switches, panelboards, etc.).

2. Short Circuit Study, in accordance with ANSI C37.010-latest, should be performed to check the adequacy and to verify the correct application of circuit protective devices and other system components specified. The study shall address the case when the system is being powered from the normal source as well as from the on-site generating facilities. Minimum, as well as maximum, possible fault conditions shall be adequately covered in the study.

3. Protective Device Coordination Study, with coordination plots of key or limiting devices,

plus tabulated data including ratings or settings selected. In the study, a professional engineering balance shall be achieved between the competing objectives of protection and continuity of service for the system specified taking into account the basic factors of sensitivity, selectivity, and speed.

4. Motor Starting Study, for each large motor and for the largest motor served from each motor control center, to determine voltage dip or power inrush limitations at selected locations due to motor starting.

B. The Contractor shall warrant the exercise of professional competence in the performance of the specified studies to be provided by the major equipment manufacturer or a qualified expert. The Contractor shall obtain and verify all information necessary to perform the specified studies including utility company service data, generating equipment service data, motor data, existing equipment ratings, etc.

C. Upon completion, the Contractor shall provide written verification of final relay and trip settings as recommended by the system studies or otherwise approved.

D. The major equipment manufacturer shall provide machine printed 4 x 6 inch thermal transfer type labels of high adhesion polyester for each location identified in the arc flash study, for field installation by the Contractor.

PART 3 - EXECUTION

3.01 Service and Training

A. The major equipment manufacturer shall provide support and technical direction of installation, energization, and operation of the electrical equipment. Experienced field service engineering personnel shall be available at the job site, as needed, to provide the following factory service:

1. Recommended procedures for checks and tests.

2. Assist in solving erection problems by making critical checks and necessary adjustments.

3. Supervise necessary operational tests, verify, and document test results.

4. Perform final inspection of installed equipment.

5. Participate in initial energization.

6. Check and test all relays for proper operation. Contractor shall set relays as directed by the Engineer and shall submit a list of "as-left" settings.

7. Provide revised factory drawings on an "as-built" basis.

8. Conduct complete operation and maintenance training program (minimum 1 days' duration) at the job site for a minimum of 4 Owner-selected operating personnel, prior to startup.

B. Upon completion, final approved as-built wiring diagrams shall be permanently fastened inside the enclosure doors of each SWB section, MCC cubicle, etc. Wiring diagrams shall include all local and remote interconnections, in detail.

C. Prior to startup, the variable speed drive manufacturer shall conduct a complete training program (minimum 1 days duration) at the job site for a minimum of 4 Owner-selected operating personnel. The training program shall include operation, preventive maintenance, and troubleshooting instructions relative to all aspects of each variable speed drive system provided.

D. Each variable speed drive manufacturer shall provide complete drive operation and maintenance manuals.

E. Each training program shall be scheduled a minimum of 14 days in advance. Proposed dates shall be submitted in writing for approval. The Owner may exercise the option to audio- or video-tape each entire training program without restriction.

END OF SECTION

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SECTION 16600

GROUNDING SYSTEM

PART 1 - GENERAL

1.01 Description Of Work

A. In general, the work specified in this Section of the specifications includes the furnishing of all labor, material, and services necessary to install the following materials, including all fees, charges and permits necessary.

1.02 General Requirements

A. The project's grounding system shall consist of a grounding electrode system in accordance with NEC specifications, bonded to a main ground bus interconnecting all power distribution equipment. Ground rods shall be located at each service connection, transformer pad, generator pad, outdoor electrical equipment pad, and as indicated or required, and shall be bonded to the main ground bus. Ground rod sections shall be coupled and driven to establish a maximum resistance to ground of 5 ohms throughout the grounding system.

1.03 Lightning Protection

A. The Contractor shall modify and expand the existing Site Lightning Protection System using Early Streamer Emission (ESE) Air Terminals as manufacturer by Lightning Preventor of America, a Division of Heary Brothers Lighting Protection Company.

1.. In accordance with CCUA standards, the ESE site lightning protection system shall be modified and expanded by Windemuller Technical Services (941-355-8822), Sarasota, Florida, or pre-approved equal.

B. Lightning protection system installations shall be in accordance with the *Manufacturer's Installation Standard for Lightning Protection Systems Using Early Streamer Emission Air Terminals HBP-21*.

C. Applied Research Laboratories, Inc., (ARL) an independent, nationally recognized testing laboratory, shall list the components, inspect, and certify the installation of the lightning protection systems for compliance with HBP-21.

D. Provide all labor, material, equipment and services to perform all operations required for installation of a complete lightning protection system for the new facilities.

E. Shop drawing submittals for the lightning protection systems shall include the proposed location of ESE air terminals, masts, conductors, installation procedures and details. Manufacturer's data sheets on all components, accessories and miscellaneous equipment shall also be submitted.

F. The system, including the air terminals, conductors, masts, and complementary parts shall be installed so that the completed work is unobtrusive and does not detract from the appearance of the buildings and structures.

G. The complete lightning protection system shall be fully tested in the presence of the Engineer. The ground resistance of the completed system shall be measured using IEEE "Fall of Potential Method". Ground resistance shall be (5) ohms or less.

H. ESE certification form shall be completed and forwarded to the ESE manufacturer for evaluation, certification, archiving and documentation. A Lighting Preventor of America Certificate of Guarantee, and an ARL Certification shall be provided upon completion of the installation.

1.04 Surge Protection

A. The Contractor shall furnish and install UL 1449 (latest edition) listed surge protection devices (SPD) for the protection of all AC electrical circuits from the effects of lightning-induced currents, substation switching transients, and internally-generated transients from inductive and/or capacitive load switching. Surge protection devices shall be provided for all switchgear, switchboards, motor control centers, power distribution panels, lighting panels, control panels, instrumentation panels, etc.

B. Each SPD unit shall be marked with a short circuit current rating and shall not be installed at a point on the system where the available fault current is in excess of that rating.

C. Complete UL 1449 performance ratings, including the fault current rating and VPR rating, shall be posted on the UL label of each SPD.

D. Submit copies of the UL Standard 1449 Listing documentation for each proposed SPD.

PART 2 - PRODUCTS

2.01 Grounding

A. Ground rods shall be minimum 10 feet long, 5/8-inch diameter, copper-clad steel sections.

B. Main ground bus cable shall be minimum No. 4/0 (19 strand, tinned copper). Bonding jumpers shall be minimum No. 2. Unless noted otherwise, all grounding conductors shall be insulated and shall have green colored insulation.

C. All grounding hardware such as clamps, connectors, couplings, lugs, bolts, nuts, and washers shall be of silicone bronze.

2.02 Lightning Protection

A. Air terminal assemblies shall consist of an ESE air terminal, 5/8" diameter x 12" long with housing.

1. Unless otherwise indicated air terminals shall be LPA-2005 early streamer emission air terminals.

2. Air terminals and masts shall be provided at designated locations shown on the plans, and at additional locations required to meet the project certification requirements.

B. Air terminal masts shall be stainless steel mast with threaded connection for the ESE air terminal and bonding plate for cable connection. Wind and safety factors shall be documented for the geographic area of installation, to determine the size and structure of mast. Base supports shall be stainless steel construction. Base supports shall be dependent upon application. The proposed base support for each mast shall be submitted for approval.

C. Lightning protection conductors shall be 28 strand copper rope lay wire. Conductors for the 20' masts at the tanks shall be 14 gauge with a minimum net weight of 375 pounds per 1,000 feet. Conductors for the 10' masts at the buildings shall be 16 gauge with a minimum net weight of 225 pounds per 1,000 feet.

1. Counterpoise ground ring shall be similar size as the largest lightning protection conductor, or larger.

2. All conductors shall be secured every 3'-0" maximum. Fasteners and clops utilized shall be the same material as the material being secured. Bare aluminum or copper material shall not be installed on dissimilar metals.

3. Conductors shall be installed to always have a horizontal or downward path, free of "U" and "V" pockets. No bend of a conductor shall form an included angle of less than 90 degrees or have a radius of bend less than 8 inches.

3. Down conductors shall be installed within PVC conduit sleeves.

2.03 Surge Protection

A. AC power surge protection devices (SPD), formally transient voltage surge suppressors (TVSS), shall utilize heavy duty 'large block' MOVs, each exceeding 30mm diameter, with redundant modules per phase. SPD equipment shall provide suppression elements between all phases and each phase conductor and the system neutral. AC power surge protection equipment shall be APT, or equal.

B. SPD shall be UL labeled as Type 1, intended for use without need for external or supplemental overcurrent controls. Every suppression component of every mode, including N-G, shall be protected by internal overcurrent and thermal overtemperature controls. SPDs relying upon external or supplementary installed safety disconnectors do not meet the intent of this specification.

C. SPD shall be UL labeled with 200kA Short Circuit Current Rating (SCCR). Fuse ratings shall not be considered in lieu of demonstrated withstand testing of SPD, per NEC 285.6.

D. SPD shall be UL labeled with 20kA I nominal (I-n) for compliance to UL 96A Lightning Protection Master Label and NFPA 780.

E. Minimum surge current capability (single pulse rated) per phase shall be:

Service Entrance Equipment:	300kA
Power Distribution Equipment:	200kA
Panelboards & Control Panels:	100kA

F. SPD shall provide surge current paths for all modes of protection: L-N, L-G, and N-G for Wye systems; L-L, L-G in Delta and impedance grounded Wye systems.

G. UL 1449 Listed Voltage Protection Ratings (VPRs) shall not exceed the following:

System Voltage	L-N	L-G	L-L	N-G
208Y/120	700V	700V	1200V	700V
480Y/277	1200V	1200V	1800V	1200V

Numerically lower is allowed/preferred; old-style Suppressed Voltage Ratings (SVRs) shall not be submitted, nor evaluated due to outdated less-strenuous testing)

H. UL 1449 Listed Maximum Continuous Operating Voltage (MCOV):

System Voltage	Allowable Voltage	MCOV
208Y/120	25%	150V
480Y/277	15%V	320V

I. SPD shall have UL 1283 EMI/RFI filtering with minimum attenuation of -50dB at 100kHz.

J. SPD shall include visual LED diagnostics including a minimum of one green LED indicator per phase, and one red service LED. SPD shall include an audible alarm with on/off silence function and diagnostic test function (excluding branch).

K. Warranty – Each SPD shall have a warranty period of not less than 10 years, incorporating unlimited replacements of suppressor parts if they are destroyed by transients during the warranty period.

PART 3 - EXECUTION

3.01 Grounding

A. The concrete-encased steel reinforcement within the foundation of each structure shall be grounded, with a minimum of one 20-foot ground rod, at each corner column and at intermediate columns at distances not to exceed 60 feet. The main ground bus shall be interconnected to each ground rod throughout the structural grounding system with a continuous tinned copper cable loop, minimum No. 4/0 (19 strand), buried 30 inches below grade and 24 inches outside the structural footing.

B. A minimum of one 20-foot ground rod shall be located within each manhole and handhole. The main ground bus shall be interconnected to each ground rod throughout the underground ductbank system with a continuous tinned copper cable, minimum No. 4/0 (19 strand), encased within the ductbank concrete envelope.

C. All grounding connections shall be made in the same manner as current carrying connections are made with bolted clamps and solderless connectors. All underground grounding system connections, cable-to-cable, cable-to-ground rod, etc., shall be made with exothermic-fused connections. Contact surfaces shall be equal in area to those of current carrying connectors. All contact surfaces shall be thoroughly cleaned before connections are made.

D. All ground connections shall be made with connectors or lugs approved for the specific type of connection.

E. Insulated-type grounding bushings shall be used for all metallic conduit terminations.

F. Permanent and effective ground connections shall be provided for transformer secondary neutrals.

G. The metallic frame of each motor, generator, transformer, panelboard, lighting fixture, outlet box, control equipment enclosure, etc. shall be grounded to the ground bus of the power distribution equipment with an insulated grounding conductor included in the feeder or branch circuit conduit.

H. The base of each street or area lighting standard shall be grounded to a ground rod driven into the ground near the base of the standard and to a separate ground wire run with the feeder. Ground rods shall be driven so that the top is 6 inches below finished ground grade. When the foundation is placed, a suitable ground wire shall be embedded in the concrete to facilitate connection to the base on the inside.

I. Installed ground cables shall be protected from subsequent mechanical damage. Sleeves shall be provided in foundation walls and in floors to facilitate installation of ground cables. Where ground cables enter buildings through sleeves, the sleeves shall be sealed with jute packing and approved sealing compound.

3.02 Lightning Protection

A. The complete lightning protection system including ESE air terminals, masts, conductors, etc. shall be installed so that the completed work is unobtrusive and does not detract from the appearance of each building and structure.

B. All work installed in accessible locations shall be properly guarded and protected.

C. All material shall be installed in a manner to prevent electrolytic action under presence of moisture.

D. All roof, wall or other structure penetrations shall be made in a manner to prevent the ingress of water or moisture. All proposed penetrations must be submitted for approval.

E. It shall be the responsibility of the lighting protection system installation contractor to assure a sound bond to the project's main grounding system and all other site ground systems. The lighting protection system shall be bonded to the project's grounding system at each ESE mast downlead cable. A minimum of three ground rods spaced 10 feet apart shall be bonded to the project's grounding system at each downlead cable connection.

F. Upon completion of the lighting protection system installation, the installation contractor shall submit copies of as-built shop drawings which shall include ground resistance test reports. The as-built shop drawings shall include a video of the installation, including but not limited to each air terminal, mast mounting, bonding connections, down conductors, ground grids and all buried, concealed or inaccessible connections and components.

3.03 Surge Protection

A. Surge protection devices (SPD) shall be provided for all switchgear, switchboards, motor control centers, power distribution panels, lighting panels, control panels, instrumentation panels, etc.

B. Service Entrance - Each SPD installed on service entrance equipment shall be replaceable modular construction. A UL approved disconnect switch shall be provided as a means of servicing disconnect if a 60A breaker is not available.

C. Power Distribution - Each SPD installed on switchboards or motor control centers shall be replaceable modular construction. Each SPD shall have an independent means of servicing disconnect such that the protected power distribution equipment remains energized. A 30A breaker (or larger) may serve this function.

D. Sub Panels - Each SPD installed on power distribution panelboards, lighting panelboards, control panels, unit equipment, etc. shall be encapsulated construction.

E. SPD equipment shall be installed per manufacturer's installation instructions with lead lengths as short (less than 24") and straight as possible. Gently twist conductors together.

F. Installer may reasonably rearrange breaker locations to ensure short & straightest possible leads to SPDs.

G. SPD shall be installed on the load side of the main service disconnect.

H Before energizing, installer shall verify service and separately derived system Neutral to Ground bonding jumpers per NEC.

I. Status indication pilot lights for each SPD shall be remote mounted and shall be visible from the front of the protected equipment enclosure.

END OF SECTION

SECTION 16900

INSTRUMENTATION AND CONTROL

PART 1 - GENERAL

1.01 Description of Work

A. In general, the work specified in this Section of the specifications includes the furnishing of all labor, material, and services necessary to install the instrumentation, control and monitoring systems, including all fees, charges, and permits.

B. As specified in Section 16000, Electrical Work - General, the Contractor shall furnish and install conduit, wiring, and connections for equipment and devices furnished under other sections of the specifications or under other contracts. The Contractor shall also install motor starters, switches, and other electrical equipment furnished under other sections or under other contracts.

C. The Contractor shall refer to the mechanical specifications and drawings for locations of pressure-operated control switches, float switches, solenoid-operated valves, limit switches, alarm actuating contacts, and other devices requiring wiring.

D. The Contractor shall make all interconnections required between transmitters, receivers, control panels, and miscellaneous devices, and shall provide for electrical supply to metering and signal systems.

E. All conduit and wiring between electrical and instrumentation panels, all field-mounted devices, and power sources shall be furnished and installed as required for a complete operable system.

F. Unless otherwise indicated, all electrical equipment and installation shall be in accordance with Section 16000, Electrical Work - General.

1.02 System Responsibility

A. To insure coordinated control systems, to properly achieve the indicated functions, and to provide a maximum interchangeability of equipment items and parts, the complete instrument and control system shall be furnished by a single Instrumentation System Contractor/Supplier who shall be responsible for the satisfactory operation of the system.

1. The Instrumentation System Contractor/Supplier shall be a CCUA prequalified and preapproved instrumentation, control and SCADA system supplier, contractor, integrator and panel builder with previous successful direct project experience on multiple SCADA system projects: Curry Controls, Inc., Revere Controls, Sun State Systems, or pre-approved equal.

B. The system contractor/supplier shall maintain permanent in-house system engineering and fabrication facilities including a quality assurance organization with the capability to perform complete system checkout and simulation in the shop prior to shipment.

C. The system contractor/supplier shall maintain a permanent field service engineer for maintenance service.

D. The system contractor/supplier shall perform all system engineering, prepare all necessary internal and external wiring and piping drawings, and assume full responsibility with the performance requirements of these specifications, and as required for a complete and operable facility.

E. The instrumentation equipment locations and conduit drawings are diagrammatic to show the general scope and route of instrumentation system conduit. The Instrumentation System Contractor/Supplier shall provide all conduit and wiring necessary for his specific requirements, in accordance with these specifications, and without additional cost to the Owner.

F. The Instrumentation System Contractor/Supplier shall be responsible for providing all applications programming and configuration services to accomplish the control and monitoring functions described in the Specifications and Contract Drawings.

G. Provide all programming functions including, but not limited to, any control strategies and communications. The Instrumentation System Contractor/Supplier shall also provide all application programming and configuration services necessary to produce the HMI graphic displays, reports, trends, historical archive, etc. as described in the Specifications and Contract Drawings.

H. Perform all system engineering, prepare all necessary internal and external wiring and piping drawings, and assume full responsibility with the performance requirements of these specifications, and as required for a complete and operable facility.

I. Coordinate the control systems for proper operation with related equipment and materials furnished by other suppliers under other sections of these specifications and with related existing equipment.

J. Auxiliary and accessory programming structures necessary for system operation or performance shall be included whether or not they are specified or shown on the contract drawings.

K. All equipment shall be controlled in full conformity with the specifications, drawings, engineering data, instructions and recommendations of the equipment manufacturer.

L. To facilitate the Owner’s future operation and maintenance requirements, all programming and operator interface development shall match the form and function of the existing CCUA standards:

M. The Instrumentation System Contractor/Supplier shall coordinate and schedule all testing procedures with the General Contractor.

1.03 Submittals

A. The Contractor's attention is directed to the requirements of the general contract conditions with regard to submissions for approval. In order to facilitate review and approval of the proposed system, shop drawing submittals shall be made in two steps. The first submittal shall include all in-line devices such as flow meters, control valves, etc., to be supplied or coordinated with the instrumentation system. The second submittal shall include complete details of the instrumentation system.

B. Shop drawing submittals shall include the following:

1. Field Instrument Submittal

   a. Instrument data sheets indicating all pertinent data including complete model number, and description of each option and accessory.
   b. Each instrument shall be identified by tag number and nomenclature as indicated on the drawings and in these specifications.

2. System Hardware Submittal

   a. Complete front panel view with component locations, subpanel view with component locations, and electrical schematics.
   b. Functional description of the entire system including individual loop diagram descriptions.
   c. Detail loop diagrams showing both piping and wiring requirements for each analog instrument loop in the system.
   d. Component drawing for each component showing dimensions, mounting, and external connection details.
   e. Detail layout, dimensions, fabrication, piping, and wiring schematic, connection, and interconnection drawings for each instrumentation panel, graphic display, termination cabinet, etc.
   f. Component manufacturing data sheet for each component indicating pertinent data and identifying each component by item number and nomenclature as indicated on the drawings and in these specifications.

3. System Software Submittal

   a. Preliminary Graphics Submittal
   b. Process Control Strategy, Graphic Screen and Reports Submittal

C. Preliminary Graphics Submittal: The preliminary graphics submittal shall be reviewed at first coordination meeting and shall include the following:

1. Standard symbols
2. Standard color conventions to be used for pumps, valves, filters, pipe colors, equipment on and off, alarm status colors, etc.
3. Sample HMI graphic displays
4. Sample equipment interface popup displays

5. Alarm display descriptions
6. Alarm acknowledge descriptions

D. Process Control Strategy, Graphic Screen and Reports:

1. The Instrumentation System Contractor/Supplier shall hold all necessary meetings at the project site and CCUA office building to solicit the Owner and Engineer's input prior to submitting the process control strategies and operator interface submittals. These meetings shall also be used to establish standards for developing the database, trends, graphics, reports and control strategies.

2. The process control strategies shall be developed in a functional block (logic) diagram presentation based on information from the specifications and drawings. Included with each diagram shall be:

   a. A short narrative of the control strategy
   b. Any assumptions made in developing the program
   c. I/O database list showing all field inputs and output signals or data points associated with the control strategy
   d. Cross-reference list of all I/O showing to which I/O modules or software modules they are linked
   e. List of all operator inputs or outputs to and from the control strategy
   f. Specific OIT and HMI graphic displays and reports related to the strategy shall be illustrated, defined and formatted
   g. A narrative of the operation of any panels shall be described as it relates to the strategy
   h. A narrative of failure contingencies shall be described in detail

3. This submittal shall cover any associated program (function block diagrams, script language, etc.) developed under this contract required to implement the control strategy specified.

4. The annotated program shall be submitted in 8-1/2 inch by 11-inch format and electronic media for all logic developed. Annotation shall be 3 lines of 6 characters each for every logic contact. In addition, each network or rung shall be annotated so that a non-technical person can read and easily comprehend what control function the rung or network is performing.

5. This submittal shall also include PLC I/O configuration tables, I/O reference usage table, complete cross-reference to specific rung used of all inputs, outputs, internal coils, data registers and special purpose coils. In addition, any special switch settings or hardware configuration requirements such as communications port configurations shall be described in detail and submitted.

6. This submittal shall cover the specific plant control strategies as well as the semifinal details of the plant reports and process graphic displays. This submittal shall also include

what appears on each display and what appears on each display and what calculations are required to support them.

7. Each system point shall have the capability of being stored historically for an indefinite period of time and shall be capable of being changed. Each system point's raw value shall be available for trending.

8. A complete list of all signals to be collected for long-term historical information shall be provided. This listing shall include frequency of data sampling and duration for which the data shall immediately accessible.

C. Shop drawings shall include detailed Bill of Materials for each component.

D. Operation and maintenance manuals, in accordance with the provisions of the general contract conditions, shall also be supplied. Operating instructions shall incorporate an updated functional description of the entire system including the system schematics that reflect as-built modifications. Special maintenance requirements particular to the system shall be clearly defined along with special calibration and test procedures.

1. A complete set of "as-built" wiring, fabrication, and interconnection drawings shall be included with the manuals.

2. Electronic copies of the O&M manuals with as-built drawings shall be provided on compact disk in Adobe PDF format.

3. Electronic copies of the as-built drawings shall also be provided on compact disk in AutoCAD 2017 format.

PART 2 - PRODUCTS

2.01 General Requirements

A. 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 and control system. The completed system shall be compatible with the functions required and the equipment furnished by the Contractor and shall include all necessary control relays, contacts, and additional devices required for a complete, coordinated, operable facility.

B. Electrical control equipment, starters, contactors, etc., shall be full NEMA rated.

C. All contacts for control of electrically-operated equipment shall be rated not less than 10 amperes on 120 volts.

D. All electrical components of the instrumentation and control system shall operate on 120 volt, single phase, 60 hertz power, except as noted otherwise in the specifications. Control circuits for components which are located in hazardous areas shall be 24 volt intrinsically safe.

E. Where control equipment is not within sight of the motor, a safety lockout station with position indication, which shall prevent application of current to the motor, shall be located near the motor. Where the driven equipment is located on a different level than their driving motors, a safety lockout station shall be provided on each level.

F. For each automatically operating field control device (float switch, pressure switch, etc.), an adjustable time delay module shall be furnished and installed within the control panel, motor control center, or other approved control equipment location. Timing modules shall be 2-wire, 0-1,000-second, delay on make, solid-state units; SSAC TDU3000A, or equal. If a programmable logic controller (PLC) is used for monitoring and control of I/O points, then the time delay functions shall be performed by that PLC.

G. Programmable controllers shall be utilized for standard relay and control functions within motor control centers, control panels, etc., only where specifically approved. In general, conventional control equipment shall be provided.

H. All controls for remote electrically-operated or motor-driven equipment shall be complete, including all necessary auxiliary relays so as to require only wiring and connections to the equipment control circuit. All contacts for control of remote motor-operated or electrically-operated equipment shall be rated not less than 10 amperes on 120 volts unless specified otherwise herein.

I. All remote motor-operated or electrically-operated equipment shall have a separate 120 volt control circuit, except as indicated otherwise.

J. All necessary fuses or switches required by the instrumentation manufacturer for his equipment shall be provided with the equipment. All instruments requiring an internal power supply shall have an internal ON-OFF switch.

K. The drawings and specifications indicate the energy sources that will be provided. Any other devices (isolation transformers, power supplies, lightning arresters, etc.) necessary to obtain proper operation and protection of the instrumentation system shall be furnished with the instrumentation system.

L. Individually adjustable alarm modules shall be provided to generate all required alarm or interlocking contacts from analog signals.

M. Signal isolators shall be provided for all analog signals to auxiliary equipment remote from instrumentation panels.

N. All printed circuit boards throughout the instrumentation system shall have a protective coating to prevent corrosion.

O. All components shall be tagged with the item number and nomenclature given in the specifications and component tabulation lists.

P. Each field mounted transmitter shall be installed within a NEMA 12/3R aluminum enclosure for weather protection. Enclosures shall exceed the dimensions of the enclosed transmitter by a minimum of three inches on all sides and shall permit full unobstructed access to the enclosed transmitter. Enclosures shall be equipped with a continuous hinged access door with 3-point latching handle. Ventilation louvers shall be provided at top and bottom of both sides to promote convection cooling.

1. Field mounted instrument weather protection enclosures shall include power and signal line surge protection with non-metallic enclosure.

2. Field mounted instrument weather protection enclosures shall be equipped with a single gang toggle switch to disconnect power to the transmitter.

3. All connections between the instrument enclosure, surge protection enclosure and toggle switch box shall be multiconductor cables sealed through a cord connector.

2.02 Control Devices

A. Control Stations: Control stations shall be heavy-duty, oil-tight, complete with NEMA 13 cast aluminum enclosures; Eaton Type T, Square-D, or equal.

1. Safety lockout stations (SAFE-OFF) shall be equipped with 316 stainless steel padlock devices for padlocking in the de-energized position.

2. Unless specified otherwise, control stations installed outdoors, or in corrosive atmospheres, shall have watertight, NEMA 4X cast aluminum enclosures.

B. Float Switches: Where required for control system operation, float switches consisting of a SPDT mechanical micro switch, rated 15 amps at 120 VAC, in a chemical-resistant casing, complete with chemical-resistant flexible cord, shall be provided; Flygt PSM, or equal.

C. Pressure Switches - Where required for control system operation, digital, adjustable deadband, industrial pressure switches shall be provided; Mercoid Model EDA. Pressure switches shall be watertight, die-cast copper-free aluminum construction, with 316 stainless steel wetted parts. Outputs shall include two individually adjustable SPDT contacts rated 5 amps at 120 VAC. Each pressure switch shall be equipped with a stainless steel, adjustable, self-cleaning pulsation dampener.

D. Alarm Horns: Alarm horns shall be piezoelectric audible signal devices; Mallory Sonalert, or equal. Each alarm horn shall be equipped with an enable/disable control switch. Unless indicated otherwise, alarm horns shall be installed within the associated control equipment enclosure. Exterior alarm horns shall be weatherproof semi-flush mounted.

2.03 Control Components

A. General: Where indicated on the drawings, or required by the functions specified, control components shall be furnished and installed with-in control panels, motor control center, or other

approved locations. Suitable nameplates shall be provided for all panel door or surface-mounted control devices. All component terminals, including auxiliary contacts, shall be wired to master terminal boards.

B. Instrument: Instruments shall be of standard size not less than 5-1/2" in width and they shall present a uniform appearance when mounted upon the panels. Instruments shall have scales 5" in length and shall be accurate within 1% of full scale. Instrument scales shall be selected with full-load readings at 75% of the scale range, unless specified otherwise or approved.

C. Pilot Devices: Selector switches, pushbuttons, indicating pilot lights, and additional pilot devices as required, shall be 600 volt rated heavy-duty, oil-tight, 30mm pilot devices as manufactured by Eaton, Square-D, or equal.

1. Pushbuttons shall be standard type with anodized aluminum rings and colored buttons.

2. Selector switches shall be standard handle type with anodized aluminum rings and handles.

3. Pilot lights shall be full brightness LED type.

4. All pilot devices shall have appropriate nameplates and locking means for locking in the de-energized mode, and shall be color coded (red - start, on, open, up; green - stop, off, close, down; black - test, silence, miscellaneous).

D. Running Time Meters: Hour meters shall be non-reset type with register to indicate hours and tenths of hours up to 99,999.9 hours. Each meter shall be a 2-1/2" round panel mounting type, suitable for operation on 120 volt control circuits; Engler Model 10NG1, or equal.

E. Timers: Where required for control system operation, multifunction programmable timing modules with shall be provided. Timers shall have cycle times as indicated, shall be provided for operation at voltage indicated, and shall have DPDT contacts; Potter & Brumfield CNS-35-96, or equal.

F. Control Relays: Where required for control system operation, control relays shall be 3P3T, 11 pin octal type, with 10 amp contacts, internal LED, test button, and large ice cube style case; Eaton D3PF3AA, D3PF3AT1, or equal.

1. Time delay relays shall be potentiometer adjustable time setting, 1.0% repeatability, 2PDT plug-in type time delay relays with, 10 amp contacts, 8-pin square sockets and hold-down springs. Delay on de-energize mode shall not require input power during the timing; Potter & Brumfield CK Series.

G. Power Monitors: Where required for control system operation, 3 phase power monitors shall be provided. Power monitors shall be surface-mounted type consisting of a phase angle sensing circuit driving a DPDT electromechanical relay. Power monitors shall sense loss of any phase, low volt-age on any or all phases, and phase sequence reversal. Power monitors shall be field-

adjustable, provided with fault indication, and adjustable time delay (0-20 seconds); Diversified Electronics Series SLD, or equal.

H. Signal Isolators and conditioners: All analog signals to and from auxiliary equipment remote from instrumentation panels shall be isolated with solid-state, optically coupled signal conditioners capable of converting DC voltage, RTD, thermocouple, DC milliamp, and frequency signals to IEEE-compliant 4-20 milliamp process signals for transmission. Signal isolating and conditioning modules shall be 35 mm DIN rail mountable and have a throughput accuracy of no less than +/- 0.1%. Components shall be Red Lion Series IAMS, or pre-approved equal.

1. One universal Programming Display Module (PGM) shall be provided for each control panel containing a signal isolator or signal conditioner.

I. DC Power Supplies (for instrument loop and other DC power requirements) shall be of the linear switching type, DIN-rail mountable, and carry an efficiency rating of at least 90%. AC ripple shall be a maximum of 2.5 %, integral over temperature protection, built-in "DC OK" status contact, and selectable short circuit and overload protection modes shall be standard functions. The power supply output circuitry shall accept connection of parallel sources without damage or back-feed to the 2nd supply. DC power supplies shall be Altech™ series PSA or functional equivalent by Allen-Bradley or Phoenix.

2.04 Control Panels

A. Where indicated on the drawings, specified, or required by the functions specified, control panels, including all necessary accessories, shall be provided for control of the associated equipment.

B. Control panel components shall be inner-panel or door-mounted, wired to terminal boards with identifying numbers. All contacts, including spare auxiliaries, shall be wired to terminal boards. All wiring shall be neatly bundled with wire ties, or in wireways, and all wiring shall be identified by color coding and numbering. Wiring shall be coded: black - primary power; red - AC control wiring; blue - DC control wiring; white - neutral; and green - ground.

C. Unless indicated otherwise, each control panel shall be furnished with red (running) and green LED pilot lights, H-O-A selector switch, circuit breaker type combination motor starter, running time meter and control circuit equipment for each motor controlled. Motor starters for all motors 25 hp and above shall be the solid state reduced voltage type. Multiplex control panels shall be furnished with a main circuit breaker, automatic alternator and lead selector switch. Each control panel shall be equipped with an independent control power system including all required control power transformers, protective fusing, and separate control power main breaker. Control panels shall be equipped with power monitors, an exterior red flashing alarm light, alarm horn, alarm test switch, and a 120 volt convenience outlet.

D. Control panels shall be furnished with a thermostatically controlled condensation heater and all additional accessories as indicated. Control operation shall be as specified or as required for proper operation of the equipment controlled. In general, for each associated alarm condition, control panels shall be furnished with amber pilot lights and auxiliary contacts for remote indication.

E. Unless indicated otherwise or required for the specific installation, panels for interior use shall be NEMA 12 construction with oil-resistant gasketing and full-sized single door. Door shall have slotted flush latch and door-mounted control devices. Exterior panels shall be NEMA 12/3R with oil-resistant gasketing and full-sized door-in-door construction. Inner door shall have door-mounted control devices and slotted flush latch. Blank outer door shall have three-point latching handle with padlocking provisions.

F. Variable speed control panels shall be equipped with VFD in accordance with the section of these specifications entitled ELECTRICAL Apparatus. The VFDs shall be flange mounted with the heat sinks located outside the enclosure. The enclosures shall be equipped with sun shields on all surfaces. A compact cooling fan shall be installed inside the enclosure to provide air circulation and eliminate hot spots within the enclosure. The fan shall provide 50,000 hours of continuous operation without lubrication or service. Finger guards shall be mounted on each side of fan for safety. The enclosure shall be oversized as required to eliminate the need for an enclosure air conditioning system.

G. Control panel enclosures and inner panels shall be seam-welded aluminum, 0.125" minimum, with all stainless steel hardware.

2.05 Supervisory Control System

A. General: The supervisory control system (SCS) shall be a complete integrated system furnished and configured by the Instrumentation System Contractor/Supplier who shall be responsible for the satisfactory operation of the entire system. The SCS shall include programmable logic controllers, operator interface panels, and fiber optic communications network.

1. The Instrumentation System Contractor/Supplier shall provide complete system configuration submittal data, including detailed I/O signal listings, proposed ladder logic, etc. for coordination and approval prior to implementation.

2. The Instrumentation System Contractor/Supplier shall provide all SCS system programming.

3. System startup and testing shall be provided by the contractor and shall be witnessed and approved by CCUA and the Engineer.

4. Each PLC shall be loaded and tested at the Instrumentation System Contractor/Supplier manufacturing facility and shall be witnessed and approved by CCUA and the Engineer.

B. Programmable Logic Controller (PLC) - Each PLC shall be fully equipped to monitor all equipment status, alarm, and instrumentation system analog signals; control selected equipment operations; and seamlessly connect to the communications network. Each PLC shall be Allen-Bradley CompactLogix, no exceptions. Configurations shall be based upon the following standardized components:

1.	1769-L33ER	CPU (2MB Memory)
2.	1769-IA16	Digital Input Modules
3.	1769-OA16	Digital Output Modules
4.	1769-IF8	Analog Input Modules
5.	1769-OF8C	Analog Output Modules
6.	1769-PA4	Power Supply
7.	2711P-T12C4A8	Operator Interface Panel (OIT)

PART 3 - EXECUTION

3.01 System Descriptions

A. General: The general arrangement of the analog instrument and control system is shown on the drawings.

1. No attempt has been made to detail on the drawings all accessories and devices required for the complete system. The system contractor/supplier shall be responsible for the preparation of all detail installation drawings showing wiring, piping, mounting, etc.

2. The system contractor/supplier shall be responsible for furnishing all devices required for a complete functioning system.

3. All PLC operator “adjustable” or “selectable” settings shall be accessible from the PLC Operator Interface Panels. Each setpoint shall include adjustable deadband and adjustable time delay.

4. PLC Operator Interface Panel controls shall include Manual-Automatic selector switch, Start and Stop pushbuttons, and Remote mode status indication for each equipment item monitored or controlled by the PLC system. Additionally, manual and automatic pacing signal controls shall be provided for all variable speed equipment.

5. Flow signals shall be forced to zero anytime the associated pumping equipment is not in operation. Additionally, flow signals below an operator adjustable minimum flow set point shall be forced to zero.

6. Automatic alternation controls shall alternate following each lead cycle, following an operator adjustable number of hours of operation, and at an operator selectable time of day. For each automatic alternation system, enable or disable shall be individually selectable for each alternation trigger. Only equipment that is ready to run when called shall be available to the automatic alternation sequence. If only one unit is ready it shall be the dedicated lead.

B. SCS System Initialization: A factory-trained qualified service representative of the SCS system manufacturer shall provide all system initialization, customization, startup, and training to provide a complete and operating system. Initialization shall include, but not be limited to the following:

1. Load and test all system data points.

2. Configure alarm status reports.

3. Configure equipment status and run time reports.

4. Configure analog data historical trend reports.

5. Configure PLC operator interface panel menu driven dynamic color graphic display screens to provide local monitoring and control of each system.

C. The existing PLC operator interface panel screens shall be updated to incorporate the new facilities including duplication of the final Occulus Panel OIT Screens.

3.02 Wiring

A. Identification: All wiring shall be color-coded using MTW #16 AWG minimum. Wire shall be as follows:

1.	120 VAC (Unswitched Hot)	#12 AWG Black
2.	120 Volt Dry Contacts	#16 AWG Red
3.	120 VAC (Neutral)	#12 AWG White
4.	120 VAC (Switched Hot)	#14 AWG Red
5.	24 VDC+	#18 AWG Blue
6.	24 VDC-	#18 AWG White/blue
7.	Ground	#12 AWG Green

B. Wiring for all instrumentation and control panels shall be 600 volt, 125 °C rated UL Type AWM stranded tinned copper conductors with cross-linked polyethylene insulation, sized per National Electrical Code for load requirements; Belden 356 series.

C. All wire conductors and cabling shall be identified with permanent machine-printed wire markers. They shall be of the shrink-tube type and affixed to each end of each conductor, with numeric or alpha-numeric characters matching the as-built wiring diagrams for the control panels. Wrap-on hand-written markers will not be accepted.

D. Wire Duct: All wiring shall be routed through a wiring duct system to provide wire protection and an organized appearance. Wire duct shall be permanently attached using screws into the back panel.

E. Terminals: Terminals shall be provided for interface with field installed equipment. Terminals shall be Allen-Bradley series 1492 or equivalent by Entrelec.

3.03 Nameplates

A. Nameplates shall be a laminated two-part system using white letters on a black background providing protection against fading, peeling or warping. The labeling system shall be computer controlled to provide logos, post-script type or custom designs. The uses of embossed plastic type tags are not acceptable.

B. As a minimum, the following components shall be labeled using a laser-screened Mylar nameplate:

1. Relays

2. Fuses

3. Circuit breakers

3.04 Mounting Hardware

A. All components shall be mounted using stainless steel machine screws. All holes shall be drilled and tapped. The uses of self-tapping screws are unacceptable.

3.05 Electrical Transient and Surge Protection

A. All components of the instrumentation system shall be equipped with suitable surge arresting devices to protect the equipment from damage due to electrical transients, including lightning induced electrical power surges.

B. All power and signal circuits of each field instrument shall be protected with surge and transient protectors installed at both the source and destination ends of each circuit. Combination power and signal line surge and transient protectors shall be EDCO model SLAC-12036 or approved equal.

1. Protectors for 120 volt power circuits shall be Citel DS40-120.

2. Protectors for signal circuits shall be Citel DLAW-24D3.

C. Surge and transient protectors shall be connected to the electrical system ground. Supplemental grounding shall be provided in accordance with the protection equipment manufacturer's recommendations.

3.06 Field Calibration and Training

A. Prior to initiation of preliminary instrumentation and control system startup, the Contractor must submit a certified statement from his installation subcontractor confirming that all field wiring is

complete, has been terminated and marked in accordance with the latest set of approved shop drawings, and has been tested for improper grounds, short circuits, and continuity.

B. Prior to energizing any part of the instrumentation and control system, the Contractor must submit a certified statement from his system contractor/supplier authorizing energization.

C. The complete instrumentation and control system shall be systematically calibrated and proper performance demonstrated in the presence of the Engineer.

1. Process calibration, such as volumetric drawdown tests on flow and level measurements, shall be conducted on all measuring systems as required by the Engineer.

2. Performance demonstrations shall be provided individually for each complete instrumentation loop. Successful performance shall depend on proper performance of each and every component associated with the loop.

3. The Contractor shall submit certified calibration and performance reports from his system contractor/supplier confirming that the entire instrumentation system is complete and operating properly.

D. Following acceptance of the complete instrumentation system startup, the system contractor/supplier shall conduct a complete training program (minimum 1 day's duration) at the job site for a minimum of 4 Owner-selected operating personnel. The training program shall include operation, preventive maintenance, and troubleshooting instructions relative to all components of the system provided and shall include calibration demonstrations for each type of instrument provided.

1. The training program shall be scheduled a minimum of 14 days in advance. Proposed dates shall be submitted in writing for approval. The Owner may exercise the option to audio- or video-tape the entire training program without restriction.

E. All calibration, testing, demonstrations, training, etc., shall be at no additional cost to the Owner.

3.07 Spare Parts

A. The instrumentation and control system contractor/supplier shall furnish, upon completion of the project, one year's supply of all consumable parts utilized within the instrumentation system.

B. Spare parts shall include pilot lights (minimum 12 of each part number), fuses (minimum 12 of each part number).

END OF SECTION

Appendix A
Geotechnical Report

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Revised Report of Geotechnical Exploration
For

CCUA Fleming Island Wastewater Treatment Facility

MAE Project No. 0011-0027
September 1, 2020

Prepared for:

CDM Smith

4651 Salisbury Road, Suite 420
Jacksonville, FL 32256

Prepared by:

MAE
Meskel & Associates Engineering
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JBJ 2020 50 FASTEST GROWING COMPANIES

March 19, 2020
Revised September 1, 2020

CDM Smith, Inc.
4651 Salisbury Road, Suite 420
Jacksonville, Florida 32256

Attention: Ms. Brittany Cogger

Subject: Revised Report of Geotechnical Exploration
CCUA Fleming Island Wastewater Treatment Facility
Fleming Island, Florida
MAE Project No. 0011-0027

Dear Ms. Cogger:

Meskel & Associates Engineering, PLLC (MAE) has completed a geotechnical exploration for the subject project. Our work was performed in general accordance with our subcontractor agreement with CDM Smith, Inc. dated December 17, 2019. The purpose of the geotechnical exploration was to evaluate the general subsurface conditions within the areas of the proposed Oxidation Ditch, Headworks, and additional piping. This report updates our previous report dated March 19, 2020 to include comments provided by the CCUA and the results of our test pit exploration.

In summary, the soil borings encountered loose to medium dense fine sand to slightly silty fine sands (SP, SP-SM, A-3) to depths of 6 to 10 feet, followed by loose to medium dense silty fine sands (SM, A-2-4) with intermittent layers of SP-SM soils to the boring termination depths of up to 50 feet below the existing grade. As exceptions, fine sands with clay to clayey fine sands (SP-SC, SC, A-2-6) were encountered at 4 locations between the ground surface and a depth of 13.5 feet. These soils are not suitable for use as foundation subgrade or pipe bedding, nor as structural fill or backfill and should be removed and replaced where encountered as discussed in Section 6.0. Groundwater levels were encountered at most boring locations and were measured at the time of drilling between 4 feet 6 inches and 8 feet 2 inches below the existing ground surface; however, we understand that dewatering operations adjacent to the planned construction area may be altering the true groundwater level elevations. Therefore, we recommend that piezometers be installed once dewatering operations are complete to monitor groundwater level fluctuations over time to provide a more precise estimate of the seasonal high groundwater level. The test pits encountered similar subsurface conditions. However, the test pits also clearly showed the presence of approximately 1.5 to 2.75 feet of fill above the existing site soils.

Based on our exploration and laboratory testing, it is our opinion that the soil conditions at the site are adaptable for support of the planned Oxidation Ditch and Headworks structures on conventional shallow foundation systems, and for support of the additional pipelines provided the site and earthwork recommendations provided in this report are followed.

We appreciate this opportunity to be of service as your geotechnical consultant on this phase of the project. If you have any questions, or if we may be of any further service, please contact us.

Sincerely,
MESKEL & ASSOCIATES ENGINEERING, PLLC
MAE FL Registry No. 28142

W. Josh Mele, E.I.
Staff Engineer

P. Rodney Mank, State of Florida, Professional Engineer, License No. 41986. This item has been electronically signed and sealed by P. Rodney Mank, P.E. on 09/01/2020 using a Digital Signature. Printed copies of this document are not considered signed and sealed and the signature must be verified on any electronic copies.

Philip R Mank Digitally signed by Philip R Mank Date: 2020.09.01 14:09:54 -04'00'

P. Rodney Mank, P.E.
Principal Engineer
Licensed, Florida No. 41986

Distribution: Ms. Brittany Cogger – CDM Smith, Inc. 1 pdf
Mr. Yanni Polematidis, P.E. – CDM Smith, Inc. 1 pdf

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APPENDICES

1.0 PROJECT INFORMATION

1.1 General

Project information was provided to us by Ms. Brittany Cogger and Mr. Yanni Polematidis, P.E., with CDM Smith, Inc. via several emails and telephone conversations. We were provided with the following project documents for review and reference:

- PDF document titled *Package for Geotech*, which contained an annotated aerial of the project site, a Pipe Layout Plan prepared by the Clay County Utility Authority (CCUA), last dated March 19, 2007, and a Report of Geotechnical Exploration titled *Improvements at Fleming Island Reginal Waste Treatment Plant*, prepared by Ellis & Associates, dated November 8, 2016.
- Proposed Site Plan, Sheet No. C-2, prepared by CDM Smith, Inc. for their 30% Submittal, dated February 2020.
- Three sheets of details of the planned Oxidation Ditch structure, including the dimensions presented in cross sections and plan views, prepared by the Crom Corporation (CROM), dated March 21, 2002.
- Yard Piping Plan, Sheet No. C-3, prepared by CDM Smith, Inc. for their 100% submittal, dated August 2020. This annotated plan denoted the location of the requested test pits, as well as provided Northing and Easting coordinates and linear dimensions from existing site features.

1.2 Project Description

The project site is the existing CCUA Fleming Island Wastewater Treatment Facility located at 1770 Radar Road in Fleming Island, Clay County, Florida. The general site location is shown on Figure 1.

Based on the provided information and our discussions with Ms. Cogger and Mr. Polematidis, it is our understanding that the proposed project includes the construction of a third Oxidation Ditch. This biological treatment unit will be an elongated, prestressed concrete tank having a capacity of 1.6 million gallons and will be approximately 200 feet in length and 100 feet in width. The detail sheets we received as prepared by CROM show a finished floor elevation of EL. 21.40 feet, with a bottom elevation at the floor slab and structure wall intersection of EL. 20.07 feet. The floor slab is shown to be 6 inches thick across most of the floor area, thickening up to almost 18 inches thick at the intersection with the wall. The outside finished grade elevation, which we have assumed was the current grade elevation at the time of our field work, is shown as EL. 22.40 feet. Therefore, the embedment of the structure is about 1.5 to 2 feet below existing grade. We also understand the water height for the structure is 13.5 feet.

In addition, the project includes modification of the existing headworks structure and installation of additional piping for the new structures. Grading plans for these areas were not provided at the time of our evaluation; however, we have assumed that final grades will also roughly match those currently existing at the site.

If actual project information varies from these conditions, then the recommendations in this report may need to be re-evaluated. Any changes in these conditions should be provided so the need for re-evaluation of our recommendations can be assessed prior to final design.

2.0 FIELD EXPLORATION

A field exploration was performed on February 17 and 18, 2020. A copy of the plan provided to us, which shows the approximate boring locations, is included as the *Boring Location Plan*, Figure 2. GPS coordinates

for the requested boring locations were obtained by overlaying the provided plan in Google Earth, and then each boring location was identified in the field using a Garmin GPSMAP 78 hand-held receiver. Each location was then marked for reference. Prior to starting our field exploration, a utility locate request was submitted to the Sunshine State One-Call Center, and the CCUA site representative was contacted to assist with locating on-site utilities. Once the site utilities were located and marked, our field crew mobilized to the site. The boring locations as shown on Figure 2 should be considered accurate only to the degree implied by the method of layout used.

2.1 Standard Penetration Test Borings

To explore the subsurface conditions within the area of the proposed structures and future pipeline area, we located and performed 10 Standard Penetration Test (SPT) borings, drilled to depths of approximately 10 feet (pipeline), 20 feet (Headworks structure), and 50 feet (Oxidation Ditch) below the existing ground surface, in general accordance with the methodology outlined in ASTM D 1586. Split-spoon soil samples recovered during performance of the borings were visually described in the field and representative portions of the samples were transported to our laboratory for testing and classification. A summary of the field procedures is included in Appendix A.

2.2 Test Pits

At your request, engineers from this office revisited the site on August 6, 2020 to observe test pits excavated with a track-mounted excavator supplied by CCUA. Our engineers documented the conditions encountered at each of the two requested locations. The two test pits, approximately 4 feet by 8 feet, were excavated to depths of approximately 12 feet below the existing ground surface. Upon completion, the test pits were backfilled with excavated soils that were compacted in lifts with the backhoe shovel.

3.0 LABORATORY TESTING

Representative soil samples obtained during our field exploration were visually classified by a geotechnical engineer. The borings performed for the Oxidation Tank and Headworks structures and the test pit samples were classified using the *Unified Soil Classification System* (USCS) in general accordance with ASTM D 2488. The borings performed for pipelines were classified using the *AASHTO Soil Classification System* in general accordance with ASTM D 3282. Keys to both Soil Classification Systems are included in Appendix A.

Quantitative laboratory testing was performed on selected samples of the soils encountered during the field exploration to better define the composition of the soils encountered and to provide data for correlation to their anticipated strength and compressibility characteristics. The laboratory testing included the natural moisture content, the percent passing a U.S. No. 200 standard sieve (percent fines), the organic content, and the Atterberg limits of selected soil samples. The results of the laboratory testing are shown in the *Summary of Laboratory Test Results* table included in Appendix B. These results are also shown on the *Generalized Soil Profiles* sheets, Figures 3 through 6, and on the soil boring logs at the respective depths from which the tested samples were recovered.

4.0 GENERAL SUBSURFACE CONDITIONS

4.1 General Soil Profile

Graphical presentation of the generalized subsurface conditions is presented on *Generalized Soil Profiles* sheets, Figures 3 through 6. Detailed boring and test pit logs are included in Appendix A. When reviewing the soil profiles and boring/test pit logs, it should be understood that the soil conditions will vary between the boring and test pit locations. The following table summarizes the soil conditions encountered at the

boring locations.

GENERAL SOIL PROFILE: OXIDATION DITCH, HEADWORKS, AND ASSOCIATED PIPELINES			
TYPICAL DEPTH (ft)		SOIL DESCRIPTION	USCS[1] /AASHTO[2]
FROM	TO		
0	6 to 10	Loose to medium dense fine sands to fine sands with silt.	SP, SP-SM / A-3
6 to 10	50	Loose to medium dense fine sands with silt to silty fine sands.	SP-SM, SM

(1) Unified Soil Classification System
(2) American Association of State Highway and Transportation Officials

As exceptions, loose to medium dense fine sands with clay to clayey fine sands (SP-SC, SC, A-2-6) were encountered at 4 locations (OD-1, HW-1, HW-2, and P-4) between the ground surface and a depth of up to 13.5 feet. In addition, loose very clayey fine sands (SC) were encountered at boring location OD-3 between depths of 38.5 to 43.5 feet, and medium dense clayey fine sands (SC) were encountered at boring OD-4 between depths of 43.5 to 48.5 feet. Furthermore, soils containing trace to little amounts of organic fines and root fragments were often encountered in the upper 10 feet explored.

4.1.1 Test Pit Exploration

The *Generalized Soil Profiles*, Figure 6, graphically illustrate the subsurface conditions encountered at each test pit location. A summary of the encountered conditions is discussed below.

4.1.1.1 Test Pit TP-1:

The test pit encountered fine sands with silt to silty fine sands (SP-SM, SM, A-3, A-2-4) to its termination depths of up to 11.5 feet below the existing ground surface. Sands containing trace to with amounts of small roots, organic fines, and gravel (rock fragments/cemented sands) were encountered from ground surface to a depth of approximately 1.5 feet, followed by sands containing trace to few clay nodules to a depth of approximately 4 feet below the existing grade. Between depths of approximately 4 to 5 feet, organic material (stumps) were encountered. The upper 2.75 feet of the soil profile at this test pit location appears to have been imported fill, underlain by native soils.

4.1.1.2 Test Pit TP-2:

The test pit encountered fine sands with silt (SP-SM) to an approximate depth of 6.5 feet, followed by a 0.5-inch layer of clayey sand (SC), and then silty fine sand to the test pit termination depth of 11.5 feet below the existing ground surface. The upper 1.4 feet of the soil profile at this test pit location appears to have been imported fill, underlain by native soils.

4.2 Groundwater Level

The groundwater level was encountered at most of the boring locations and recorded at the time of drilling at depths varying from 4 feet 6 inches to 8 feet 2 inches below the existing ground surface. Groundwater was not encountered at boring location P-2. It should be noted that our field crew observed ongoing dewatering activities at the site during this phase of the exploration. Therefore, it is likely that the measured groundwater levels and the lack of a groundwater level at boring location P-2, were impacted by the dewatering. If the observed dewatering activity is temporary, then we recommend that MAE return to the site once dewatering is complete to re-measure the groundwater level in the areas explored. In addition,

during our test pit exploration six months after our initial site visit, groundwater was encountered at an approximate depth of 7 feet at test pit location TP-2; however, no evidence of groundwater was identified within the vertical depths explored at test pit location TP-1.

It should be understood that the lack of a measured groundwater level at boring P-2 and test pit TP-1 does not mean that groundwater does not exist at these locations. It also does not mean that groundwater would not be encountered within the vertical reaches of the boring or test pit at a different date.

It should be anticipated that groundwater levels will fluctuate seasonally and with changes in climate. As such, we recommend that the water table be remeasured prior to construction. Measured groundwater levels where encountered are shown on the *Generalized Soil Profiles* sheets (Figures 3 through 6) and on the soil boring logs.

4.3 Review of the USDA Web Soil Survey Map

The results of a review of the USDA Soil Survey Conservation Service (SSCS) Web Soil Survey of Clay County are shown in the table below. There are three predominant soil map units at the project site: Meadowbrook sand, and Surrency and Sapelo fine sands. The soil drainage class, hydrological group, and estimated seasonal high groundwater levels reported in the Soil Survey are as follows:

Map Unit Symbol	Map Unit Name	Drainage Class	Hydrologic Group	Depth to the Water Table[(1)] (inches)
8	Sapelo fine sand	Poorly Drained	B/D	6 to 18
12	Surrency fine sand	Very Poorly Drained	B/D	0
65	Meadowbrook sand	Poorly Drained	A/D	6 to 12

[(1)] The "Water table" above refers to a saturated zone in the soil which occurs during specified months, typically the summer wet season. Estimates of the upper limit shown in the Web Soil Survey are based mainly on observations of the water table at selected sites and on evidence of a saturated zone, namely grayish colors (redoximorphic features) in the soil. A saturated zone that lasts for less than a month is not considered a water table.

4.4 Seasonal High Groundwater Level

In estimating seasonal high groundwater level, a number of factors are taken into consideration including antecedent rainfall, soil redoximorphic features (i.e., soil mottling), stratigraphy (including presence of hydraulically restrictive layers), vegetative indicators, effects of development, current groundwater levels, and relief points such as drainage ditches, low-lying areas, etc.

Based on the wide variability of the groundwater levels at the time of our field exploration, which appear to be influenced by the on-going dewatering activity, we are not able to estimate a seasonal high groundwater level. Therefore, we recommend that piezometers be installed across the site to monitor groundwater level fluctuations over time to provide a reasonable estimate of the seasonal high groundwater level.

5.0 DESIGN RECOMMENDATIONS

5.1 General

The following evaluation and recommendations are based on the provided project information as presented in this report, the results of the field exploration and laboratory testing performed, and the construction techniques recommended in Section 6.0 below. If the project details differ from those as described in this report, or if the subsurface conditions encountered during construction are different from those reported, then MAE should be notified so that these recommendations can be re-evaluated and revised, if necessary. We recommend that MAE be allowed to review the foundation plans and earthwork specifications to verify that the recommendations in this report have been properly interpreted and implemented.

5.2 Foundation Design Recommendations

The detail sheets for the Oxidation Ditch as provided by CROM show the prestressed concrete tank to have a floor slab-on-grade varying from 6 to about 18 inches in thickness. The walls of the tank are to be founded on a continuous "working slab" that is 2 feet wide by 3.5 inches thick.

Details for the headworks modification were not provided. However, we have assumed the structure addition will be founded on a continuous footing shallow foundation.

Based on the results of our exploration, we consider the subsurface conditions at the site adaptable for support of the proposed Oxidation Ditch and Headworks modification structures when constructed on a properly designed shallow foundation system. Provided the site preparation and earthwork construction recommendations outlined in Section 6.0 of this report are performed, the following parameters may be used for foundation design.

5.2.1 Bearing Pressure

The maximum allowable net soil bearing pressure for use in shallow foundation design for the headworks modification should not exceed 2,000 psf. The working slab below the Oxidation Ditch structure wall should also be designed for the same 2,000 psf bearing pressure. Net bearing pressure is defined as the soil bearing pressure at the foundation bearing level in excess of the natural overburden pressure at that level. The foundations should be designed based on the maximum load that could be imposed by all loading conditions.

5.2.2 Foundation Size

The minimum widths recommended for the working slab below the Oxidation Ditch wall and for the Headworks modification structure continuous footings is 18 inches. Even though the maximum allowable soil bearing pressure may not be achieved, these width recommendations should control the size of the foundations.

5.2.3 Bearing Depth

The continuous foundations for the headworks modification should bear at a depth of at least 18 inches below the exterior final grades. The working slab for the Oxidation Ditch walls should bear at least 2 feet below the adjacent outside finished grade. It is recommended that stormwater be diverted away from the building exterior to reduce the possibility of erosion beneath the exterior footings.

5.2.4 Bearing Material

The foundations may bear in either the compacted suitable natural soils or compacted structural fill. The bearing level soils, after compaction, should exhibit densities equivalent to 98 percent of the modified Proctor

maximum dry density (ASTM D 1557), to a depth of at least one foot below the foundation bearing levels.

We note that clayey soils (SC) were encountered within the anticipated bearing depths for the planned Headworks modification foundation. These soils are not suitable for use as bearing or backfill material. Where encountered, the clayey soils should be removed to a depth of 24 inches below the planned foundation bearing elevation and replaced with suitable structural fill. The excavated clayey soils should be stockpiled separate from the soils intended for reuse and removed from the site.

5.2.5 Settlement Estimates

Post-construction settlements of the structure will be influenced by several interrelated factors, such as (1) subsurface stratification and strength/compressibility characteristics; (2) footing size, bearing level, applied loads, and resulting bearing pressures beneath the foundations; and (3) site preparation and earthwork construction techniques used by the contractor. Our settlement estimates for the Oxidation Ditch and Headworks structures are based on the use of site preparation/earthwork construction techniques as recommended in Section 6.0 of this report. Any deviation from these recommendations could result in an increase in the estimated post-construction settlements of the structure.

The soil borings encountered predominately sandy soils throughout the depth of exploration. Therefore, we expect that settlement of the Oxidation Ditch will occur in an elastic manner and fairly rapidly during construction within these sandy soils. Using estimated loads based on the provided design details as discussed earlier in this report and the field and laboratory test data that we have correlated to geotechnical strength and compressibility characteristics of the subsurface soils, we estimate the total settlement of the Oxidation Ditch to be approximately 2.5 inches.

For the Headworks modification, due to the sandy nature of the near-surface soils, we expect the majority of settlement to also occur in an elastic manner and fairly rapidly during construction. Using the recommended maximum bearing pressure and the field and laboratory test data that we have correlated to geotechnical strength and compressibility characteristics of the subsurface soils, we estimate that total settlements of the structure could be on the order of one inch or less.

Differential settlements result from differences in applied bearing pressures and variations in the compressibility characteristics of the subsurface soils. Because of the general uniformity of the subsurface conditions and the recommended site preparation and earthwork construction techniques outlined in Section 6.0, we estimate the differential settlements of the Oxidation Ditch structure to be approximately 1 to 1.5 inches. For the headworks modification, we estimate the differential settlement to be on the order of 0.5 inch or less.

5.2.6 Bottom Slab

The bottom slab for the Oxidation Ditch can be constructed as a grade-supported slab, provided any unsuitable material is removed and replaced with compacted structural fill as outlined in Section 6.0. The detail sheets for the Oxidation Ditch show a 6-mil visqueen layer below the slab, presumably to reduce moisture entry. Care should be exercised not to tear large sections of the membrane during placement of reinforcing steel and concrete.

The floor slab for the headworks modification can also be constructed as a slab-on-grade, provided any unsuitable material is removed and replaced with compacted structural fill as outlined in Section 6.0. It is recommended that the floor slab bearing soils below any climate controlled areas be covered with an impervious membrane to reduce moisture entry and floor dampness. A 6-mil thick plastic membrane is commonly used for this purpose. Care should be exercised not to tear large sections of the membrane during placement of reinforcing steel and concrete. A minimum separation of 2 feet between the finished floor levels and the ambient groundwater level as maintained at the Facility is recommended.

5.3 Pipeline Support Recommendations

Based on the results of the subsurface explorations, laboratory testing, and provided information, as included in this report, we consider the subsurface conditions at the site adaptable for supporting the proposed below-grade pipeline when constructed upon properly prepared subgrade soils.

As discussed earlier in the report, the borings for the cut and cover portion of the proposed pipeline routes (borings P-1 through P-4) generally encountered a surficial topsoil layer, approximately 2 inches in depth, underlain by fine sands and fine sands with silt (A-3) to approximate depths of 4 to 6 feet, followed by silty fine sands (A-2-4) within the vertical extents of the planned pipeline alignments. The A-3 soils are suitable for use as pipe bedding and backfill soil. These soils should be placed and compacted as discussed in Section 6.0 below. However, the encountered silty fine sands (A-2-4) are not recommended for use as bedding material at the pipe invert bearing elevations, nor for reuse as backfill material due to their affinity for moisture, which makes them difficult to place and compact. We recommend that the A-2-4 soils where encountered at the invert elevations of the planned pipelines be undercut to a minimum depth of 12 inches below the planned invert elevations and replaced with suitable A-3 soils, compacted as discussed in Section 6.0. However, for use as backfill material, A-2-4 soils could be blended with the A-3 soils as long as the blended soil meets the structural backfill recommendations provided in Section 6.5 below.

We note that clayey soils (A-2-6) were also encountered within bearing depths for the planned pipelines. We recommend that test pits be excavated within specific pipeline areas to better define the lateral and vertical extent of the clayey soils. These soils are not suitable for use as bearing or backfill material. Where encountered, the clayey soils should be removed to a depth of 24 inches below the planned pipe bearing elevations and replaced with suitable structural fill. The excavated clayey soils should be stockpiled separate from the soils intended for reuse and removed from the site.

In addition, we note that during our test pit exploration, test pit TP-1, excavated within the area of the planned pipelines, encountered sands containing unsuitable amounts of organic fines between depths of approximately 2 to 4 feet, followed by sands containing apparent stumps between approximate depths of 4 to 5 feet. These stumps were likely remnants of surficial vegetation that were not removed during the clearing operations and construction of the WTF. We do not recommend soils with organic fines and organic matter for direct support of the planned pipelines, nor as backfill material. We recommend that organic soils and organic debris be completely removed vertically and 5 feet horizontally from the footprint area of the planned pipeline.

Provided the site preparation and earthwork construction recommendations outlined in Section 6.0 of this report are performed, the following parameters may be used for design of below-grade utilities.

5.3.1 Lateral Pressure Design Parameters

Below-grade walls that are backfilled on one side and restrained against rotation at the top, should be designed to resist lateral pressures from soil and groundwater based on the following equivalent fluid unit weights:

- Above Water Table - Equivalent Fluid Density 60 lb/ft^3
- Below Water Table - Equivalent Fluid Density 90 lb/ft^3

For the design of lateral loads on below-grade walls, we recommend that the groundwater level be assumed to be at the ground surface. Lateral pressure distributions in accordance with the above do not take into account forces from construction equipment, wheel loads or other surcharge loads. To account for this loading, a pressure equal to 0.5 times the anticipated surface surcharge should be applied over the full height of all walls.

5.3.2 Resisting Lateral Forces

Horizontal forces that act on pipeline structures such as thrust and anchor blocks can be resisted to some extent by the earth pressures that develop in contact with the buried perpendicular face of the block structure, and by shearing resistance mobilized along the block structures base and subgrade interface. Allowable passive earth pressure resistance may be determined using the following equivalent fluid densities:

- Above Water Table - Equivalent Fluid Density 100 lb/ft^3
- Below Water Table - Equivalent Fluid Density 60 lb/ft^3

A factor of safety of 3 was used for the above values. It is assumed the block structures are surrounded by well compacted structural backfill, as described in Section 6.5 below, extending at least 5 feet horizontally beyond the vertical bearing face. In addition, it is presumed that the block structures can withstand horizontal movements on the order of 0.5-inch before mobilizing full passive resistance.

The allowable sliding shearing resistance mobilized along the base of the block structure may be determined by the following formula:

$$P = {}^1/_3 V \tan({}^2/_3 \phi)$$

Where: P = Allowable shearing resistance force
V = Net vertical force (total weight of block and soil overlying the structure minus hydrostatic uplift forces)
ϕ = Angle of internal friction = 30°

The following unit weights can be used to calculate the weight of the overburden soil:

- Compacted Moist Soil 110 lb/ft^3
- Saturated Soil 120 lb/ft^3

5.3.3 Hydrostatic Uplift Resistance

It is anticipated that the buried structures will exert little or no net downward pressure on the soils, rather, the structures may be subject to hydrostatic uplift pressure when empty. Below grade structures should be designed to resist hydrostatic uplift pressures appropriate for their depth below existing grade assuming the groundwater level is at the existing ground surface elevation. Hydrostatic uplift forces can be resisted in several ways including:

- Addition of dead weight to the structure.
- Mobilizing the dead weight of the soil surrounding the structure through extension of footings outside the perimeter of the structure.

A moist compacted soil unit weight of 110 lb/ft^3 may be used in designing structures to resist buoyancy.

5.4 Borrow Suitability

Based on the boring results and classification of the soil samples, the fine sands and fine sands with silt are considered suitable for use as fill soils. These soils were encountered from ground surface to approximate depths of 6 to 10 feet below the existing grade. The encountered silty fine sands (SM, A-2-4) are not recommend for use as fill material, nor for reuse as backfill material, due to their affinity for moisture, which makes them difficult to place and compact. However, the silty soils may be utilized for fill and backfill material if they are blended with the cleaner sands (SP, SP-SM, A-3), as long as the blended soil meets the structural backfill recommendations provided in Section 6.5 below. The soils containing surficial organic material (topsoil) will require removal and are considered unsuitable for use as structural fill. The organic soils could be used in landscape berms.

We note, clayey soils (SC, A-2-6) were also encountered at 4 boring locations (OD-1, HW-1, HW-2, and P-4), between the existing ground surface to depths of up to 13.5 feet below the existing grade. These soils are not suitable for use as bearing or backfill material. Where encountered, the clayey soils should be removed to a depth of 24 inches below the planned foundation and pipe bearing elevations and replaced with suitable structural fill. The excavated clayey soils should be stockpiled separate from the soils intended for reuse and removed from the site.

Furthermore, we note that during our test pit exploration, test pit TP-1 encountered sands containing unsuitable amounts of organic fines between depths of approximately 2 to 4 feet, followed by sands containing organic material (stumps) between approximate depths of 4 to 5 feet. Soils with organic fines and organic matter are not suitable for use as fill or backfill material; however, these organic soils may be placed in landscape berms and areas to be grassed. Large organic materials such as stumps should be disposed of.

6.0 SITE PREPARATION AND EARTHWORK RECOMMENDATIONS

Site preparation as outlined in this section should be performed to provide more uniform foundation bearing conditions, to reduce the potential for post-construction settlements of the planned structure(s) and to maintain the integrity of a flexible pavement section.

6.1 Clearing and Stripping

Prior to construction, the location of existing underground utility lines within the construction area should be established. Provisions should then be made to relocate interfering utilities to appropriate locations. It should be noted that, if underground pipes are not properly removed or plugged, they may serve as conduits for subsurface erosion, which may subsequently lead to excessive settlement of overlying structures.

The "footprint" of the proposed Oxidation Ditch and Headworks structures, plus a minimum additional margin of 5 feet, should be stripped of all surface vegetation, stumps, debris, organic topsoil, or other deleterious materials. During grubbing operations, roots with a diameter greater than 0.5-inch, stumps, or small roots in a concentrated state, should be grubbed and completely removed.

Based on the results of our field exploration, it should be anticipated that at least 2 inches of topsoil and soils containing significant amounts of organic materials may be encountered across the site. In addition, soils with significant organic content were encountered at boring OD-4 location between depths of about 2 and 4 feet below existing grade. The actual depths of unsuitable soils and materials should be determined by MAE using visual observation and judgment during earthwork operations. Any topsoils removed from the building and parking/drive areas can be stockpiled and used subsequently in areas to be grassed.

6.2 Temporary Groundwater Control

The groundwater level was encountered at depths varying from 4 feet 6 inches to 8 feet 2 inches below the existing ground surface at the time of our exploration. Because of the need for densification at the planned Oxidation Ditch bearing and pipeline invert elevation, it may be necessary to install temporary groundwater control measures to facilitate the compaction efforts. Dewatering methods should be determined by the contractor; however, we recommend the groundwater control measures remain in place until construction of the Oxidation Ditch slab is complete and compaction and backfilling of the pipeline trenches have been completed. The site should be graded to direct surface water runoff away from the construction areas.

Note that discharge of produced groundwater to surface waters of the state from dewatering operations or other site activities is regulated and requires a permit from the State of Florida Department of Environmental Protection (FDEP). This permit is termed a *Generic Permit for the Discharge of Produced Groundwater From Any Non-Contaminated Site Activity*. If discharge of produced groundwater is anticipated, we recommend

sampling and testing of the groundwater early in the site design phase to prevent project delays during construction. MAE can provide the sampling, testing, and professional consulting required to evaluate compliance with the regulations.

6.3 Compaction of Structure Backfill

Backfill soil placed against the sides of subsurface structures should consist of sand soils as defined in Section 6.5 below. The backfill should be placed in maximum 6-inch lifts, with each lift compacted with hand-held equipment as defined in Section 6.5. Backfill placed more than 5 feet away from the structure walls may be placed in lifts up to 12 inches in thickness, with each lift compacted with appropriate compaction equipment to achieve the same level of compaction. Dewatering should remain in place until the level of backfill is at least 2 feet above the groundwater table at the time of construction.

6.4 Structure Areas Surface Compaction

The exposed surface areas for the Oxidation Ditch floor slab and the Headworks structure should be compacted with a vibratory drum roller having a minimum static, at-drum weight, on the order of 5 to 10 tons. Typically, the material should exhibit moisture contents within ±2 percent of the modified Proctor optimum moisture content (ASTM D 1557) during the compaction operations. Compaction should continue until densities of at least 98 percent of the modified Proctor maximum dry density (ASTM D 1557) have been achieved within the upper 2 feet of the compacted natural soils at the sites. Prior to compaction, proof-rolling of these areas with a loaded dump truck is recommended to locate any unforeseen soft areas or unsuitable surface or near-surface soils.

Due to the proximity of the Headworks modification to the existing Headworks structure, we recommend that only hand-held compaction equipment be used to compact the surface soils. Compaction should continue until densities of at least 98 percent of the modified Proctor maximum dry density (ASTM D 1557) have been achieved within the upper 12 inches of the compacted natural soils.

Should the surface soils experience pumping and soil strength loss during the compaction operations, compaction work should be immediately terminated. The disturbed soils should be removed and backfilled with dry structural fill soils, which are then compacted, or the excess moisture content within the disturbed soils should be allowed to dissipate before recompacting.

Care should be exercised to avoid damaging any nearby structures while the compaction operation is underway. Prior to commencing compaction, the existing conditions of the adjacent structures should be documented with photographs and survey. Compaction should cease if deemed detrimental to adjacent structures, and MAE should be contacted immediately. It is recommended that the vibratory roller remain a minimum of 50 feet from existing structures. Within this zone, use of a track-mounted bulldozer, front-end loader or a vibratory roller, operating in the static mode, is recommended.

6.5 Structural Backfill and Fill Soils

Any structural backfill or fill required for site development should be placed in loose lifts not exceeding 12 inches in thickness and compacted by the use of the above described vibratory drum roller. The lift thickness should be reduced to 8 inches if the roller operates in the static mode or if track-mounted compaction equipment is used. If hand-held compaction equipment is used, the lift thickness should be further reduced to 6 inches.

Structural fill is defined as a non-plastic, inorganic, granular soil having less than 10 percent material passing the No. 200 mesh sieve and containing less than 4 percent organic material. The fine sand and slightly silty fine sand, without roots, as encountered in the borings, are suitable as fill materials and, with proper moisture control, should densify using conventional compaction methods. It should be noted that soils with

more than 10 percent passing the No. 200 sieve will be more difficult to compact, due to their nature to retain soil moisture, and may require drying. Typically, the material should exhibit moisture contents within ±2 percent of the modified Proctor optimum moisture content (ASTM D 1557) during the compaction operations. Compaction should continue until densities of at least 98 percent of the modified Proctor maximum dry density (ASTM D 1557) have been achieved within each lift of the compacted structural fill.

We recommend that material excavated from the pipeline trenches that will be reused as backfill be stockpiled a safe distance from the excavations and in such a manner that promotes runoff away from the open trenches and limits saturation of the materials.

6.6 Foundation Areas

After satisfactory placement and compaction of the required structural fill, the foundation areas may be excavated to the planned bearing levels. The foundation bearing level soils, after compaction, should exhibit densities equivalent to 98 percent of the modified Proctor maximum dry density (ASTM D 1557), to a depth of 24 inches below the bearing level. If silty sands (SM) or clayey sands (SC) are encountered at the foundation bearing level, then these soils should be excavated to a depth of at least 12 or 24 inches below the foundation bearing level, respectively. The excavation should be backfilled in compacted lifts with suitable fill to the foundation bearing level as described in Section 6.5 above.

For confined areas, such as the footing excavations, any additional compaction operations can probably best be performed by the use of a lightweight vibratory sled or roller having a total weight on the order of 500 to 2000 pounds.

6.7 Pipeline Construction Recommendations

Excavation for the pipelines may commence once clearing and stripping and temporary dewatering measures are implemented if necessary. Pipelines bearing on suitable sands (A-3) should be compacted to 95 percent of the bearing soil's modified Proctor maximum dry density (ASTM D 1557) to a depth of 24 inches below the pipe bearing level. If silty sands (A-2-4) or clayey sands (A-2-6) are encountered at the bearing level, then these soils should be excavated to a depth of at least 12 or 24 inches below the pipe invert elevation, respectively. The pipe trench excavation should be backfilled in compacted lifts with suitable fill as described in Section 6.5 above.

As previously mentioned, test pit TP-1, excavated within the area of the planned pipelines, encountered sands containing unsuitable amounts of organic fines between depths of approximately 2 to 4 feet, followed by sands containing apparent organic material (stumps) between approximate depths of 4 to 5 feet. These stumps were likely remnants of surficial organic material that were not removed during the clearing operations and construction of the WTF. We do not recommend soils with organic fines and organic matter for direct support of the planned pipelines, nor as backfill material. We recommend that organic soils and organic debris be completely removed vertically and 5 feet horizontally from the footprint area of the planned pipeline.

6.8 Excavation Protection

Excavation work for pipeline construction will be required to meet OSHA Excavation Standard Subpart P regulations for Type C Soils. The use of excavation support systems will be necessary where there is not sufficient space to allow the side slopes of the excavation to be laidback to at least 2H:1V (2 horizontal to 1 vertical) to provide a safe and stable working area and to facilitate adequate compaction along the sides of the excavation.

The method of excavation support should be determined by the contractor but can consist of a trench box, drilled-in soldier piles with lagging, interlocking steel sheeting or other methods. The support structure

should be designed according to OSHA sheeting and bracing requirements by a Florida registered Professional Engineer. Shoring left in place may be necessary for the headworks structure modification.

7.0 QUALITY CONTROL TESTING

A representative number of field in-place density tests should be made in the upper 2 feet of compacted natural soils, in each lift of compacted backfill and fill, and in the upper 12 inches below the bearing levels in the footing excavations. The density tests are considered necessary to verify that satisfactory compaction operations have been performed. We recommend density testing be performed as listed below:

- One location every 100 feet of Headworks foundation area, minimum of 2 locations.
- One location for every 5,000 square feet of slab area within the Oxidation Ditch footprint area.
- One location for every 200 feet of below-grade pipeline.

8.0 REPORT LIMITATIONS

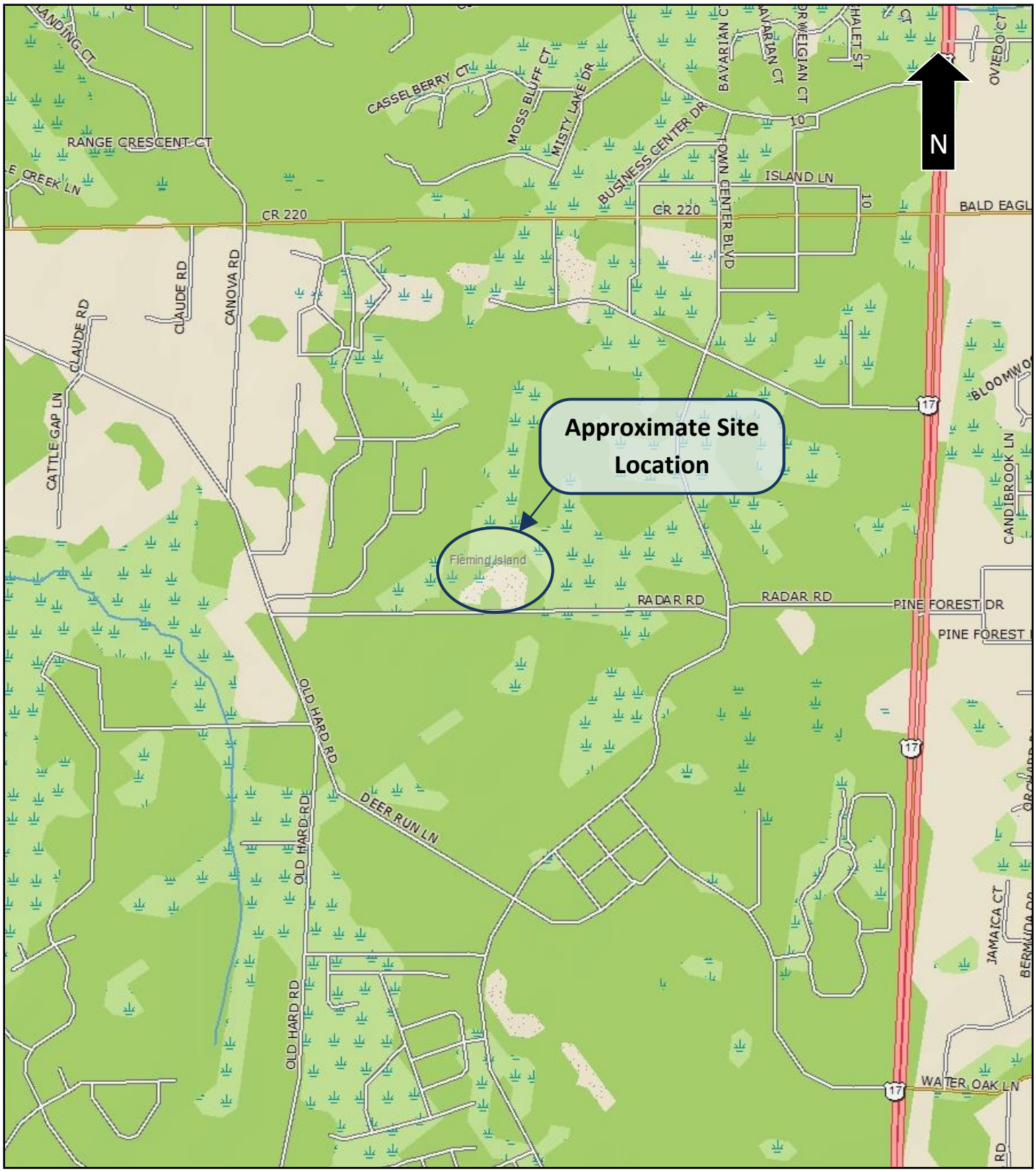
This report has been prepared for the exclusive use of CDM Smith, Inc. and the CCUA for specific application to the design and construction of the *CCUA Fleming Island Wastewater Treatment Facility* project. An electronically signed and sealed version, and a version of our report that is signed and sealed in blue ink, may be considered an original of the report. Copies of an original should not be relied on unless specifically allowed by MAE in writing. Our work for this project was performed in accordance with generally accepted geotechnical engineering practice. No warranty, express or implied, is made.

The analyses and recommendations contained in this report are based on the data obtained from this project. This testing indicates subsurface conditions only at the specific locations and times, and only to the depths explored. These results do not reflect subsurface variations that may exist away from the boring locations and/or at depths below the boring termination depths. Subsurface conditions and water levels at other locations may differ from conditions occurring at the tested locations. In addition, it should be understood that the passage of time may result in a change in the conditions at the tested locations. If variations in subsurface conditions from those described in this report are observed during construction, the recommendations in this report must be re-evaluated.

The scope of our services did not include any environmental assessment or testing for the presence or absence of hazardous or toxic materials in the soil, groundwater, or surface water within or beyond the subject site. Any statements made in this report, and/or notations made on the generalized soil profiles or boring logs, regarding odors or other potential environmental concerns are based on observations made during execution of our scope of services and as such are strictly for the information of our client. No opinion of any environmental concern of such observations is made or implied. Unless complete environmental information regarding the site is already available, an environmental assessment is recommended.

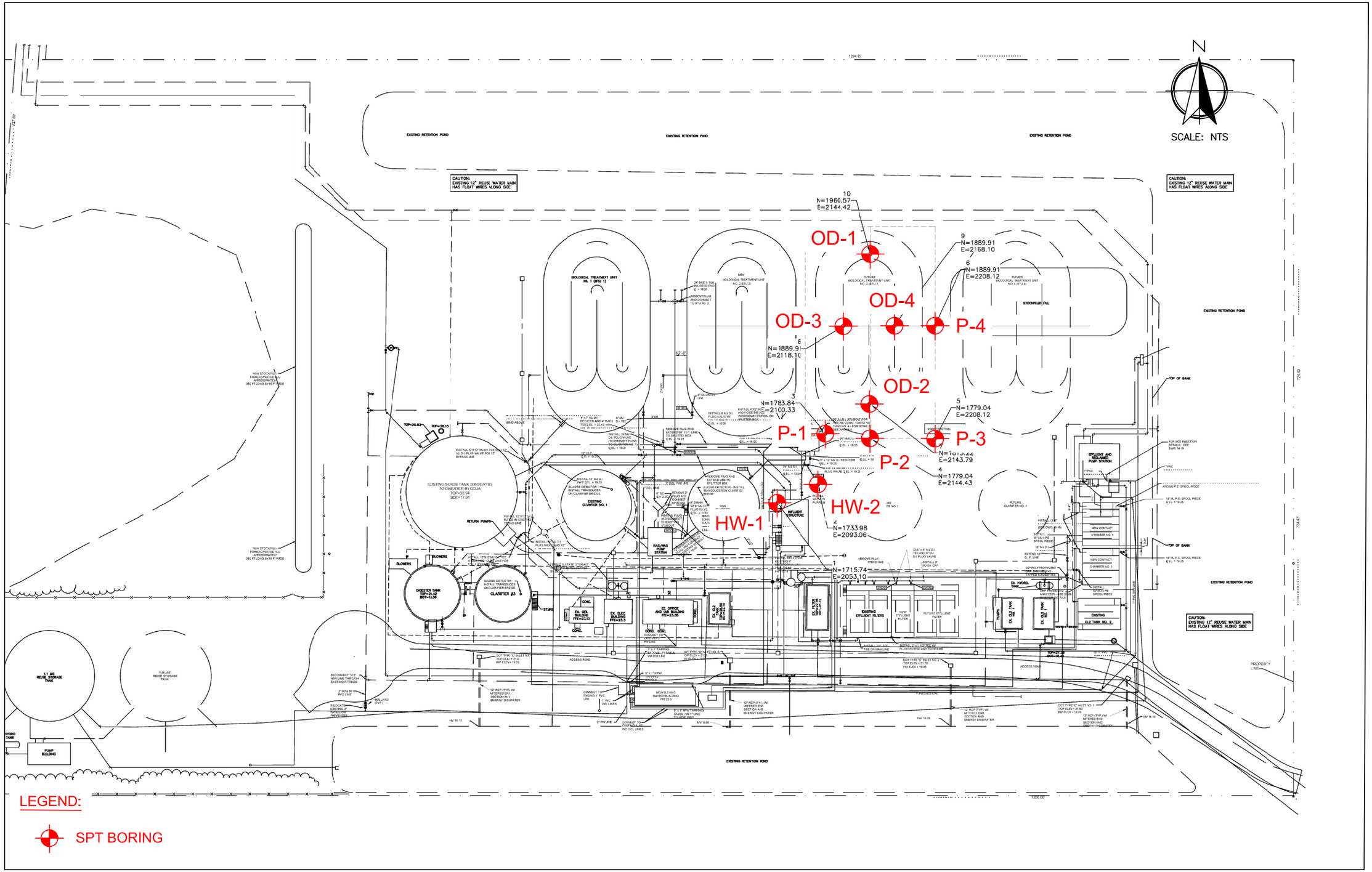
If changes in the design or location of the structures and pipelines occur, the conclusions and recommendations contained in this report may need to be modified. We recommend that these changes be provided to us for our consideration. MAE is not responsible for conclusions, interpretations, opinions or recommendations made by others based on the data contained in this report.

Figures



Site Location Map

PREPARED BY	PROJECT NAME	
Meskel & Associates Engineering	CCUA Fleming Island Wastewater Treatment Facility Fleming Island, Florida	
	REFERERENCE	SCALE
	Delorme XMap 7.0	NTS
PREPARED FOR	MAE PROJECT NO.	FIGURE NO.
CDM Smith, Inc.	0011-0027	1



NOTE: Proposed Site Plan dated February 2020 as provided by CDM Smith, Inc.

REVISIONS					
DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION

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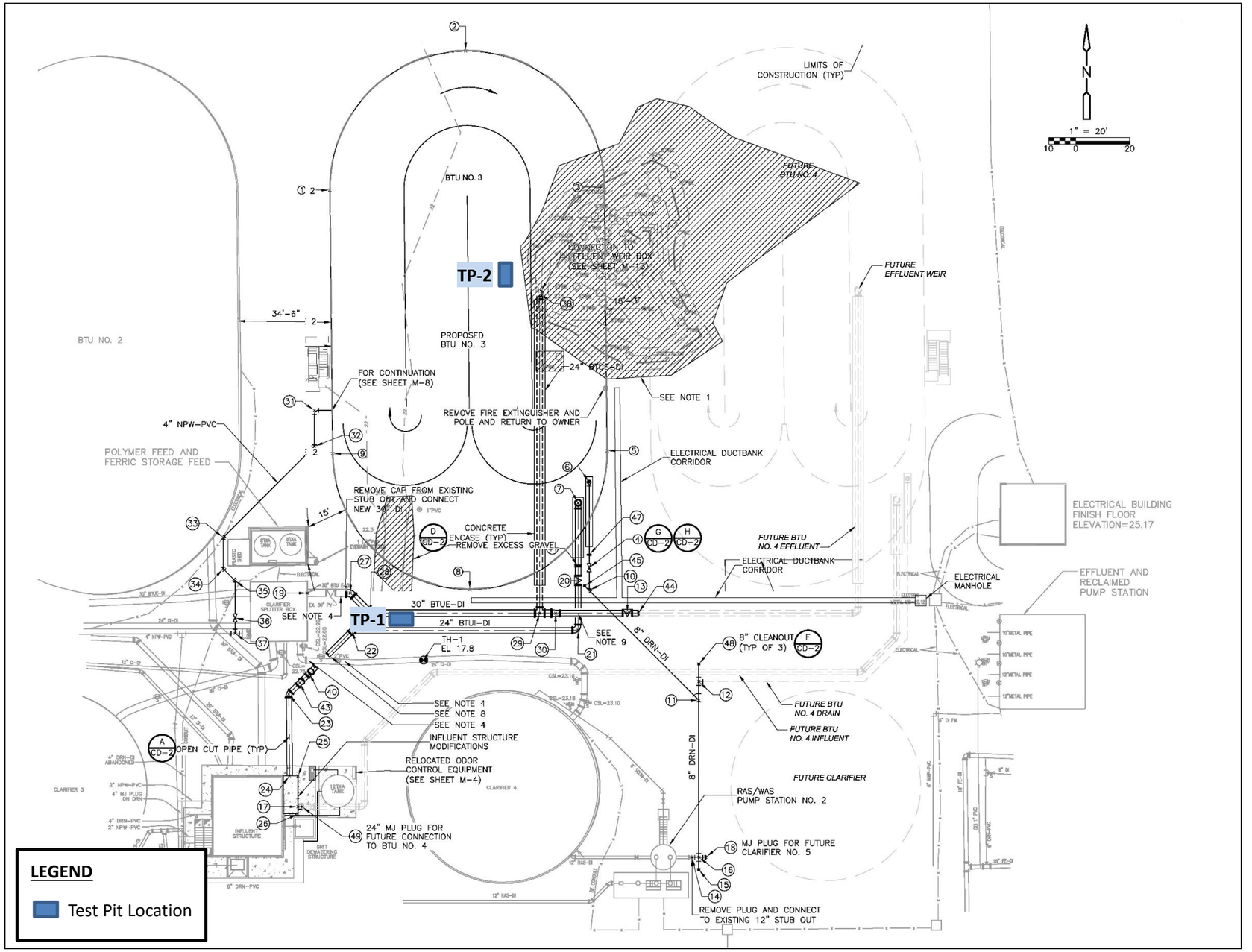
3728 Philips Highway, Suite 208, Jacksonville, FL 32207

CLIENT:	
CDM Smith, Inc.	
DATE:	MAE PROJECT NO.
8/1/2020	0011-0027

SHEET TITLE: BORING LOCATION PLAN

PROJECT NAME: *CCUA Fleming Island Wastewater Treatment Facility*
Fleming Island, Florida

FIGURE NO. 2



NOTE: Yard Piping Plan, Sheet C-3 dated August 2020 as provided by CDM Smith, Inc.

Project Manager:	PRM
Drawn by:	MCV
Checked by:	MCV
Approved by:	WJM

Project No.	0011-0027
Scale:	AS SHOWN
File Name:	0011-0027.TPL
Date:	9/1/2020

Meskel & Associates Engineering

3728 PHILIPS HIGHWAY, SUITE 208, JACKSONVILLE, FL 32207

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TEST PIT LOCATION PLAN

CCUA FLEMING ISLAND WASTEWATER TREATMENT FACILITY
FLEMING ISLAND, FLORIDA

FIG NO. 2A

Oxidation Ditch

OD-1
Latitude: 30° 5'37.09"N
Longitude: 81°43'7.67"W

N	Depth (ft)	Description
	0	Topsoil (2")
7		Loose, Very dark gray to dark fine SAND with silt, few root fragments and gravel (rock fragments), poorly graded. (SP-SM)
12		Medium dense, Very dark gray fine SAND with silt, poorly graded. (SP-SM)
10	5	Medium dense, Light brownish gray clayey fine SAND with silt, poorly graded. (SC)
9		
8		Medium dense, Light greenish gray silty fine SAND, trace clay, poorly graded. (SM)
6	15	Loose, Light greenish gray silty fine SAND, poorly graded. (SM)
6	20	Loose, Light greenish gray fine SAND with silt, poorly graded. (SP-SM)
8	25	Medium dense,Greenish gray silty fine SAND, poorly graded. (SM)
6	30	Loose, Light greenish gray silty fine SAND, poorly graded. (SM)
5	35	Loose, Dark greenish gray silty fine SAND, trace clay, poorly graded. (SM)
31	40	Dense, Gray fine SAND with silt, poorly graded. (SP-SM)
33	45	
10	50	Medium dense, Greenish gray silty fine SAND, few clay layers, poorly graded. (SM)
	55	

w = 23, -200 = 24
w = 24, -200 = 18
w = 27, -200 = 13

BT @ 50.'
Date Drilled: 2/17/2020
Boring Grouted upon Termination.

OD-2
Latitude: 30° 5'35.62"N
Longitude: 81°43'7.68"W

N	Depth (ft)	Description
7	0	Loose, Very dark gray fine SAND, trace silt and root fragments, poorly graded. (SP)
19		Medium dense, Dark gray to gray fine SAND with silt, trace organic fines, poorly graded. (SP-SM)
7		Loose, Brown silty fine SAND with organic fines and root fragments, poorly graded. (SM)
5	10	
7		
8	15	Loose to medium dense, Light brownish gray silty fine SAND, poorly graded. (SM)
6	20	Loose, Light gray fine SAND with silt, poorly graded. (SP-SM)
6	25	
5	30	Loose, Gray silty fine SAND, poorly graded. (SM)
6	35	
6	40	Loose to medium dense, Gray fine SAND with silt, poorly graded. (SP-SM)
22	45	
10	50	Medium dense, Greenish gray silty fine SAND, poorly graded. (SM)
	55	

BT @ 50.'
Date Drilled: 2/17/2020
Boring Grouted upon Termination.

OD-3
Latitude: 30° 5'36.39"N
Longitude: 81°43'7.97"W

N	Depth (ft)	Description
4	0	Loose, Dark gray fine SAND with silt, poorly graded. (SP-SM)
8		Medium dense, Very dark brown fine SAND with silt, trace organic fines, poorly graded. (SP-SM)
16		Medium dense, Dark grayish brown to grayish brown fine SAND with silt, poorly graded. (SP-SM)
15	5	Medium dense, Gray silty fine SAND, poorly graded. (SM)
13		Medium dense, Gray to grayish brown silty fine SAND, poorly graded. (SM)
5	15	
5	20	Loose, Gray silty fine SAND, poorly graded. (SM)
6	25	Loose, Grayish to brownish yellow silty fine SAND, poorly graded. (SM)
6	30	
6	35	Loose, Gray silty fine SAND, poorly graded. (SM)
5	40	Loose, Dark gray very clayey fine SAND, poorly graded. (SC)
39	45	Dense, Gray silty fine SAND, poorly graded. (SM)
12	50	Medium dense, Light brownish gray to gray silty fine SAND, poorly graded. (SM)
	55	

w = 21, -200 = 10
w = 29, -200 = 17
w = 47, -200 = 46, LL = 37, PI = 18

BT @ 50.'
Date Drilled: 2/17/2020
Boring Grouted upon Termination.

OD-4
Latitude: 30° 5'36.39"N
Longitude: 81°43'7.41"W

N	Depth (ft)	Description
9	0	Medium dense, Light brownish gray fine SAND with silt, trace clay, poorly graded. (SP-SM)
18		Medium dense, Very dark gray fine SAND with silt, little organic fines, few root fragments, poorly graded. (SP-SM)
15		Medium dense, Very dark grayish brown fine SAND with silt, trace root fragments, poorly graded. (SP-SM)
5	10	Loose, Light brownish gray silty fine SAND with clay, poorly graded. (SM)
10		Medium dense, Light brownish gray to light greenish gray silty fine SAND, poorly graded. (SM)
5	15	
6	20	Medium dense to loose, Light greenish gray silty fine SAND, trace organic fines, poorly graded. (SM)
6	25	
5	30	
7	35	
5	40	Loose, Dark greenish gray silty fine SAND, poorly graded. (SM)
15	45	Medium dense, Greenish gray clayey fine SAND with silt, poorly graded. (SC)
10	50	Medium dense, Greenish gray silty SAND, trace clay, poorly graded. (SM)
	55	

w = 24, -200 = 10, OC = 6.5
w = 26, -200 = 22
w = 28, OC = 0.6

BT @ 50.'
Date Drilled: 2/18/2020
Boring Grouted upon Termination.

Legend

Topsoil
Silty Fine Sand
Fine Sand with Silt
Fine Sand
Clayey Fine Sand

N — Standard Penetration Resistance, Blows/Foot
BT — Boring Terminated at Depth Below Existing Grade
(SP) — Unified Soil Classification System (USCS)
▽ — Depth to Groundwater at Time of Drilling
w — Natural Moisture Content (%)
-200 — % Passing No. 200 U.S. Standard Sieve
OC — Organic Content (%)
LL — Liquid Limit
PI — Plasticity Index

REVISIONS					
DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION

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CDM Smith, Inc.

DATE:	MAE PROJECT NO.
8/1/2020	0011-0027

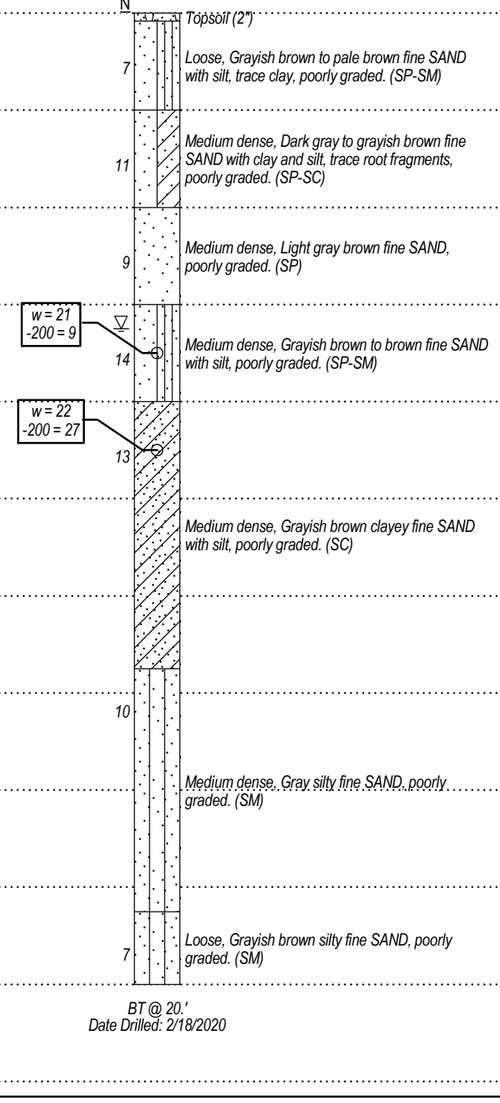
SHEET TITLE: Generalized Soil Profiles

PROJECT NAME: CCUA Fleming Island Wastewater Treatment Facility
Fleming Island, Florida

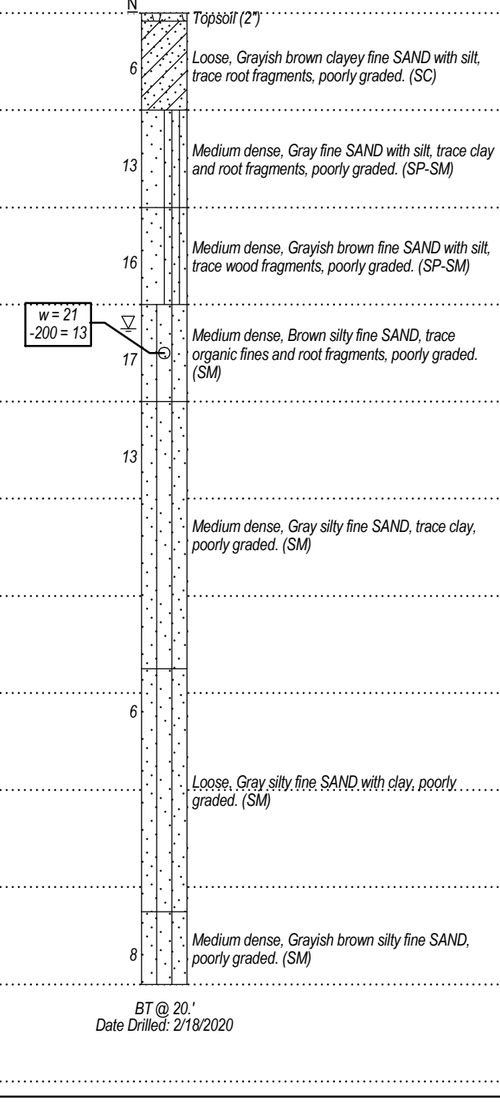
FIGURE NO. 3

Headworks Structure

HW-1
Latitude: 30° 5'34.65"N
Longitude: 81°43'8.71"W



HW-2
Latitude: 30° 5'34.82"N
Longitude: 81°43'8.25"W



Depth (ft)

Legend

- Topsoil
- Fine Sand
- Fine Sand with Silt
- Clayey Fine Sand
- Fine Sand with Clay
- Silty Fine Sand

N — Standard Penetration Resistance, Blows/Foot
BT — Boring Terminated at Depth Below Existing Grade
(SP) — Unified Soil Classification System (USCS)
▽ — Depth to Groundwater at Time of Drilling
w — Natural Moisture Content (%)
-200 — % Passing No. 200 U.S. Standard Sieve

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DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION

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CDM Smith, Inc.

DATE:	MAE PROJECT NO.
8/1/2020	0011-0027

SHEET TITLE: *Generalized Soil Profiles*

PROJECT NAME: *CCUA Fleming Island Wastewater Treatment Facility*
Fleming Island, Florida

FIGURE NO. 4

Pipeline

P-1
Latitude: 30° 5'35.33"N
Longitude: 81°43'8.17"W

Depth (ft)	N	
0		Topsoil (2")
1	8	Medium dense, Dark grayish brown fine SAND with silt, trace organic fines and rock fragments, poorly graded (A-3)
2	14	Medium dense, Gray to very dark gray fine SAND, little root fragments, trace organic fines, poorly graded. (A-3)
3	19	w = 27, -200 = 13 Medium dense, Dark brown silty fine SAND, poorly graded. (A-2-4)
4		▽
5	15	Medium dense, Brown silty fine SAND, poorly graded. (A-2-4)
6	16	Medium dense, Light brownish gray silty fine SAND, poorly graded. (A-2-4)
7		
8		
9		
10		BT @ 10'. Date Drilled: 2/18/2020
11		

P-2
Latitude: 30° 5'35.28"N
Longitude: 81°43'7.67"W

Depth (ft)	N	
0		Topsoil (2")
1	14	Medium dense, Light brownish gray to dark grayish brown fine SAND with silt, trace clay, poorly graded. (A-3)
2	18	Medium dense, Gray fine SAND with silt, poorly graded. (A-3)
3	15	Medium dense, Dark brown fine SAND with silt, poorly graded. (A-3)
4		
5	18	w = 18, -200 = 18 Medium dense, Brown silty fine SAND, poorly graded. (A-2-4)
6	15	Medium dense, Light gray silty fine SAND, poorly graded. (A-2-4)
7		
8		
9		
10		BT @ 10'. Date Drilled: 2/17/2020 GNE
11		

P-3
Latitude: 30° 5'35.28"N
Longitude: 81°43'6.94"W

Depth (ft)	N	
0		Topsoil (2")
1	20	Medium dense, Dark grayish brown to very pale brown fine SAND with clay, trace silt and root fragments, poorly graded. (A-3)
2	16	Medium dense, Gray fine SAND, trace silt and root fragments, poorly graded. (A-3)
3	17	Medium dense, Yellowish brown fine SAND with silt, poorly graded. (A-3)
4		
5	16	w = 17, -200 = 17 Medium dense, Light brownish gray clayey fine SAND, trace root fragments, poorly graded. (A-2-6)
6		▽
7	11	Medium dense, Gray silty fine SAND, poorly graded. (A-2-4)
8		
9		
10		BT @ 10'. Date Drilled: 2/18/2020
11		

P-4
Latitude: 30° 5'36.38"N
Longitude: 81°43'6.94"W

Depth (ft)	N	
0		
1	11	Medium dense, Dark grayish brown fine SAND with silt, trace clay layers and root fragments, poorly graded. (A-3)
2	20	Medium dense, Dark gray to gray fine SAND with silt, trace root fragments, poorly graded. (A-3)
3		▽
4	17	w = 24, -200 = 24 Medium dense, Light yellowish brown silty fine SAND, trace root fragments, poorly graded. (A-2-4)
5		
6	8	Medium dense, Greenish gray clayey fine SAND with silt, poorly graded. (A-2-6)
7		
8		
9	11	Medium dense, Pale brown silty fine SAND, trace clay, poorly graded. (A-2-4)
10		BT @ 10'. Date Drilled: 2/18/2020
11		

Legend

- Topsoil
- Silty Fine Sand
- Fine Sand with Silt
- Fine Sand with Clay
- Fine Sand
- Clayey Fine Sand

N — Standard Penetration Resistance, Blows/Foot
BT — Boring Terminated at Depth Below Existing Grade
(A-3) — AASHTO Soil Classification System
▽ — Depth to Groundwater at Time of Drilling
w — Natural Moisture Content (%)
-200 — % Passing No. 200 U.S. Standard Sieve

REVISIONS					
DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION

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CDM Smith, Inc.

DATE:	MAE PROJECT NO.
8/1/2020	0011-0027

SHEET TITLE: Generalized Soil Profiles

PROJECT NAME: CCUA Fleming Island Wastewater Treatment Facility
Fleming Island, Florida

FIGURE NO. 5

TP-1
Latitude: 30° 5'35.23"N,
Longitude: 81°43'7.75"W

Brown fine SAND with silt, trace root fragments, gravel (rock fragments) and cemented sand, poorly graded. (SP-SM) (Fill)

Light yellowish brown fine SAND with silt, trace clay nodules, poorly graded. (SP-SM) (Fill)

w = 34
-200 = 19
OC = 14

Very dark gray to gray silty fine SAND with organic fines, few clay nodules, root and wood fragments, poorly graded. (SM)

Note: Large stumps encountered at approximately 3 to 4 feet below existing grade.

Gray fine SAND with silt, few wood fragments, trace root fragments, poorly graded. (SP-SM)

Brown to light brown fine SAND with silt, poorly graded. (SP-SM)

TPT @ 12'.
Date Excavated: 8/6/2020
GNE

TP-2
Latitude: 30° 5'36.46"N,
Longitude: 81°43'7.34"W

Grayish brown to light yellowish brown fine SAND with silt, poorly graded. (SP-SM) (Fill)

Note: Very dark gray sand layer observed at approximately 1.4 feet. No sample obtained.

Light brownish gray to light gray fine SAND with silt, poorly graded. (SP-SM)

Dark gray fine SAND with silt, poorly graded. (SP-SM)

Brown fine SAND with silt, poorly graded. (SP-SM)

w = 24
-200 = 25

Dark gray to yellowish brown clayey fine SAND, poorly graded. (SC)

Gray silty fine SAND, trace clay, poorly graded. (SM)

TPT @ 12'.
Date Excavated: 8/6/2020

Depth (ft)

0 1 2 3 4 5 6 7 8 9 10 11 12

Legend

- Fine Sand with Silt
- Silty Fine Sand
- Silty Fine Sand with Organic Fines
- Clayey Fine Sand

(SP) Unified Soil Classification System (USCS)
TPT Test Pit Terminated at Depth Below Grade
Depth to Groundwater at Time of Drilling
-200 % Passing No. 200 U.S. Standard Sieve
Apparent Fill Soil
w Natural Moisture Content (%)
GNE Groundwater Not Encountered at time of excavation
OC Organic Content (%)

REVISIONS					
DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION

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CDM Smith, Inc.

DATE	MAE PROJECT NO.
8/1/2020	0011-0027

SHEET TITLE: Generalized Soil Profiles

PROJECT NAME: CCUA Fleming Island Wastewater Treatment Facility
Fleming Island, Florida

FIGURE NO. 6

Appendix A

Meskel & Associates Engineering, PLLC
FL. Registry No. 28142
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Jacksonville, FL 32207
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Meskel & Associates Engineering

BORING OD-1

PROJECT NO. 0011-0027

PROJECT NAME CCUA Fleming Island Wastewater Treatment Facility

PROJECT LOCATION Fleming Island, Florida **CLIENT** CDM Smith, Inc.

DATE STARTED 2/17/20 **COMPLETED** 2/17/20 **LATITUDE** 30° 5'37.09"N **LONGITUDE** 81°43'7.67"W

DRILLING CONTRACTOR MAE, PLLC **DRILLING METHOD** Standard Penetration Test

LOGGED BY D.McLellan **CHECKED BY** W. Josh Mele **GROUND ELEVATION** — **HAMMER TYPE** Automatic

DEPTH (ft)	SAMPLE DEPTH NUMBER	MATERIAL DESCRIPTION	USCS	GRAPHIC LOG	BLOW COUNTS	N-VALUE	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	POCKET PEN. (tsf)	RECOVERY % (RQD)	REMARKS
0		Topsoil (2")												
	1	Loose, Very dark gray to dark fine SAND with silt, few root fragments and gravel (rock fragments), poorly graded.	SP-SM		4 3 4 4	7								
	2	Medium dense, Very dark gray fine SAND with silt, poorly graded.	SP-SM		4 5 7 9	12								
5	3	▽ Medium dense, Light brownish gray clayey fine SAND with silt, poorly graded.	SC		4 5 5 6	10	23	24						
	4	Medium dense, Light greenish gray silty fine SAND, trace clay, poorly graded.	SM		5 4 5 4	9								
10	5				3 4 4 4	8	24	18						
	6				3 3 3	6	27	13						
15		Loose, Light greenish gray silty fine SAND, poorly graded.	SM											
	7	Loose, Light greenish gray fine SAND with silt, poorly graded.	SP-SM		2 3 3	6								
20														

NOTES

GROUND WATER LEVELS

▽ **AT TIME OF DRILLING** 4 ft 6 in *▽ **AFTER DRILLING** ---

(Continued Next Page)

NEW MAE LOG LAT/LON -USCS - NEW TEMPLATE 7-30-12.GDT - 3/11/20 09:02 - F:\GINT\GINT FILES\PROJECTS\0011-0027\FLEMING ISLAND WWTF.GPJ

Meskel & Associates Engineering, PLLC
FL. Registry No. 28142
3728 Philips Highway, Suite 208
Jacksonville, FL 32207
P: (904)519-6990 F: (904)519-6992

Meskel & Associates Engineering

BORING OD-1

PROJECT NO. 0011-0027

PROJECT NAME CCUA Fleming Island Wastewater Treatment Facility

PROJECT LOCATION Fleming Island, Florida **CLIENT** CDM Smith, Inc.

DEPTH (ft)	SAMPLE DEPTH NUMBER	MATERIAL DESCRIPTION	USCS	GRAPHIC LOG	BLOW COUNTS	N-VALUE	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	POCKET PEN. (tsf)	RECOVERY % (RQD)	REMARKS
20		Loose, Light greenish gray fine SAND with silt, poorly graded. *(continued)*	SP-SM											
25	8	Medium dense,Greenish gray silty fine SAND, poorly graded.	SM		3 4 4	8								
30	9	Loose, Light greenish gray silty fine SAND, poorly graded.	SM		2 3 3	6								
35	10	Loose, Dark greenish gray silty fine SAND, trace clay, poorly graded.	SM		2 3 2	5								
40	11	Dense, Gray fine SAND with silt, poorly graded.	SP-SM		8 13 18	31								

NOTES

GROUND WATER LEVELS

AT TIME OF DRILLING 4 ft 6 in *▽ **AFTER DRILLING** ---

(Continued Next Page)

NEW MAE LOG LAT/LON -USCS - NEW TEMPLATE 7-30-12.GDT - 3/11/20 09:02 - F:\GINT\GINT FILES\PROJECTS\0011-0027\FLEMING ISLAND WWTF.GPJ

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BORING OD-1

PROJECT NO. 0011-0027

PROJECT NAME CCUA Fleming Island Wastewater Treatment Facility

PROJECT LOCATION Fleming Island, Florida **CLIENT** CDM Smith, Inc.

DEPTH (ft)	SAMPLE DEPTH NUMBER	MATERIAL DESCRIPTION	USCS	GRAPHIC LOG	BLOW COUNTS	N-VALUE	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	POCKET PEN. (tsf)	RECOVERY % (RQD)	REMARKS
45	12	Dense, Gray fine SAND with silt, poorly graded. *(continued)*	SP-SM		9 14 19	33								
50	13	Medium dense, Greenish gray silty fine SAND, few clay layers, poorly graded.	SM		4 5 5	10								
		Bottom of borehole at 50 feet. Boring Grouted upon Termination.												

NOTES

GROUND WATER LEVELS

▽ **AT TIME OF DRILLING** 4 ft 6 in *▽ **AFTER DRILLING** ---

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BORING OD-2

PROJECT NO. 0011-0027

PROJECT NAME CCUA Fleming Island Wastewater Treatment Facility

PROJECT LOCATION Fleming Island, Florida **CLIENT** CDM Smith, Inc.

DATE STARTED 2/17/20 **COMPLETED** 2/17/20 **LATITUDE** 30° 5'35.62"N **LONGITUDE** 81°43'7.68"W

DRILLING CONTRACTOR MAE, PLLC **DRILLING METHOD** Standard Penetration Test

LOGGED BY D.McLellan **CHECKED BY** W. Josh Mele **GROUND ELEVATION** — **HAMMER TYPE** Automatic

DEPTH (ft)	SAMPLE DEPTH NUMBER	MATERIAL DESCRIPTION	USCS	GRAPHIC LOG	BLOW COUNTS	N-VALUE	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	POCKET PEN. (tsf)	RECOVERY % (RQD)	REMARKS
0	1	Loose, Very dark gray fine SAND, trace silt and root fragments, poorly graded.	SP		4 3 4 4	7								
	2	Medium dense, Dark gray to gray fine SAND with silt, trace organic fines, poorly graded.	SP-SM		5 10 9 5	19								
5	3	Loose, Brown silty fine SAND with organic fines and root fragments, poorly graded.	SM		2 3 4 4	7								
	4 ▽				3 3 2 2	5								
10	5	Loose to medium dense, Light brownish gray silty fine SAND, poorly graded.	SM		3 3 4 6	7								
15	6				5 4 4	8								
20	7	Loose, Light gray fine SAND with silt, poorly graded.	SP-SM		2 3 3	6								

NOTES

GROUND WATER LEVELS

▽ **AT TIME OF DRILLING** 7 ft 10 in *▽ **AFTER DRILLING** ---

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BORING OD-2

PROJECT NO. 0011-0027

PROJECT NAME CCUA Fleming Island Wastewater Treatment Facility

PROJECT LOCATION Fleming Island, Florida **CLIENT** CDM Smith, Inc.

DEPTH (ft)	SAMPLE DEPTH NUMBER	MATERIAL DESCRIPTION	USCS	GRAPHIC LOG	BLOW COUNTS	N-VALUE	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	POCKET PEN. (tsf)	RECOVERY % (RQD)	REMARKS
20		Loose, Light gray fine SAND with silt, poorly graded. *(continued)*	SP-SM											
25	8				4 3 3	6								
30	9	Loose, Gray silty fine SAND, poorly graded.	SM		1 2 3	5								
35	10				2 3 3	6								
40	11	Loose to medium dense, Gray fine SAND with silt, poorly graded.	SP-SM		2 4 2	6								

NOTES

GROUND WATER LEVELS

▽ **AT TIME OF DRILLING** 7 ft 10 in *▽ **AFTER DRILLING** ---

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BORING OD-2

PROJECT NO. 0011-0027

PROJECT NAME CCUA Fleming Island Wastewater Treatment Facility

PROJECT LOCATION Fleming Island, Florida **CLIENT** CDM Smith, Inc.

DEPTH (ft)	SAMPLE DEPTH NUMBER	MATERIAL DESCRIPTION	USCS	GRAPHIC LOG	BLOW COUNTS	N-VALUE	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	POCKET PEN. (tsf)	RECOVERY % (RQD)	REMARKS
45	12	Loose to medium dense, Gray fine SAND with silt, poorly graded. *(continued)*	SP-SM		9 11 11	22								
50	13	Medium dense, Greenish gray silty fine SAND, poorly graded.	SM		5 5 5	10								
		Bottom of borehole at 50 feet. Boring Grouted upon Termination.												

NOTES

GROUND WATER LEVELS

▽ **AT TIME OF DRILLING** 7 ft 10 in *▽ **AFTER DRILLING** ---

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BORING OD-3

PROJECT NO. 0011-0027

PROJECT NAME CCUA Fleming Island Wastewater Treatment Facility

PROJECT LOCATION Fleming Island, Florida **CLIENT** CDM Smith, Inc.

DATE STARTED 2/17/20 **COMPLETED** 2/17/20 **LATITUDE** 30° 5'36.39"N **LONGITUDE** 81°43'7.97"W

DRILLING CONTRACTOR MAE, PLLC **DRILLING METHOD** Standard Penetration Test

LOGGED BY D.McLellan **CHECKED BY** W. Josh Mele **GROUND ELEVATION** — **HAMMER TYPE** Automatic

DEPTH (ft)	SAMPLE DEPTH NUMBER	MATERIAL DESCRIPTION	USCS	GRAPHIC LOG	BLOW COUNTS	N-VALUE	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	POCKET PEN. (tsf)	RECOVERY % (RQD)	REMARKS
0	1	Loose, Dark gray fine SAND with silt, poorly graded.	SP-SM		1 3 1 5	4								
	2	Medium dense, Very dark brown fine SAND with silt, trace organic fines, poorly graded.	SP-SM		5 3 5 6	8								
5	3	▽ Medium dense, Dark grayish brown to grayish brown fine SAND with silt, poorly graded.	SP-SM		7 7 9 8	16	21	10						
	4	Medium dense, Gray silty fine SAND, poorly graded.	SM		6 6 9 7	15								
10	5	Medium dense, Gray to grayish brown silty fine SAND, poorly graded.	SM		5 6 7 7	13								
15	6	Loose, Gray silty fine SAND, poorly graded.	SM		2 2 3	5	29	17						
20	7				2 3 2	5								

NOTES

GROUND WATER LEVELS

▽ **AT TIME OF DRILLING** 5 ft 2 in *▽ **AFTER DRILLING** ---

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BORING OD-3

PROJECT NO. 0011-0027

PROJECT NAME CCUA Fleming Island Wastewater Treatment Facility

PROJECT LOCATION Fleming Island, Florida **CLIENT** CDM Smith, Inc.

DEPTH (ft)	SAMPLE DEPTH NUMBER	MATERIAL DESCRIPTION	USCS	GRAPHIC LOG	BLOW COUNTS	N-VALUE	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	POCKET PEN. (tsf)	RECOVERY % (RQD)	REMARKS
20		Loose, Gray silty fine SAND, poorly graded. *(continued)*	SM											
25	8	Loose, Grayish to brownish yellow silty fine SAND, poorly graded.	SM		3 3 3	6								
30	9	Loose, Gray silty fine SAND, poorly graded.	SM		2 3 3	6								
35	10				2 3 3	6								
40	11	Loose, Dark gray very clayey fine SAND, poorly graded.	SC		3 2 3	5	47	46		37	18			

NOTES

GROUND WATER LEVELS

▽ **AT TIME OF DRILLING** 5 ft 2 in *▽ **AFTER DRILLING** ---

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BORING OD-3

PROJECT NO. 0011-0027

PROJECT NAME CCUA Fleming Island Wastewater Treatment Facility

PROJECT LOCATION Fleming Island, Florida **CLIENT** CDM Smith, Inc.

DEPTH (ft)	SAMPLE DEPTH NUMBER	MATERIAL DESCRIPTION	USCS	GRAPHIC LOG	BLOW COUNTS	N-VALUE	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	POCKET PEN. (tsf)	RECOVERY % (RQD)	REMARKS
		Loose, Dark gray very clayey fine SAND, poorly graded. *(continued)*	SC											
45	12				9 16 23	39								
		Dense, Gray silty fine SAND, poorly graded.	SM											
50	13	Medium dense, Light brownish gray to gray silty fine SAND, poorly graded.	SM		3 5 7	12								
		Bottom of borehole at 50 feet. Boring Grouted upon Termination.												

NOTES

GROUND WATER LEVELS

AT TIME OF DRILLING 5 ft 2 in ***AFTER DRILLING** ---

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BORING OD-4

PROJECT NO. 0011-0027

PROJECT NAME CCUA Fleming Island Wastewater Treatment Facility

PROJECT LOCATION Fleming Island, Florida **CLIENT** CDM Smith, Inc.

DATE STARTED 2/18/20 **COMPLETED** 2/18/20 **LATITUDE** 30° 5'36.39"N **LONGITUDE** 81°43'7.41"W

DRILLING CONTRACTOR MAE, PLLC **DRILLING METHOD** Standard Penetration Test

LOGGED BY D.McLellan **CHECKED BY** W. Josh Mele **GROUND ELEVATION** — **HAMMER TYPE** Automatic

DEPTH (ft)	SAMPLE DEPTH NUMBER	MATERIAL DESCRIPTION	USCS	GRAPHIC LOG	BLOW COUNTS	N-VALUE	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	POCKET PEN. (tsf)	RECOVERY % (RQD)	REMARKS
0	1	Medium dense, Light brownish gray fine SAND with silt, trace clay, poorly graded.	SP-SM		3 4 5 5	9								
	2	Medium dense, Very dark gray fine SAND with silt, little organic fines, few root fragments, poorly graded.	SP-SM		5 9 9 10	18	24	10	6.5					
5	3	Medium dense, Very dark grayish brown fine SAND with silt, trace root fragments, poorly graded. ▽	SP-SM		6 7 8 7	15								
	4	Loose, Light brownish gray silty fine SAND with clay, poorly graded.	SM		3 2 3 4	5	26	22						
10	5	Medium dense, Light brownish gray to light greenish gray silty fine SAND, poorly graded.	SM		3 4 6 6	10								
15	6				2 2 3	5								
		Medium dense to loose, Light greenish gray silty fine SAND, trace organic fines, poorly graded.	SM											
20	7				3 3 3	6	28		0.6					

NOTES

GROUND WATER LEVELS

▽ **AT TIME OF DRILLING** 5 ft 10 in *▽ **AFTER DRILLING** ---

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BORING OD-4

PROJECT NO. 0011-0027

PROJECT NAME CCUA Fleming Island Wastewater Treatment Facility

PROJECT LOCATION Fleming Island, Florida **CLIENT** CDM Smith, Inc.

DEPTH (ft)	SAMPLE DEPTH NUMBER	MATERIAL DESCRIPTION	USCS	GRAPHIC LOG	BLOW COUNTS	N-VALUE	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	POCKET PEN. (tsf)	RECOVERY % (RQD)	REMARKS
20														
	8				3 3 3	6								
25		Medium dense to loose, Light greenish gray silty fine SAND, trace organic fines, poorly graded. *(continued)*	SM											
	9				2 2 3	5								
30														
	10				2 3 4	7								
35		Loose, Dark greenish gray silty fine SAND, poorly graded.	SM											
	11				2 3 2	5								
40														

NOTES

GROUND WATER LEVELS

▽ **AT TIME OF DRILLING** 5 ft 10 in *▽ **AFTER DRILLING** ---

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BORING OD-4

PROJECT NO. 0011-0027

PROJECT NAME CCUA Fleming Island Wastewater Treatment Facility

PROJECT LOCATION Fleming Island, Florida **CLIENT** CDM Smith, Inc.

DEPTH (ft)	SAMPLE DEPTH NUMBER	MATERIAL DESCRIPTION	USCS	GRAPHIC LOG	BLOW COUNTS	N-VALUE	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	POCKET PEN. (tsf)	RECOVERY % (RQD)	REMARKS
		Loose, Dark greenish gray silty fine SAND, poorly graded. *(continued)*	SM											
45	12	Medium dense, Greenish gray clayey fine SAND with silt, poorly graded.	SC		7 9 6	15								
50	13	Medium dense, Greenish gray silty SAND, trace clay, poorly graded.	SM		3 5 5	10								
		Bottom of borehole at 50 feet. Boring Grouted upon Termination.												

NOTES

GROUND WATER LEVELS

▽ **AT TIME OF DRILLING** 5 ft 10 in *▽ **AFTER DRILLING** ---

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BORING HW-1

PROJECT NO. 0011-0027

PROJECT NAME CCUA Fleming Island Wastewater Treatment Facility

PROJECT LOCATION Fleming Island, Florida **CLIENT** CDM Smith, Inc.

DATE STARTED 2/18/20 **COMPLETED** 2/18/20 **LATITUDE** 30° 5'34.65"N **LONGITUDE** 81°43'8.71"W

DRILLING CONTRACTOR MAE, PLLC **DRILLING METHOD** Standard Penetration Test

LOGGED BY D.McLellan **CHECKED BY** W. Josh Mele **GROUND ELEVATION** — **HAMMER TYPE** Automatic

DEPTH (ft)	SAMPLE DEPTH NUMBER	MATERIAL DESCRIPTION	USCS	GRAPHIC LOG	BLOW COUNTS	N-VALUE	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	POCKET PEN. (tsf)	RECOVERY % (RQD)	REMARKS
0		Topsoil (2")												
	1	Loose, Grayish brown to pale brown fine SAND with silt, trace clay, poorly graded.	SP-SM		3 4 3 4	7								
	2	Medium dense, Dark gray to grayish brown fine SAND with clay and silt, trace root fragments, poorly graded.	SP-SC		5 5 6 6	11								
5	3	Medium dense, Light gray brown fine SAND, poorly graded.	SP		5 4 5 5	9								
	4	▽ Medium dense, Grayish brown to brown fine SAND with silt, poorly graded.	SP-SM		6 7 7 6	14	21	9						
10	5	Medium dense, Grayish brown clayey fine SAND with silt, poorly graded.	SC		5 6 7 5	13	22	27						
15	6	Medium dense, Gray silty fine SAND, poorly graded.	SM		6 4 6	10								
20	7	Loose, Grayish brown silty fine SAND, poorly graded.	SM		4 3 4	7								

Bottom of borehole at 20 feet.

NOTES Boring backfilled with soil cuttings.

GROUND WATER LEVELS

▽ **AT TIME OF DRILLING** 6 ft 6 in *▽ **AFTER DRILLING** ---

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BORING HW-2

PROJECT NO. 0011-0027

PROJECT NAME CCUA Fleming Island Wastewater Treatment Facility

PROJECT LOCATION Fleming Island, Florida **CLIENT** CDM Smith, Inc.

DATE STARTED 2/18/20 **COMPLETED** 2/18/20 **LATITUDE** 30° 5'34.82"N **LONGITUDE** 81°43'8.25"W

DRILLING CONTRACTOR MAE, PLLC **DRILLING METHOD** Standard Penetration Test

LOGGED BY D.McLellan **CHECKED BY** W. Josh Mele **GROUND ELEVATION** — **HAMMER TYPE** Automatic

DEPTH (ft)	SAMPLE DEPTH NUMBER	MATERIAL DESCRIPTION	USCS	GRAPHIC LOG	BLOW COUNTS	N-VALUE	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	POCKET PEN. (tsf)	RECOVERY % (RQD)	REMARKS
0		Topsoil (2")												
	1	Loose, Grayish brown clayey fine SAND with silt, trace root fragments, poorly graded.	SC		2 3 3 4	6								
	2	Medium dense, Gray fine SAND with silt, trace clay and root fragments, poorly graded.	SP-SM		5 7 6 6	13								
5	3	Medium dense, Grayish brown fine SAND with silt, trace wood fragments, poorly graded.	SP-SM		6 9 7 12	16								
	4	▽ Medium dense, Brown silty fine SAND, trace organic fines and root fragments, poorly graded.	SM		7 9 8 7	17	21	13						
10	5	Medium dense, Gray silty fine SAND, trace clay, poorly graded.	SM		9 7 6 6	13								
15	6	Loose, Gray silty fine SAND with clay, poorly graded.	SM		3 3 3	6								
20	7	Medium dense, Grayish brown silty fine SAND, poorly graded.	SM		3 4 4	8								

Bottom of borehole at 20 feet.

NOTES Boring backfilled with soil cuttings.

GROUND WATER LEVELS

▽ **AT TIME OF DRILLING** 6 ft 6 in *▽ **AFTER DRILLING** ---

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BORING P-4

PROJECT NO. 0011-0027

PROJECT NAME CCUA Fleming Island Wastewater Treatment Facility

PROJECT LOCATION Fleming Island, Florida **CLIENT** CDM Smith, Inc.

DATE STARTED 2/18/20 **COMPLETED** 2/18/20 **LATITUDE** 30° 5'36.38"N **LONGITUDE** 81°43'6.94"W

DRILLING CONTRACTOR MAE, PLLC **DRILLING METHOD** Standard Penetration Test

LOGGED BY D.McLellan **CHECKED BY** W. Josh Mele **GROUND ELEVATION** — **HAMMER TYPE** Automatic

DEPTH (ft)	SAMPLE DEPTH NUMBER	MATERIAL DESCRIPTION	AASHTO	GRAPHIC LOG	BLOW COUNTS	N-VALUE	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	POCKET PEN. (tsf)	RECOVERY % (RQD)	REMARKS
0	1	Medium dense, Dark grayish brown fine SAND with silt, trace clay layers and root fragments, poorly graded.	A-3		3 5 6 11	11								
	2	Medium dense, Dark gray to gray fine SAND with silt, trace root fragments, poorly graded.	A-3		5 7 13 12	20								
5	3	▽ Medium dense, Light yellowish brown silty fine SAND, trace root fragments, poorly graded.	A-2-4		9 8 9 9	17	24	24						
	4	Medium dense, Greenish gray clayey fine SAND with silt, poorly graded.	A-2-6		7 4 4 6	8								
10	5	Medium dense, Pale brown silty fine SAND, trace clay, poorly graded.	A-2-4		4 5 6 4	11								
		Bottom of borehole at 10 feet.												

NOTES Boring backfilled with soil cuttings.

GROUND WATER LEVELS

▽ **AT TIME OF DRILLING** 4 ft 6 in *▽ **END OF DAY** ---

NEW MAE LOG AASTHO LAT_LONG - NEW TEMPLATE 7-30-12.GDT - 3/11/20 09:12 - F:\GINT\GINT FILES\PROJECTS\0011-0027\FLEMING ISLAND WWTF.GPJ

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BORING P-2

PROJECT NO. 0011-0027

PROJECT NAME CCUA Fleming Island Wastewater Treatment Facility

PROJECT LOCATION Fleming Island, Florida **CLIENT** CDM Smith, Inc.

DATE STARTED 2/17/20 **COMPLETED** 2/17/20 **LATITUDE** 30° 5'35.28"N **LONGITUDE** 81°43'7.67"W

DRILLING CONTRACTOR MAE, PLLC **DRILLING METHOD** Standard Penetration Test

LOGGED BY D.McLellan **CHECKED BY** W. Josh Mele **GROUND ELEVATION** — **HAMMER TYPE** Automatic

DEPTH (ft)	SAMPLE DEPTH NUMBER	MATERIAL DESCRIPTION	AASHTO	GRAPHIC LOG	BLOW COUNTS	N-VALUE	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	POCKET PEN. (tsf)	RECOVERY % (RQD)	REMARKS
0		Topsoil (2")												
	1	Medium dense, Light brownish gray to dark grayish brown fine SAND with silt, trace clay, poorly graded.	A-3		4 6 8 9	14								
	2	Medium dense, Gray fine SAND with silt, poorly graded.	A-3		4 6 12 11	18								
5	3	Medium dense, Dark brown fine SAND with silt, poorly graded.	A-3		6 7 8 20	15								
	4	Medium dense, Brown silty fine SAND, poorly graded.	A-2-4		4 7 11 10	18	18	18						
10	5	Medium dense, Light gray silty fine SAND, poorly graded.	A-2-4		2 7 8 9	15								
		Bottom of borehole at 10 feet.												

NOTES Boring backfilled with soil cuttings.

GROUND WATER LEVELS

AT TIME OF DRILLING --- GNE **END OF DAY** ---

NEW MAE LOG AASTHO LAT_LONG - NEW TEMPLATE 7-30-12.GDT - 3/11/20 09:12 - F:\GINT\GINT FILES\PROJECTS\0011-0027\FLEMING ISLAND WWTF.GPJ

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BORING P-3

PROJECT NO. 0011-0027

PROJECT NAME CCUA Fleming Island Wastewater Treatment Facility

PROJECT LOCATION Fleming Island, Florida **CLIENT** CDM Smith, Inc.

DATE STARTED 2/18/20 **COMPLETED** 2/18/20 **LATITUDE** 30° 5'35.28"N **LONGITUDE** 81°43'6.94"W

DRILLING CONTRACTOR MAE, PLLC **DRILLING METHOD** Standard Penetration Test

LOGGED BY D.McLellan **CHECKED BY** W. Josh Mele **GROUND ELEVATION** — **HAMMER TYPE** Automatic

DEPTH (ft)	SAMPLE DEPTH NUMBER	MATERIAL DESCRIPTION	AASHTO	GRAPHIC LOG	BLOW COUNTS	N-VALUE	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	POCKET PEN. (tsf)	RECOVERY % (RQD)	REMARKS
0		Topsoil (2")												
	1	Medium dense, Dark grayish brown to very pale brown fine SAND with clay, trace silt and root fragments, poorly graded.	A-3		7 10 10 12	20								
	2	Medium dense, Gray fine SAND, trace silt and root fragments, poorly graded.	A-3		4 6 10 12	16								
5	3	Medium dense. Yellowish brown fine SAND with silt, poorly graded.	A-3		7 9 8 10	17								
	4	Medium dense, Light brownish gray clayey fine SAND, trace root fragments, poorly graded.	A-2-6		9 8 8 7	16	17	17						
	5	▽ Medium dense, Gray silty fine SAND, poorly graded.	A-2-4		7 6 5 7	11								
10		Bottom of borehole at 10 feet.												

NOTES Boring backfilled with soil cuttings.

GROUND WATER LEVELS

▽ **AT TIME OF DRILLING** 8 ft 2 in *▽ **END OF DAY** ---

NEW MAE LOG AASTHO LAT_LONG - NEW TEMPLATE 7-30-12.GDT - 3/11/20 09:12 - F:\GINT\GINT FILES\PROJECTS\0011-0027\FLEMING ISLAND WWTF.GPJ

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Meskel & Associates Engineering

BORING P-4

PROJECT NO. 0011-0027

PROJECT NAME CCUA Fleming Island Wastewater Treatment Facility

PROJECT LOCATION Fleming Island, Florida **CLIENT** CDM Smith, Inc.

DATE STARTED 2/18/20 **COMPLETED** 2/18/20 **LATITUDE** 30° 5'36.38"N **LONGITUDE** 81°43'6.94"W

DRILLING CONTRACTOR MAE, PLLC **DRILLING METHOD** Standard Penetration Test

LOGGED BY D.McLellan **CHECKED BY** W. Josh Mele **GROUND ELEVATION** — **HAMMER TYPE** Automatic

DEPTH (ft)	SAMPLE DEPTH NUMBER	MATERIAL DESCRIPTION	AASHTO	GRAPHIC LOG	BLOW COUNTS	N-VALUE	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	POCKET PEN. (tsf)	RECOVERY % (RQD)	REMARKS
0	1	Medium dense, Dark grayish brown fine SAND with silt, trace clay layers and root fragments, poorly graded.	A-3		3 5 6 11	11								
	2	Medium dense, Dark gray to gray fine SAND with silt, trace root fragments, poorly graded.	A-3		5 7 13 12	20								
5	3	▽ Medium dense, Light yellowish brown silty fine SAND, trace root fragments, poorly graded.	A-2-4		9 8 9 9	17	24	24						
	4	Medium dense, Greenish gray clayey fine SAND with silt, poorly graded.	A-2-6		7 4 4 6	8								
10	5	Medium dense, Pale brown silty fine SAND, trace clay, poorly graded.	A-2-4		4 5 6 4	11								
		Bottom of borehole at 10 feet.												

NOTES Boring backfilled with soil cuttings.

GROUND WATER LEVELS

▽ **AT TIME OF DRILLING** 4 ft 6 in *▽ **END OF DAY** ---

NEW MAE LOG AASTHO LAT_LONG - NEW TEMPLATE 7-30-12.GDT - 3/11/20 09:12 - F:\GINT\GINT FILES\PROJECTS\0011-0027\FLEMING ISLAND WWTF.GPJ

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TEST PIT TP-1

PROJECT NO. 0011-0027

PROJECT NAME CCUA Fleming Island Wastewater Treatment Facility

PROJECT LOCATION Fleming Island, Florida **CLIENT** CDM Smith, Inc.

DATE STARTED 8/6/2020 **COMPLETED** 8/6/2020 **LATITUDE** 30° 5'35.23"N **LONGITUDE** 81°43'7.75"W

EXCAVATION CONTRACTOR MAE, PLLC **EXCAVATION METHOD** Backhoe

LOGGED BY C.Purvis **CHECKED BY** W. Josh Mele **GROUND ELEVATION** — **HAMMER TYPE** —

DEPTH (ft)	MATERIAL DESCRIPTION	USCS	GRAPHIC LOG	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	REMARKS
0.0	Brown fine SAND with silt, trace root fragments, gravel (rock fragments) and cemented sand, poorly graded. (Fill)	SP-SM							
2.5	Light yellowish brown fine SAND with silt, trace clay nodules, poorly graded. (Fill)	SP-SM							
	Very dark gray to gray silty fine SAND with organic fines, few clay nodules, root and wood fragments, poorly graded.	SM		34	19	14			Large stumps encountered at approximately 3 to 4 feet below existing grade.
5.0	Gray fine SAND with silt, few wood fragments, trace root fragments, poorly graded.	SP-SM							
7.5	Brown to light brown fine SAND with silt, poorly graded.	SP-SM							
10.0	Bottom of test pit at 12 feet.								

NOTES GNE-Groundwater Level Not Encountered at Time of Excavation.

GROUND WATER LEVELS

AT TIME OF EXCAVATION --- GNE **END OF DAY** ---

NEW MAE TEST PIT-USCS2018 - NEW TEMPLATE 7-30-12.GDT - 8/18/20 16:48 - F:\GINT\GINT FILES\PROJECTS\0011-0027\FLEMING ISLAND WWTF_TEST PIT.GPJ

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TEST PIT TP-2

PROJECT NO. 0011-0027

PROJECT NAME CCUA Fleming Island Wastewater Treatment Facility

PROJECT LOCATION Fleming Island, Florida **CLIENT** CDM Smith, Inc.

DATE STARTED 8/6/2020 **COMPLETED** 8/6/2020 **LATITUDE** 30° 5'36.46"N **LONGITUDE** 81°43'7.34"W

EXCAVATION CONTRACTOR MAE, PLLC **EXCAVATION METHOD** Backhoe

LOGGED BY C.Purvis **CHECKED BY** W. Josh Mele **GROUND ELEVATION** — **HAMMER TYPE** —

DEPTH (ft)	MATERIAL DESCRIPTION	USCS	GRAPHIC LOG	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	REMARKS
0.0	Grayish brown to light yellowish brown fine SAND with silt, poorly graded. (Fill)	SP-SM							
	Light brownish gray to light gray fine SAND with silt, poorly graded.	SP-SM							Very dark gray sand layer observed at approximately 1.4 feet. No sample obtained.
2.5	Dark gray fine SAND with silt, poorly graded.	SP-SM							
5.0	Brown fine SAND with silt, poorly graded.	SP-SM							
	▽ Dark gray to yellowish brown clayey fine SAND, poorly graded.	SC		24	25				
7.5	Gray silty fine SAND, trace clay, poorly graded.	SM							
10.0	Bottom of test pit at 12 feet.								

NOTES

GROUND WATER LEVELS

▽ **AT TIME OF EXCAVATION** 7 ft 1 in *▽ **END OF DAY** ---

NEW MAE TEST PIT-USCS2018 - NEW TEMPLATE 7-30-12.GDT - 8/18/20 16:48 - F:\GINT\GINT FILES\PROJECTS\0011-0027\FLEMING ISLAND WWTF_TEST PIT.GPJ

FIELD EXPLORATION PROCEDURES

Standard Penetration Test (SPT) Borings

The Standard Penetration Test (SPT) boring(s) are performed in general accordance with the latest revision of ASTM D1586, "Standard Test Method for Standard Penetration Test (SPT) and Split-Barrel Sampling of Soils." In some cases, the borings are advanced manually from the ground surface using a hand-held bucket auger to a depth of approximately 5 feet if there are possible shallow utility conflicts. Otherwise, the borings are advanced using rotary drilling techniques. A split-barrel sampler is inserted to the bottom of the borehole at each sampling interval. The sampler is driven 18 to 24 inches into the soil using a 140-pound hammer falling an average height of 30 inches per hammer blow. The number of hammer blows for the final 12 inches of penetration (18" sample) or for the sum of the middle 12 inches of penetration (24" sample) is termed the "penetration resistance, blow count, or N-value." This value is an index to several in-situ geotechnical properties of the material tested, such as relative density and Young's Modulus.

After driving the sampler, it was retrieved from the borehole and representative samples of the material within the split-barrel were containerized and sealed. After completing the drilling operations, the samples for each boring were transported to the laboratory where they were examined by our engineer in order to verify the field descriptions.

Once the boring is complete and the groundwater level is measured, the borehole is backfilled with soil, or it is backfilled from bottom to top with a lean cementitious grout.

KEY TO BORING LOGS – USCS/AASHTO

Soil Classification

Soil classification of samples obtained at the boring locations is based on the Unified Soil Classification System (USCS) or the American Association of State Highway and Transportation Officials (AASHTO) classification system. Coarse grained soils have more than 50% of their dry weight retained on a #200 sieve. Their principal descriptors are: sand, cobbles and boulders. Fine grained soils have less than 50% of their dry weight retained on a #200 sieve. They are principally described as clays if they are plastic and silts if they are slightly to non-plastic. Major constituents may be added as modifiers and minor constituents may be added according to the relative proportions based on grain size. In addition to gradation, coarse-grained soils are defined on the basis of their in-place relative density and fine-grained soils on the basis of their consistency.

BORING LOG LEGEND

Symbol	Description
N	Standard Penetration Resistance, the number of blows required to advance a standard spoon sampler 12" when driven by a 140-lb hammer dropping 30".
WOR	Split Spoon sampler advanced under the weight of the drill rods
WOH	Split Spoon sampler advanced under the weight of the SPT hammer
50/2”	Indicates 50 hammer blows drove the split spoon 2 inches; 50 Hammer blows for less than 6-inches of split spoon driving is considered “Refusal”.
(SP)	Unified Soil Classification System
-200	Fines content, % Passing No. 200 U.S. Standard Sieve
w	Natural Moisture Content (%)
OC	Organic Content (%)
LL	Liquid Limit
PI	Plasticity Index
NP	Non-Plastic
PP	Pocket Penetrometer in tons per square foot (tsf)

MODIFIERS

SECONDARY CONSTITUENTS
(Sand, Silt or Clay)

Trace	Less than 5%
With	5% to 12%
Sandy, Silty or Clayey	12% to 35%
Very Sandy, Very Silty or Very Clayey	35% to 50%

ORGANIC CONTENT

Trace	Less than 5%
Organic Soils	5% to 20%
Highly Organic Soils (Muck)	20% to 75%
PEAT	Greater than 75%

MINOR COMPONENTS
(Shell, Rock, Debris, Roots, etc.)

Trace	Less than 5%
Few	5% to 10%
Little	15% to 25%
Some	30% to 45%

RELATIVE DENSITY (Coarse-Grained Soils)

Relative Density	N-Value *
Very Loose	Less than 3
Loose	3 to 8
Medium Dense	8 to 24
Dense	24 to 40
Very Dense	Greater than 40

CONSISTENCY (Fine-Grained Soils)

Consistency	N-Value *
Very Soft	Less than 1
Soft	1 to 3
Firm	3 to 6
Stiff	6 to 12
Very Stiff	12 to 24
Hard	Greater than 24

RELATIVE HARDNESS (Limestone)

Relative Hardness	N-Value *
Soft	Less than 50
Hard	Greater than 50

* Using Automatic Hammer

Unified Soil Classification System (USCS)
(from ASTM D 2487)

Major Divisions			*Group Symbol*	*Typical Names*
Coarse-Grained Soils More than 50% retained on the 0.075 mm (No. 4) sieve	**Gravels** 50% or more of coarse fraction retained on the 4.75 mm (No. 4) sieve	Clean Gravels	GW	Well-graded gravels and gravel-sand mixtures, little or no fines
			GP	Poorly graded gravels and gravel-sand mixtures, little or no fines
		Gravels with Fines	GM	Silty gravels, gravel-sand-silt mixtures
			GC	Clayey gravels, gravel-sand-clay mixtures
	Sands 50% or more of coarse fraction passes the 4.75 (No. 4) sieve	Clean Sands	SW	Well-graded sands and gravelly sands, little or no fines
			SP	Poorly graded sands and gravelly sands, little or no fines
		Sands with Fines	SM	Silty sands, sand-silt mixtures
			SC	Clayey sands, sand-clay mixtures
Fine-Grained Soils More than 50% passes the 0.075 mm (No. 200) sieve	**Silts and Clays** Liquid Limit 50% or less		ML	Inorganic silts, very fine sands, rock four, silty or clayey fine sands
			CL	Inorganic clays of low to medium plasticity, gravelly/sandy/silty/lean clays
			OL	Organic silts and organic silty clays of low plasticity
	Silts and Clays Liquid Limit greater than 50%		MH	Inorganic silts, micaceous or diatomaceous fine sands or silts, elastic silts
			CH	Inorganic clays or high plasticity, fat clays
			OH	Organic clays of medium to high plasticity
Highly Organic Soils			PT	Peat, muck, and other highly organic soils

Prefix: G = Gravel, S = Sand, M = Silt, C = Clay, O = Organic
Suffix: W = Well Graded, P = Poorly Graded, M = Silty, L = Clay, LL < 50%, H = Clay, LL > 50%

AASHTO Soil Classification System
(from AASHTO M 145 or ASTM D 3282)

General Classification	***Granular Materials*** *(35% or less passing the 0.075 mm sieve)*							***Silt-Clay Materials*** *(>35% passing the 0.075 mm sieve)*			
Group Classification	A-1		A-3	A-2				A-4	A-5	A-6	A-7
	A-1-a	A-1-b		A-2-4	A-2-5	A-2-6	A-2-7				A-7-5* A-7-6*
Sieve Analysis, % passing:											
2.00 mm (No. 10)	50 max	…	…	…	…	…	…	…	…	…	…
0.425 (No. 40)	30 max	50 max	51 min	…	…	…	…	…	…	…	…
0.075 (No. 200)	15 max	25 max	10 max	35 max	35 max	35 max	35 max	36 min	36 min	36 min	36 min
Characteristics of fraction passing 0.425 mm (No. 40):											
Liquid Limit	…		…	40 max	41 min	40 max	41 min	40 max	41 min	40 max	41 min
Plasticity Index	6 max		N.P.	10 max	10 max	11 min	11 min	10 max	10 max	11 min	11 min
Usual types of significant constituent materials	stone fragments, gravel and sand		fine sand	silty or clayey gravel and sand				silty soils		clayey soils	
General ***local*** rating as a subgrade	excellent to good			fair to poor							

* Plasticity index of A-7-5 subgroup is equal to or less than the LL - 30. Plasticity index of A-7-6 subgroup is greater than LL – 30

** *Northeast Florida*

Meskel & Associates Engineering

Appendix B

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SUMMARY OF LABORATORY TEST RESULTS

PROJECT NO. 0011-0027

PROJECT NAME CCUA Fleming Island Wastewater Treatment Facility

DATE. 9/1/2020

PROJECT LOCATION Fleming Island, Florida

CLIENT CDM Smith, Inc.

Borehole	Sample No.	Approx. Depth (ft)	%<#200 Sieve	Water Content (%)	Organic Content (%)	Liquid Limit	Plastic Limit	Plasticity Index	USCS AASHTO Classification	Comments
HW-1	4	7	9	21	---	---	---	---	SP-SM	
HW-1	5	9	27	22	---	---	---	---	SC	
HW-2	4	7	13	21	---	---	---	---	SM	
OD-1	3	5	24	23	---	---	---	---	SC	
OD-1	5	9	18	24	---	---	---	---	SM	
OD-1	6	14	13	27	---	---	---	---	SM	
OD-3	3	5	10	21	---	---	---	---	SP-SM	
OD-3	6	14	17	29	---	---	---	---	SM	
OD-3	11	38	46	47	---	37	19	18	SC	
OD-4	2	3	10	24	6.5	---	---	---	SP-SM	
OD-4	4	7	22	26	---	---	---	---	SM	
OD-4	7	19		28	0.6	---	---	---	SM	
P-1	3	5	13	27	---	---	---	---	A-2-4	
P-2	4	7	18	18	---	---	---	---	A-2-4	
P-3	4	7	17	17	---	---	---	---	A-2-6	
P-4	4	5	24	24	---	---	---	---	A-2-4	
TP-1	---	3	19	34	14.0	---	---	---	SM	
TP-2	---	7	25	24	---	---	---	---	SC	

Note: "---" Untested Parameter

LAB SUMMARY_MAE_ALL PROJECTS-USCS - GINT STD US LAB.GDT - 3/11/20 09:29 - F:\GINT\GINT FILES\PROJECTS\0011-0027\FLEMING ISLAND WWTF.GPJ

LABORATORY TEST PROCEDURES

Percent Fines Content

The percent fines or material passing the No. 200 mesh sieve of the sample tested was determined in general accordance with the latest revision of ASTM D 1140. The percent fines are the soil particles in the silt and clay size range.

Natural Moisture Content

The water content of the tested sample was determined in general accordance with the latest revision of ASTM D 2216. The water content is defined as the ratio of "pore" or "free" water in a given mass of material to the mass of solid material particles.

Atterberg Limits

The Atterberg Limits consist of the Liquid Limit (LL) and the Plastic Limit (PL). The LL and PL were determined in general accordance with the latest revision of ASTM D 4318. The LL is the water content of the material denoting the boundary between the liquid and plastic states. The PL is the water content denoting the boundary between the plastic and semi-solid states. The Plasticity Index (PI) is the range of water content over which a soil behaves plastically and is denoted numerically by the difference between the LL and the PL. The water content of the sample tested was determined in general accordance with the latest revision of ASTM D 2216. The water content is defined as the ration of "pore" or "free" water in a given mass of material to the mass of solid material particles.

Organic Loss on Ignition (Percent Organics)

The organic loss on ignition or percent organic material in the sample tested was determined in general accordance with ASTM D 2974. The percent organics is the material, expressed as a percentage, which is burned off in a muffle furnace at 455±10 degrees Celsius.

Appendix B

Survey

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FILE No. T5S-1490

Map Showing
A Specific Purpose Survey of

A PORTION OF SECTION 5, TOWNSHIP 5 SOUTH, RANGE 26 EAST, CLAY COUNTY, FLORIDA

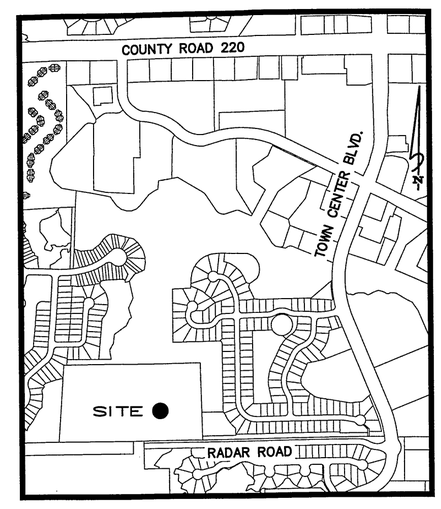
FOR: CDM SMITH

GENERAL NOTES

1. THIS MAP DOES NOT REPRESENT A BOUNDARY SURVEY.
2. THIS DRAWING MAY HAVE BEEN ENLARGED OR REDUCED FROM THE ORIGINAL. UTILIZE THE GRAPHIC SCALE AS SHOWN.
3. RIGHT OF WAY & PARCEL LINES SHOWN HEREON ARE APPROXIMATE ONLY.
4. ELEVATIONS SHOWN HEREON ARE PER NAVD 1988
5. REFERENCE BENCHMARK: FDOT FLORIDA PERMANENT REFERENCE NETWORK, SITE NAME ST JOHNS, SITE CODE BART, ELEVATION = 89.49' NAVD 1988. STATE PLANE COORDINATE SYSTEM, FLORIDA EAST ZONE, NORTH AMERICAN DATUM 1983/1990 NGS ADJUSTMENT.
6. THIS SURVEY WAS MADE WITHOUT THE BENEFIT OF A TITLE COMMITMENT.
7. +20.4 DENOTES SPOT ELEVATION ON GROUND. (NAVD88).
8. +20.58 DENOTES SPOT ELEVATION ON ASPH, CONC, ETC. (NAVD88).
9. LOCATIONS AND DEPTHS OF UNDERGROUND UTILITIES SHOWN HEREON ARE APPROXIMATE ONLY.
10. UNDERGROUND UTILITIES AS SHOWN HEREON ARE BASED ON FIELD VERIFICATION OF INFORMATION PROVIDED BY THE CLIENT AND/OR UTILITY COMPANY. NO OTHER UTILITIES LOCATED THIS DATE.
11. ALL TREES LOCATED IN AREA PROVIDED BY CLIENT.
12. MEASUREMENTS ON TREES REFER TO DIAMETER DIMENSIONS AT BREAST HEIGHT LEVEL (DBH).

LEGEND

R/W	= RIGHT OF WAY		= WIRE PULL BOX
CONC	= CONCRETE		= ANTENNA
FM	= FORCE MAIN		= ELECTRIC SERVICE BOX
DI	= DUCTILE IRON		= POST (SIZE & TYPE AS NOTED)
BE	= BURIED ELECTRIC		= LIGHT POLE
DIA	= DIAMETER		= SANITARY VALVE
CSL	= CONCRETE SLAB		= REUSE VALVE
PVC	= POLYVINYL CHLORIDE		= TREE (SIZE & TYPE AS NOTED)
SQ	= SQUARE		= BENCHMARK
BTM	= BOTTOM		= BORING
IP	= IRON PIPE		= TEST HOLE (VVH)
RWL	= REUSE WATER LINE		
FOC	= FIBER OPTIC CABLE		
VVH	= VERTICAL VERIFICATION HOLE		
[54"]	= APPROXIMATE DEPTH FROM GROUND TO TOP OF UTILITY		



VICINITY MAP
(NOT TO SCALE)

S89° 29' 20.23"W 1294.95'

FOUND 5/8" REBAR "BTS LB 6991"

FOUND 1/2" IP "LB 2518"

N

POND
TOP WATER ELEVATION=15.79
01/13/2020 1:35PM

APPROXIMATE WATERS EDGE

APPROXIMATE TOP BANK

2" PVC FOC

12" PVC RWL

20" PVC RWL

SILT FENCE

2"DIA METAL WITH ELECTRIC BOX ATTACHED

2"DIA METAL

1 1/2" PVC BE

*** THIS AREA IS UNDER CONDTRUCTION ***

DIRT PILES IN AREA, ELEVATION CHANGING CONSTANTLY

OD-1 50' MAE GND=21.7

OD-2 50' MAE GND=22.5

OD-3 50' MAE GND=21.6

OD-4 50' MAE GND=22.4

P-1 10' MAE GND=22.6

P-2 10' MAE GND=23.0

P-3 10' MAE GND=22.8

P-4 10' MAE GND=22.6

HW-1 20' MAE GND=22.3

4"DIA WOOD WITH FIRE EXTINGUISHER ATTACHED

1 STORY CONCRETE FINISH FLOOR ELEVATION=25.17

CONCRETE TANK

CONCRETE WALL

ROCK ROAD

BENCHMARK
ELEV=23.02 (NAVD88)
NAIL & DISK CLARY ELEV
N: 2094640.13
E: 428802.89

TOP WALL=25.57
CONCRETE=23.07

1 1/2"PVC EYEWASH STATION

LADDER

CSL=22.83

CSL=22.92

CSL=22.68

CSL=22.75

CSL=22.62

CSL=23.16

CSL=23.18

CSL=23.10

VVH1
24" DI FM
GROUND=23.16
UTILITY=18.81

ELECTRIC PANEL

12'DIA TANK

8'DIA TANK

PLASTIC SHED

ELECTRIC METAL LID=22.12

3"SQ METAL WITH ELECTRIC BOX ATTACHED
10"METAL PIPE

3"SQ METAL WITH ELECTRIC BOX ATTACHED
12"METAL PIPE

LOST UNDER PIPE

NEW CONCRETE BOX TOP=28.30
GROUND=22.7

NEW 12' DIA CSL= 25.74
GROUND=22.6

METAL LID
6" DI
10" DI
6" DI
CONTROL PANEL
CONTROL PANEL

N00° 30' 39.77"W 724.43'

FOUND 4"X4" CMON "ST REGIS"

FOUND NAIL & DISK "LB 1704"

N89° 29' 20.23"E 1356.00'

APPROXIMATE EDGE OF PAVEMENT

RADAR ROAD

APPROXIMATE EDGE OF PAVEMENT

BENCHMARK
ELEV=20.97 (NAVD88)
NAIL & DISK CLARY ELEV
N: 2094106.19
E: 428817.94

GRAPHIC SCALE
0 15 30
(IN FEET)
1" = 30'

REVISION DATE	DRAFTER	WORK ORDER NO.	REASON FOR REVISION
05/20/2020	EJC	2020-19	REVISED TO SHOW ADDITIONAL LOCATION & VVH1; NO OTHER AREAS FIELD VERIFIED
02/19/2020	EJC	2020-17	REVISED TO SHOW BORINGS & CONC WALL; NO OTHER AREAS FIELD VERIFIED

THIS MAP OR SURVEY MEETS THE STANDARDS OF PRACTICE SET FORTH BY THE FLORIDA DEPARTMENT OF AGRICULTURE AND CONSUMER SERVICES, IN CHAPTER 5J-17, FLORIDA ADMINISTRATIVE CODE, PURSUANT TO SECTION 472.027, FLORIDA STATUTES, UNLESS OTHERWISE SHOWN AND STATED HEREON.

THIS DRAWING, SKETCH, PLAT OR MAP IS NOT VALID UNLESS IT BEARS THE SIGNATURE AND THE ORIGINAL RAISED SEAL OF A FLORIDA LICENSED SURVEYOR AND MAPPER (CHAPTER 5J-17, FLORIDA ADMINISTRATIVE CODE).

THIS MAP OR SURVEY IS FOR THE EXCLUSIVE USE OF THE ENTITIES NAMED HEREON. THE CERTIFICATION SHOWN HEREON DOES NOT EXTEND TO ANY UNNAMED PARTY.

MICHAEL J. COLLIGAN, P.S.M. CERT. NO. 6788

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PROFESSIONAL SURVEYORS & MAPPERS
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WWW.CLARYASSOC.COM

JOB No. 2020-17 DRAFTING: EJC PARTY CHIEF: MICKLER, ESPOSITO F.B. DIGITAL CAD FILE: 2020-17 TOPO.DWG CHECKED BY: MJC DATE: 01/24/2020

FILE No. T5S-1490

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Appendix C

Subsurface Utility Exploration

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NAVD88

SUB-SURFACE UTILITY LOCATION FORM

WPI No.: 2020-19 State Job No: _____ Consultant: CDM SMITH

State Road : _____ At: FLEMING ISLAND WWTP

NORTHING	EASTING	ELEVATION (TOP OF UTILITY)	SURFACE ELEVATION (GROUND)	SIZE	TYPE	COMMENTS
2094491.10	428845.93	17.81	22.16	24"	DI FORCE MAIN	VVH1

ABBREVIATIONS: BT=BURIED TELEPHONES DBC=DIRECT BURIED CABLE ELEC=ELECTRIC FOC=FIBER OPTIC CABLE GL=GAS C.I.=CAST IRON GAL=GALVANIZED D=DUCT BANK PVC=POLYVINYL CHLORIDE ST=STEEL WM=WATER MAIN FM=FORCE MAIN LT=LEFT RT=RIGHT EFF=EFFIUENT

DATE OF FIELD WORK: 05-19-2020 NOTE: ALL ELEVATIONS ARE TO TOP OF UTILITY UNLESS OTHERWISE NOTED.

ELEVATIONS SHOWN HEREON ARE BASED ON THE NORTH AMERICAN VERTICAL DATUM OF 1988 ESTABLISHED FROM THE FOLLOWING BENCH MARKS:

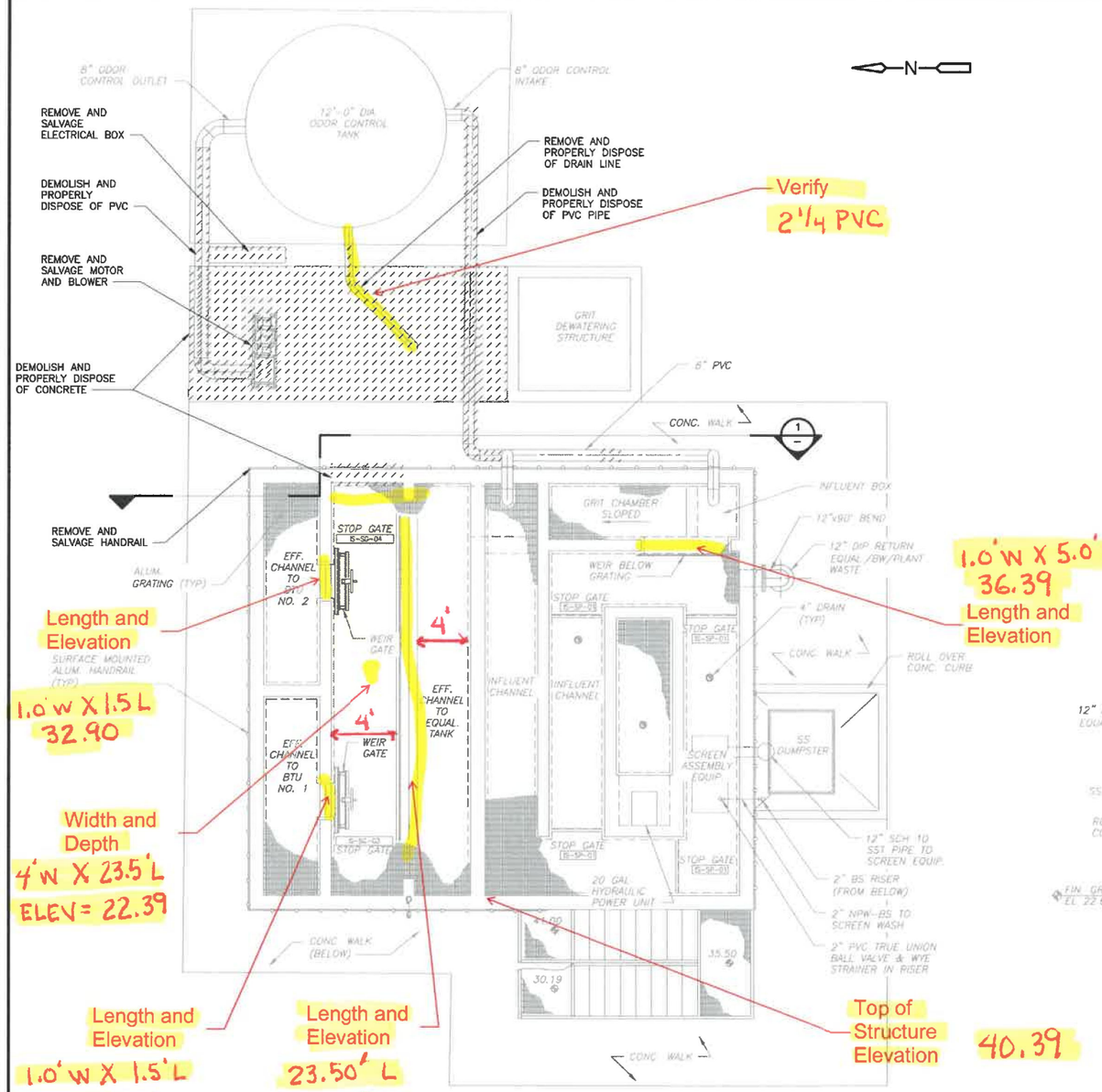
CERTIFICATIONS: I HEREBY CERTIFY THAT THIS SURVEY REPORT IS TRUE AND CORRECT TO THE BEST OF MY KNOWLEDGE AND BELIEF AND REPRESENTS FIELD MEASUREMENTS SURVEYED IN THE FIELD UNDER MY DIRECTION ON 05-19-2020. I FURTHER CERTIFY THAT THESE MEASUREMENTS MEET THE STANDARDS OF PRACTICE. SET FORTH BY THE FLORIDA BOARD OF PROFESSIONAL SURVEYORS AND MAPPERS IN CHAPTER 5J-17, FLORIDA ADMINISTRATIVE CODE, PURSUANT TO FLORIDA STATUTE 472.027.

11-01-18

05-20-2020

MICHAEL COLLIGAN PLS 6788 DATE
CLARY & ASSOCIATES, INC., 3830 CROWN POINT ROAD, JACKSONVILLE, FL 32257
TELEPHONE 904-260-2703

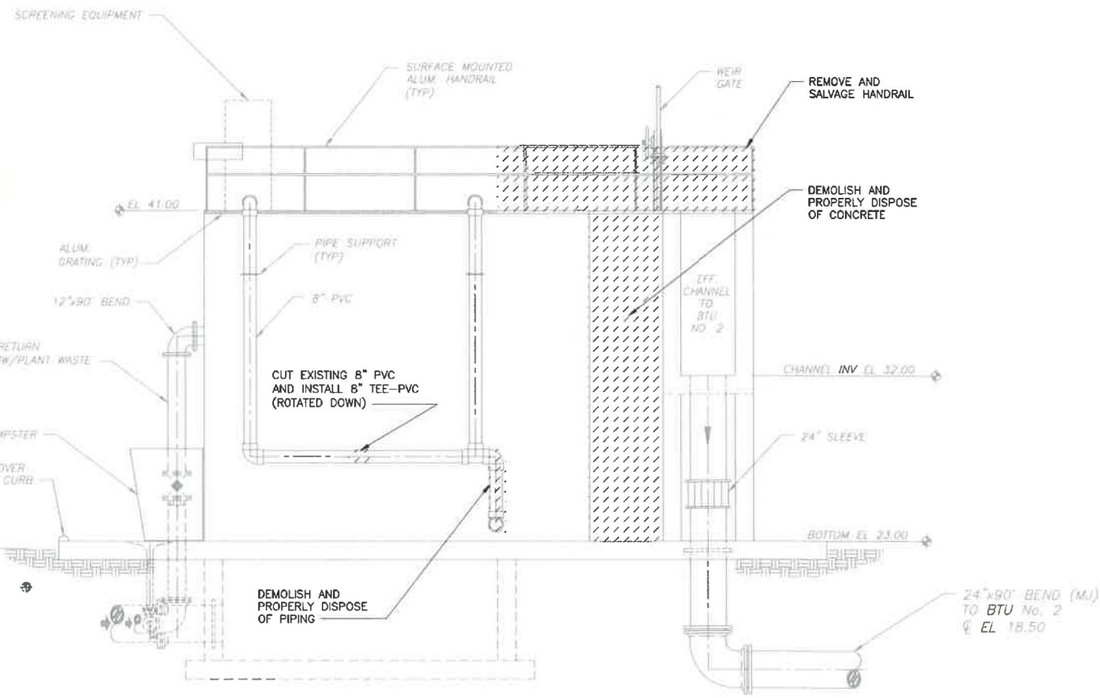

24" D.I. FM



HEADWORKS – TOP PLAN

PLAN

1/4" = 1'-0"



HEADWORKS AND ODOR CONTROL

SECTION 1

1/4" = 1'-0"

XREFs: [CDMS_2234, MEP000F, MMP000F, MES000F] Images: []
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REV. NO.	DATE	DRWN	CHKD	REMARKS

DESIGNED BY: C. LAIRD
DRAWN BY: A. EDWARDS
SHEET CHK'D BY: B. COGGER
CROSS CHK'D BY: B. COGGER
APPROVED BY: M. BURKMAN
DATE: MAY 2020

CDM Smith
4651 Salisbury Road, Suite 420
Jacksonville, FL 32256
Tel: (904) 731-7109
FL COA No. EB-0000020

CLAY COUNTY UTILITY AUTHORITY

CCUA FLEMING ISLAND REGIONAL WWTF
BTU NO. 3 EXPANSION

HEADWORKS AND ODOR CONTROL DEMOLITION PLAN AND SECTION

PROJECT NO. 259364-242828
FILE NAME: MOO6HWDP.DWG

SHEET NO.
M-6

60% SUBMITTAL - NOT FOR CONSTRUCTION

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