INVITATION TO BID

BID: 26-68-3320

KENTMERE LIFT STATION MODIFICATIONS AND FORCE MAIN DESIGN

JUNE 1, 2026

FORSYTH COUNTY
DEPARTMENT OF WATER AND SEWER
FORSYTH COUNTY, GEORGIA

Kentmere Lift Station Modifications and Force Main Design

Specification Seals

SECTION NO.	SECTION TITLE	RESPONSIBLE ENGINEER
DIVISION 01 – GENERAL REQUIREMENTS		
01 11 00	Summary of Work	
01 23 10	Alternates and Allowances	
01 26 00	Change Management	
01 29 01	Measurement and Basis for Payment	
01 31 00	Project Management and Coordination	
01 31 13	Project Administration	
01 33 00	Document Management	
01 33 02	Shop Drawings	
01 33 03	Product Data	
01 33 04	Operation and Maintenance Data	
01 33 05	Construction Progress Schedule	
01 33 06	Graphic Documentation	
01 35 00	Special Procedures	
01 40 00	Quality Management	
01 50 00	Temporary Facilities and Controls	
01 57 00	Temporary Controls	
01 70 00	Execution and Closeout Requirements	
01 74 23	Final Cleaning	

5/29/2026

Kentmere Lift Station Modifications and Force Main Design

Specification Seals

SECTION NO.	SECTION TITLE	RESPONSIBLE ENGINEER
DIVISION 02 – EXISTING CONDITIONS		
02 41 00	Demolition	
02 96 00	Temporary Bypass Pumping	
DIVISION 03 – CONCRETE		
03 30 53	Miscellaneous Cast-In-Place Concrete	
03 41 19	Precast Reinforced Concrete Valve Vault	
DIVISION 09 – FINISHES		
09 96 00.01	High-Performance Coatings	
09 96 01	Concrete Protective Coatings	
DIVISION 31 – EARTHWORK		
31 05 13	Soils for Earthwork	
31 05 16	Aggregates for Earthwork	
31 11 00	Clearing and Grubbing	
31 23 23.34	Flowable Fill	
31 23 33	Trenching and Backfill	
31 23 36	Trench Safety	
31 25 13.13	Seeding for Erosion Control	
31 32 19.15	Geotextile	
DIVISION 32 – EXTERIOR IMPROVEMENTS		
32 12 16	Asphalt Paving	
32 15 00	Aggregate Surface and Drainage Course	
32 16 13	Curbs and Gutters	
32 31 13	Chain Link Fences and Gates	
32 31 29	Wood Fences and Gates	
32 91 19.13	Topsoil Placement and Grading	
32 92 13	Hydro-Mulching	
DIVISION 33 – UTILITIES		
33 05 01.02	Ductile Iron Pipe and Fittings	

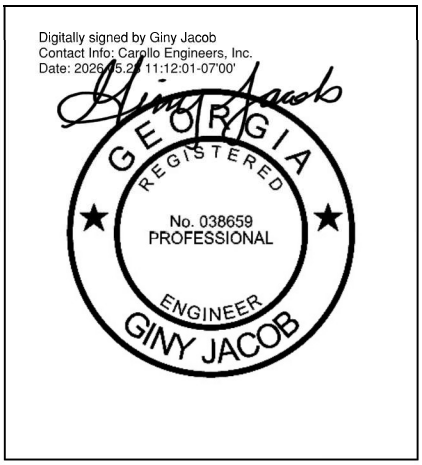
Digitally signed by Giny Jacob
Contact Info: Carollo Engineers, Inc.
Date: 2026.05.29 11:11:46-07'00'

GEORGIA
REGISTERED
No. 038659
PROFESSIONAL
ENGINEER
GINY JACOB

33 05 01.13	Sanitary Sewer Pipe (PVC)
33 05 05.31	Hydrostatic Testing
33 39 13	Sanitary Utility Sewage Manholes, Frames, & Covers

DIVISION 40 – PROCESS INTEGRATION

40 05 00	Common Work Results for Process Interconnections
40 05 62	Eccentric Plug Valves
40 05 97	Identification for Process Piping Equipment
40 71 13	Magnetic Flow Meters



Kentmere Lift Station Modifications and Force Main Design

Specification Seals

SECTION NO.	SECTION TITLE	RESPONSIBLE ENGINEER
DIVISION 26 – ELECTRICAL		
26 01 26	Testing of Electrical Systems	
26 05 00	Common Work Results for Electrical	
26 05 19	Low-Voltage Electrical Power Conductors and Cables	
26 05 23	Control-Voltage Electrical Power Cables	
26 05 26	Grounding and Bonding for Electrical Systems	
26 05 33	Identification for Electrical Systems	
26 27 26	Wiring Devices	
26 28 16	Enclosed Switches and Circuit Breakers	
26 29 13.19	Industrial Control Panels	
26 29 16	Motor Operators for Valves	

Kentmere Lift Station Modifications and Force Main Design

Specification Seals

SECTION NO.	SECTION TITLE	RESPONSIBLE ENGINEER
DIVISION 40 – PROCESS INTEGRATION		
40 61 13	Process Control System General Provisions	
40 61 21	Process Control System Testing	
40 61 26	Process Control System Training	
40 61 93	Process Control System IO List	
40 61 96	Process Control Descriptions	
40 61 96.01	Kentmere Lift Station	
40 67 00	Control System Equipment Panels and Racks	
40 72 76	Level Switches	

DIVISION 00

PROCUREMENT AND CONTRACTING REQUIREMENTS

INVITATION TO BID

BID: 26-68-3320

KENTMERE LIFT STATION MODIFICATIONS AND FORCE MAIN DESIGN

JUNE 1, 2026

FORSYTH COUNTY
DEPARTMENT OF WATER AND SEWER
FORSYTH COUNTY, GEORGIA

KENTMERE LIFT STATION MODIFICATIONS AND FORCE MAIN DESIGN
Invitation to Bid
Table of Contents

DIVISION 00 - FRONT END DOCUMENTS

00 11 13	Advertisement for Bids
00 21 13	Instructions to Bidders
00 41 13	Bid Form for Construction Contract
	Exhibit A: Corporate Certificate Form
	Bid Bond (Penal Sum Form)
00 52 13	Agreement
	Performance Bond
	Payment Bond
C-700	General Conditions
00 73 01	Supplemental Conditions

DIVISION 01 - GENERAL REQUIREMENTS

01 11 00	Summary of Work
01 23 10	Alternates and Allowances
01 26 00	Change Management
01 29 01	Measurement and Basis for Payment
01 31 00	Project Management and Coordination
01 31 13	Project Administration
01 33 00	Document Management
01 33 02	Shop Drawings
01 33 03	Product Data
01 33 04	Operation and Maintenance Data
01 33 05	Construction Progress Schedule
01 33 06	Graphic Documentation
01 35 00	Special Procedures
01 40 00	Quality Management
01 50 00	Temporary Facilities and Controls

01 57 00 Temporary Controls
01 70 00 Execution and Closeout Requirements
01 74 23 Final Cleaning

DIVISION 02 - EXISTING CONDITIONS

02 41 00 Demolition
02 96 00 Temporary Bypass Pumping

DIVISION 03 - CONCRETE

03 30 53 Miscellaneous Cast-In-Place Concrete
03 41 19 Precast Reinforced Concrete Valve Vault

DIVISION 09 - FINISHES

09 96 00.01 High-Performance Coatings
09 96 01 Concrete Protective Coatings

DIVISION 26 - ELECTRICAL

26 01 26 Testing of Electrical Systems
26 05 00 Common Work Results for Electrical
26 05 19 Low-Voltage Electrical Power Conductors and Cables
26 05 23 Control-Voltage Electrical Power Cables
26 05 26 Grounding and Bonding for Electrical Systems
26 05 33 Identification for Electrical Systems
26 27 26 Wiring Devices
26 28 16 Enclosed Switches and Circuit Breakers
26 29 13.19 Industrial Control Panels
26 29 16 Motor Operators for Valves

DIVISION 31 - EARTHWORK

31 05 13 Soils for Earthwork
31 05 16 Aggregates for Earthwork
31 11 00 Clearing and Grubbing
31 23 23.34 Flowable Fill
31 23 33 Trenching and Backfill
31 23 36 Trench Safety

31 25 13.13 Seeding for Erosion Control
31 32 19.15 Geotextile

DIVISION 32 - EXTERIOR IMPROVEMENTS

32 12 16 Asphalt Paving
32 15 00 Aggregate Surface and Drainage Course
32 16 13 Curbs and Gutters
32 31 13 Chain Link Fences and Gates
32 31 29 Wood Fences and Gates
32 91 19.13 Topsoil Placement and Grading
32 92 13 Hydro-Mulching

DIVISION 33 - UTILITIES

33 05 01.05 Ductile Iron Pipe and Fittings
33 05 01.13 Sanitary Sewer Pipe (PVC)
33 05 05.31 Hydrostatic Testing
33 39 13 Sanitary Utility Sewage Manholes, Frames, & Covers

DIVISION 40 - PROCESS INTEGRATION

40 05 00 Common Work Results for Process Interconnections
40 05 62 Eccentric Plug Valves
40 05 78 Air Valves
40 05 97 Identification for Process Piping Equipment
40 61 13 Process Control System General Provisions
40 61 21 Process Control System Testing
40 61 26 Process Control System Training
40 61 93 Process Control System IO List
40 61 96 Process Control Descriptions
40 61 96.01 Kentmere Lift Station
40 67 00 Control System Equipment Panels and Racks
40 71 13 Magnetic Flow Meters
40 72 76 Level Switches

APPENDICES

Appendix A – Permits

Appendix B – Easement Documents

SECTION 00 11 13
Advertisement for Bids – Bid No. 26-68-3320

The Forsyth County procurement department will accept sealed bids until 2:00 p.m. on Thursday, July 2, 2026, for the following:

The Forsyth County Board of Commissioners is soliciting bids from qualified firms to provide Construction services for the Forsyth County – Kentmere Lift Station Modifications and Force Main Design including the following major components:

1. Modifications to the existing Kentmere Lift Station pump control logic and wetwell control elevations, including the installation of two wetwell float switches.
2. Installation of two (2) new flow meter vaults with associated two (2) new magnetic flow meters (6-inch and 8-inch), one 6-inch and one 8-inch actuated plug valves, new yard piping and valves, and associated controls.
3. Approximately 20 linear feet of 8-inch ceramic epoxy lined ductile iron pipe (DIP) at the lift station site, 2,130 linear feet of 6-inch ceramic epoxy lined DIP force main and 265 linear feet of 8-inch polyvinyl chloride (PVC) gravity sewer pipe with associated manholes, valves, and appurtenances.

Non-mandatory pre-bid meeting: 2:00 pm on Monday, June 22, 2026 at the Forsyth County Department of Water and Sewer, Kentmere LS, 3289 Glen Wallace Drive, Cumming, Georgia 30040.

All work to be substantially completed within 485 calendar days from issuance of notice to proceed.

All firms must be licensed in Georgia, maintain a full-time office in Georgia, and have a Registered agent in Georgia. In order to perform public work, the contractor and its Subcontractors, prior to the award of contract shall hold such licenses as required by state Statutes, and federal and local laws and regulations.

No firm may withdraw their bid within 120 days of the actual date of opening.

Bids must be submitted in the format prescribed herein. Failure to comply with the directions Listed in this ITB, or omission of requested information could result in disqualification of your firm's Bid.

Forsyth County uses a procurement portal powered by Euna procurement ("Euna") for accepting and Evaluating bids, statements of qualification, and proposals digitally, found by using the link: https://www.forsythco.com/Departments-Offices/Procurement/Bids-Results

Bids shall only be accepted online through the Euna portal.

The bid opening will be at 2:30 p.m., July 2, 2026, at Forsyth County Administration Building, Liberty Training Room, Suite 1010, 2435 Freedom Parkway, Cumming, Georgia 30041, and via Microsoft Teams (visit the Forsyth County Procurement Department webpage for information). All interested parties and the general public are invited.

Greg Bridges, Deputy Director, Procurement

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 00 21 13
INSTRUCTIONS TO BIDDERS

FOR CONSTRUCTION CONTRACT

TABLE OF CONTENTS

Page

Article 1— Defined Terms 1

Article 2— Bidding Documents 1

Article 3— Qualifications of Bidders 3

Article 4— Pre-Bid Conference 3

Article 5— Site and Other Areas; Existing Site Conditions; Examination of Site; Owner's Safety Program; Other Work at the Site 4

Article 6— Bidder's Representations and Certifications 6

Article 7— Interpretations and Addenda 6

Article 8— Bid Security 7

Article 9— Contract Times 8

Article 10— Substitute and "Or Equal" Items 8

Article 11— Subcontractors, Suppliers, and Others 8

Article 12— Preparation of Bid 9

Article 13— Basis of Bid 10

Article 14— Submittal of Bid 11

Article 15— Modification and Withdrawal of Bid 11

Article 16— Opening of Bids 11

Article 17— Bids to Remain Subject to Acceptance 11

Article 18— Evaluation of Bids and Award of Contract 11

Article 19— Bonds and Insurance 12

Article 20— Signing of Agreement 12

Article 21— Sales and Use Taxes 13

Article 22— Contracts to Be Assigned (NOT USED) 13

EJCDC® C-200, Instructions to Bidders for Construction Contract.
Copyright© 2018 National Society of Professional Engineers, American Council of Engineering Companies, and American Society of Civil Engineers. All rights reserved.

ARTICLE 1—DEFINED TERMS

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

A. *Issuing Office*—The office from which the Bidding Documents are to be issued, and which registers plan holders.

ARTICLE 2—BIDDING DOCUMENTS

2.01 Bidder shall obtain a complete set of Bidding Requirements and proposed Contract Documents (together, the Bidding Documents). See the Agreement for a list of the Contract Documents. It is Bidder's responsibility to determine that it is using a complete set of documents in the preparation of a Bid. Bidder assumes sole responsibility for errors or misinterpretations resulting from the use of incomplete documents, by Bidder itself or by its prospective Subcontractors and Suppliers.

2.02 Bidding Documents are made available for the sole purpose of obtaining Bids for completion of the Project and permission to download or distribution of the Bidding Documents does not confer a license or grant permission or authorization for any other use, nor does it grant or confer ownership or any property interest in the Bidding Documents and other documents distributed for the Project. Authorization to download documents, or other distribution, includes the right for Bidding Documents holders to print documents solely for their use, and the use of their prospective Subcontractors and Suppliers, provided the Bidding Documents holder pays all costs associated with printing or reproduction. Paper or other types of printed documents may not be re-sold under any circumstances.

2.03 Owner has established a Bidding Documents Website as indicated in the Advertisement or invitation to bid. The Bidder must register as a Bidding Documents holder with the Issuing Office at such website, and obtain a complete set of the Bidding Documents from such website. Bidders may rely that sets of Bidding Documents obtained from the Bidding Documents Website are complete, unless an omission is blatant. Registered Bidding Documents holders will receive Addenda issued by Owner or Issuing Office.

2.04 Bidder may register as a Bidding Documents holder and obtain complete sets of Bidding Documents, in the format stated in the Advertisement or invitation to bid, from the Issuing Office. Bidders may rely that sets of Bidding Documents obtained from the Issuing Office are complete, unless an omission is blatant. Registered Bidding Documents holders will receive Addenda issued by Owner or Issuing Office.

2.05 Plan rooms (including construction information subscription services, and electronic and virtual plan rooms) may distribute the Bidding Documents, or make them available for examination. Those prospective bidders that obtain an electronic (digital) copy of the Bidding Documents from a plan room are encouraged to register as Bidding Documents holders from the Bidding Documents Website or Issuing Office. Owner is not responsible for omissions in Bidding

Copyright© 2018 National Society of Professional Engineers, American Council of Engineering Companies, and American Society of Civil Engineers. All rights reserved.

Documents or other documents obtained from plan rooms or other such sources (such as other prospective bidders), or for a Bidder's failure to obtain Addenda from a plan room.

2.06 *Electronic Documents*

A. When the Bidding Requirements indicate that electronic (digital) copies of the Bidding Documents are available, such documents will be made available to prospective Bidders as Electronic Documents in the manner specified.

1. Bidding Documents will be provided in Adobe PDF (Portable Document Format) (.pdf) that is readable by Adobe Acrobat Reader. It is the intent of the Owner that such Electronic Documents are to be exactly representative of the paper copies of the documents. However, because the Owner cannot totally control the transmission and receipt of Electronic Documents nor any bidder's or the Contractor's means of reproduction of such documents, the Owner cannot and do not guarantee that Electronic Documents and reproductions prepared from those versions are identical in every manner to the paper copies.

B. Unless otherwise stated in the Bidding Documents, the Bidder may use and rely upon complete sets of Electronic Documents of the Bidding Documents, described in Paragraph 2.06.A above. However, Bidder assumes all risks associated with differences arising from transmission/receipt of Electronic Documents versions of Bidding Documents and reproductions prepared from those versions and, further, assumes all risks, costs, and responsibility associated with use of the Electronic Documents versions to derive information that is not explicitly contained in paper versions of the documents, and for Bidder's reliance upon such derived information.

C. After the Contract is awarded, the Owner will provide or direct the Engineer to provide for the use of the Contractor certain documents that were developed by Engineer as part of the Project design process, as Electronic Documents in native file formats as originally prepared by Engineer.

1. Electronic Documents that are available in native file format include:

a. Bid Form

b. Specifications

c. Contract Drawings

2. Release of such documents will be solely for the convenience of the Contractor and subject to additional requirements, if any, for such release as indicated in Specifications Section 01 31 26 – Electronic Communication Protocols. No such document is a Contract Document.

3. Unless the Contract Documents explicitly identify that such information will be available to the Successful Bidder (Contractor), nothing herein will create an obligation on the part of the Owner to provide or create such information, and the Contractor is not entitled to rely on the availability of such information in the preparation of its Bid or pricing of the Work. In all cases, the Contractor shall take appropriate measures to verify that electronic/digital information provided in Electronic Documents is appropriate and adequate for Contractor's specific purposes.

Copyright© 2018 National Society of Professional Engineers, American Council of Engineering Companies, and American Society of Civil Engineers. All rights reserved.

4. In no case will Contractor be entitled to additional compensation or time for completion due to any differences between the actual Contract Documents and any related document in native file format.

ARTICLE 3—QUALIFICATIONS OF BIDDERS

3.01 Bidder is to submit the following information with its Bid to demonstrate Bidder's qualifications to perform the Work:

A. Written evidence establishing its qualifications such as financial data, previous experience, and present commitments.

B. A written statement that Bidder is authorized to do business in the state where the Project is located, or a written certification that Bidder will obtain such authority prior to the Effective Date of the Contract.

C. Bidder's state (or other) contractor license number, if applicable.

D. GA Utility Contractor's License.

E. List of Major Subcontractors and Suppliers and qualification information. Major is defined as greater than 5% of the bid value.

F. Other required information regarding qualifications, including the following:

1. Experience on at least 3 pressure pipeline projects of at least 6 inches in diameter and 1 mile in length, in the last 5 years.

2. For each project listed, Bidder should submit the Project Reference Form included in the Bid Documents.

3. Organizational chart for Bidder's project team (including but not limited to project manager, superintendent, and safety officer).

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

3.03 No requirement in this Article 3 to submit information will prejudice the right of Owner to seek additional pertinent information regarding Bidder's qualifications.

3.04 Bidders shall be experienced in the kind of Work to be performed, shall have the or be able to obtain construction equipment necessary for the Work, and shall possess sufficient capital to properly perform the Work within the time allowed. Bids received from Bidders who have previously failed to complete work within the time required, or who have previously performed similar work in an unsatisfactory manner, may be rejected. A Bid may be rejected if Bidder cannot show and document to Owner's satisfaction that Bidder has the necessary ability, facilities, equipment, and resources to commence the Work at the time prescribed and thereafter to prosecute and complete the Work at the rate or within the times specified. A Bid may be rejected if Bidder is already obligated for the performance of other work which would delay the commencement, prosecution or completion of the Work.

ARTICLE 4—PRE-BID CONFERENCE

4.01 A non-mandatory pre-bid conference will be held at the time and location indicated in the Advertisement or invitation to bid. Representatives of Owner and Engineer will be present to

Copyright© 2018 National Society of Professional Engineers, American Council of Engineering Companies, and American Society of Civil Engineers. All rights reserved.

discuss the Project. Bidders are encouraged to attend and participate in the conference; however, attendance at this conference is not required to submit a Bid.

4.02 Information presented at the pre-bid conference does not alter the Bidding Documents. Owner or Issuing Office will issue Addenda to make any changes to the Bidding Documents that result from discussions at the pre-bid conference. Information presented, and statements made at the pre-bid conference will not be binding or legally effective unless incorporated in an Addendum.

ARTICLE 5—SITE AND OTHER AREAS; EXISTING SITE CONDITIONS; EXAMINATION OF SITE; OWNER'S SAFETY PROGRAM; OTHER WORK AT THE SITE

5.01 *Site and Other Areas*

A. The Site is identified in the Bidding Documents, including in Specifications Section 01 11 00 – Summary of Work. By definition, the Site includes rights-of-way, easements, and other lands furnished by Owner for the use of the Contractor. Any additional lands required for temporary construction facilities, construction equipment, or storage of materials and equipment, and any access needed for such additional lands, are to be obtained and paid for by Contractor.

5.02 *Existing Site Conditions*

A. *Subsurface and Physical Conditions; Hazardous Environmental Conditions*

1. The Supplementary Conditions identify the following regarding existing conditions at or adjacent to the Site:

a. Those reports of explorations and tests of subsurface conditions at or adjacent to the Site that contain Technical Data.

b. Those drawings known to Owner of existing physical conditions at or adjacent to the Site, including those drawings depicting existing surface or subsurface structures at or adjacent to the Site (except Underground Facilities), that contain Technical Data.

c. Reports and drawings known to Owner relating to Hazardous Environmental Conditions that have been identified at or adjacent to the Site.

d. Technical Data contained in such reports and drawings.

2. Owner will make copies of reports and drawings referenced above available to any prospective Bidder on request. These reports and drawings are not part of the Contract Documents, but the Technical Data contained therein upon whose accuracy Bidder is entitled to rely, as provided in the General Conditions, has been identified and established in the Supplementary Conditions. Bidder is responsible for any interpretation or conclusion Bidder draws from any Technical Data or any other data, interpretations, opinions, or information contained in such reports or shown or indicated in such drawings.

3. If the Supplementary Conditions do not identify Technical Data, the default definition of Technical Data set forth in Article 1 of the General Conditions will apply.

4. *Geotechnical Baseline Report and Geotechnical Data Report:* The Bidding Documents do not contain a Geotechnical Baseline Report (GBR) and Geotechnical Data Report (GDR).

Copyright© 2018 National Society of Professional Engineers, American Council of Engineering Companies, and American Society of Civil Engineers. All rights reserved.

B. *Underground Facilities:* Underground Facilities are shown or indicated on the Drawings, pursuant to Paragraph 5.05 of the General Conditions, and not in the drawings referred to in Paragraph 5.02.A of these Instructions to Bidders. Information and data regarding the presence or location of Underground Facilities are not intended to be categorized, identified, or defined as Technical Data.

5.03 *Other Site-Related Documents*

A. No other Site-related documents are available.

5.04 *Site Visit and Testing by Bidders*

A. Bidder is required to visit the Site and conduct a thorough visual examination of the Site and adjacent areas. During the visit the Bidder must not disturb any ongoing operations at the Site. Due to the linear nature of the project, Bidder must stay within public right of way and shall not enter private property unless expressly allowed by the Owner.

B. A Site visit is scheduled following the pre-bid conference. Maps, directions, or GPS coordinates to the Site, when the Site is remote from the pre-bid conference location, will be available at the pre-bid conference.

C. A Site visit is scheduled at the pump station site immediately following the pre-bid conference. The location of the Site is indicated in the Bidding Documents, including in Specifications Section 01 11 00 – Summary of Work.

D. Bidders visiting the Site are required to: (1) arrange their own transportation to the Site; and (2) each Bidder visiting the Site is responsible for providing and using its own personal protective equipment appropriate for the Site and conditions, and in accordance with posted requirements, if any. At minimum, each visitor to the Site should have an appropriate hardhat, steel-toed boots, eye and hearing protection (other than ordinary eyewear), and a high-visibility reflective safety vest. Comply with Paragraph 5.05 of these Instructions to Bidders.

E. All access to the Site, other than during a regularly scheduled Site visit, must be coordinated through the following Owner or Engineer contact for visiting the Site: Greg Bridges, (770) 888-8872 EXT 2605, GEBridges@forsythco.com. Bidder must conduct the required Site visit during normal working hours, Mondays through Fridays.

F. Bidder is not required to conduct any subsurface testing, or exhaustive investigations of Site conditions.

G. During the bidding process, and on request, and to the extent Owner has control over the Site, and schedule permitting, the Owner will provide Bidder general access to the Site to conduct such additional examinations, investigations, explorations, tests, and studies as Bidder deems necessary for preparing and submitting a successful Bid. Owner will not have any obligation to grant such access if doing so is not practical because of existing operations, security or safety concerns, or restraints on Owner's authority regarding the Site. As many of the properties are private, Bidder may not be permitted to access properties without express permission from Owner. Bidder is responsible for establishing access needed to reach specific selected test sites.

H. Bidder must comply with Laws and Regulations regarding excavation and location of utilities, obtain necessary permits, and comply with all terms and conditions established by Owner or

Copyright© 2018 National Society of Professional Engineers, American Council of Engineering Companies, and American Society of Civil Engineers. All rights reserved.

by property owners or other entities controlling the Site with respect to schedule, access, existing operations, security, liability insurance, and applicable safety programs.

I. Bidder must fill all holes and clean up and restore the Site to its former condition upon completion of such explorations, investigations, tests, and studies.

5.05 *Owner's Safety Program*

A. Site visits and work at the Site may be governed by an Owner safety program. If an Owner safety program exists, it will be indicated in the Supplementary Conditions. Where the Bidding Documents indicate an Owner's safety program, visitors to the Site during the bidding phase and at other times shall comply with Owner's safety programs.

5.06 *Other Work at the Site*

A. Reference is made to Specifications Section 01 11 00 – Summary of Work, for the identification of the general nature of other work of which Owner is aware (if any) that is to be performed at the Site by Owner or others (such as utilities and other prime contractors) and relates to the Work contemplated by these Bidding Documents. If Owner is party to a written contract for such other work, then on request, Owner will provide to each Bidder access to examine such contracts (other than portions thereof related to price and other potentially confidential matters), if any. Site is anticipated to be used for public right of way access, access for businesses, homes, school vehicles, emergency vehicles, material storage, and storage of contractor equipment along roadways. Road closures will need to be approved to prevent conflicts with other work activities.

ARTICLE 6—BIDDER'S REPRESENTATIONS AND CERTIFICATIONS

6.01 *Express Representations and Certifications in Bid Form, Agreement*

A. The Bid Form that each Bidder will complete and submit contains express representations regarding the Bidder's examination of Project documentation, Site visit, and preparation of the Bid, and certifications regarding lack of collusion or fraud in connection with the Bid. Bidder should review these representations and certifications, and assure that Bidder can make the representations and certifications in good faith, before executing and submitting its Bid.

B. If Bidder is awarded the Contract, Successful Bidder (as Contractor) will make similar express representations and certifications when it signs the Agreement.

ARTICLE 7—INTERPRETATIONS AND ADDENDA

7.01 Owner on its own initiative may issue Addenda to clarify, correct, supplement, or change the Bidding Documents.

7.02 Bidder shall submit all questions about the meaning or intent of the Bidding Documents to the Issuing Office in writing via the online portal Bonfire. Contact information and submittal procedures for such questions are as follows:

A. It is the sole responsibility of each Bidder to notify the Issuing Office utilizing the question/answer feature provided by Bonfire and request modification or clarification of any ambiguity, conflict, discrepancy, omission, or other error discovered in this competitive solicitation. All questions and requests for information received through Bonfire will be

Copyright© 2018 National Society of Professional Engineers, American Council of Engineering Companies, and American Society of Civil Engineers. All rights reserved.

responded to by official written Addendum issued by the Issuing Office and uploaded to Bonfire as an Addendum. All addenda are a part of the competitive solicitation documents, and each Bidder will be bound by such addenda. It is the responsibility of each Bidder to read and comprehend all addenda issued.

7.03 Interpretations or clarifications considered necessary by the Issuing Office in response to such questions will be issued by Addenda delivered to all Bidding Documents holders registered with the Issuing Office. Questions received less than seven days prior to the date for opening of Bids may not be answered.

7.04 Only responses set forth in an Addendum will be binding. Oral and other interpretations or clarifications will be without legal effect. Responses to questions are not part of the Contract Documents unless set forth in an Addendum that expressly modifies or supplements the Bidding Documents.

7.05 Addenda that Issuing Office to have a material or significant effect on Bidders' preparation of pricing and other requirement element of the Bid will be transmitted via Addendum for Bidders' receipt not less than three days prior to the scheduled date for receipt of the Bids. Clarifications or modifications that the Issuing Office deems will not have a material or substantial effect on the preparation of Bids may be transmitted for Bidders' receipt later, for receipt prior to the deadline for receipt of Bids.

ARTICLE 8—BID SECURITY

8.01 *Required Form and Amount of Bid Security*

A. A Bid must be accompanied by bid security made payable to Owner in an amount of five percent of Bidder's maximum Bid price (determined by adding the base bid and all alternates) and in the form of a bid bond issued by a surety meeting the requirements of Paragraph 6.01 of the General Conditions.

B. Such bid bond will be issued in the form included in the Bidding Documents.

8.02 *Bid Security of Successful Bidder*

A. The Bid security of the apparent Successful Bidder will be retained until Owner awards the Contract to such Bidder, and such Bidder has signed the Contract, furnished the required Contract security, and met the other conditions of the Notice of Award, whereupon the Successful Bidder's bid security will be released.

B. If the Successful Bidder fails to sign and deliver the Contract and furnish the required Contract security within the number of days, indicated in Paragraph 20.01 of these Instructions to Bidders, 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.

C. Upon Successful Bidder's default:

1. When the bid security is a penal sum bid bond, the entire penal sum amount of the bid bond will be forfeit and due Owner.

2. When the bid security is a damages form of bid bond, to the extent of Owner's damages will be forfeit and due Owner.

Copyright© 2018 National Society of Professional Engineers, American Council of Engineering Companies, and American Society of Civil Engineers. All rights reserved.

3. If a type of bid security other than a bid bond is allowed and is furnished, the amount that will be forfeit and due Owner will be the same as for the form of bid bond included in the Bidding Documents. Owner will so notify the defaulting Bidder in writing of the annulment and the amount of the forfeiture, with documentation of the amount forfeited.

D. Such forfeiture will be Owner's exclusive remedy if Bidder defaults.

8.03 *Bid Security of Bidders other than the Successful Bidder*

A. Release of Bid Security: Owner may release any Bidder's bid security by returning such bid security to the associated Bidder. When bid security is in the form of a bid bond, Owner may dispose of or destroy the bid bond and so advice the associated Bidder in writing that the bid bond has been released.

ARTICLE 9—CONTRACT TIMES

9.01 The number of days within which, or the dates by which, the Work is to be (a) substantially completed and (b) ready for final payment, and (c) Milestones (if any), are to be achieved are set forth in the Agreement.

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

ARTICLE 10—SUBSTITUTE AND "OR EQUAL" ITEMS

10.01 The Contract for the Work, as awarded, will be on the basis of materials, equipment, and procedures specified or described in the Bidding Documents without consideration during the bidding and Contract award process of possible substitute or "or-equal" items or procedures. In cases in which the Contract allows the Contractor to request that Engineer authorize the use of a substitute or "or-equal" item of material or equipment or procedure, application for such acceptance may not be made to and will not be considered by Engineer until after the Effective Date of the Contract.

10.02 All prices that Bidder sets forth in its Bid will be based on the presumption that the Contractor will furnish the materials and equipment specified or described in the Bidding Documents, and will perform the Work in accordance with procedures indicated in the Bidding Documents, as supplemented by Addenda, if any. Assumptions regarding the possibility of post-bid approvals of "or-equal" or substitution requests are made at Bidder's sole risk.

ARTICLE 11—SUBCONTRACTORS, SUPPLIERS, AND OTHERS

11.01 A Bidder must be prepared to retain specific Subcontractors and Suppliers for the performance of the Work if required to do so in the Specifications or elsewhere in the Bidding Documents. If a prospective Bidder objects to retaining any such Subcontractor or Supplier and the concern is not relieved by an Addendum, then the prospective Bidder should not submit a Bid.

11.02 Bidder must submit a list of Subcontractors and Suppliers accompanied by an experience statement with pertinent information regarding similar projects and other evidence of qualification for each such Subcontractor or Supplier. If Owner, after due investigation, has reasonable objection to any proposed Subcontractor or Supplier, Owner may, before the Notice

Copyright© 2018 National Society of Professional Engineers, American Council of Engineering Companies, and American Society of Civil Engineers. All rights reserved.

Award is given, request apparent Successful Bidder to submit an acceptable substitute, in which case apparent Successful Bidder will submit a substitute, Bidder's Bid price will be increased (or decreased) by the difference in cost occasioned by such substitution, and Owner may consider such price adjustment in evaluating Bids and awarding the Contract.

11.03 If apparent Successful Bidder declines to make a requested substitution, Owner may award the Contract to another Bidder, consistent with the basis for evaluating the Bids for award as set forth in these Instructions to Bidders, that proposes to use acceptable Subcontractors and Suppliers. Declining to make requested substitutions will constitute grounds for forfeiture of the bid security of any Bidder. Any Subcontractor or Supplier, so listed and against which Owner makes no written objection prior to issuance of the Notice of Award will be deemed acceptable to Owner to subsequent revocation of such acceptance as provided in Paragraph 7.07 of the General Conditions.

ARTICLE 12—PREPARATION OF BID

12.01 The Bid Form is included with the Bidding Documents.

A. To receive consideration, Bids must be received prior to the bid opening date and time. Unless otherwise specified, Bidders should use the Bid Form provided by the Issuing Office. Bids are only accepted through Bonfire. No paper bids shall be considered. Bids will be publicly opened in the Issuing Office, or other designated area, in the presence of Bidders, the public, and Owner staff. Bidders and the public are invited and encouraged to attend bid openings. Bids will be tabulated and made available for review by Bidders and the public via Bonfire under Public Files.

B. All blanks on the Bid Form shall be printed, typewritten, or filled in with pen and ink, and the Bid Form signed in ink. Erasures or alterations must be initialed in ink by the person signing the Bid Form. A Bid price must be indicated for each section, Bid item, alternate, adjustment unit price item, and unit price item listed therein.

C. If the Bid Form expressly indicates that submitting pricing on a specific alternate item is optional, and Bidder elects to not furnish pricing for such optional alternate item, then Bidder may enter the words "No Bid" or "Not Applicable."

12.02 If Bidder has obtained the Bidding Documents as Electronic Documents, then Bidder shall prepare its Bid on a paper copy of the Bid Form printed from the Electronic Documents version of the Bidding Documents. The printed copy of the Bid Form must be clearly legible, printed on 8.5inch by 11-inch paper and as closely identical in appearance to the Electronic Document version of the Bid Form as may be practical. The Owner reserves the right to accept Bid Forms which nominally vary in appearance from the original paper version of the Bid Form, providing that all required information and submittals are included with the Bid.

12.03 A Bid by a corporation must be signed in the corporate name by a corporate officer (whose title must appear under the signature), accompanied by evidence of authority to sign. The corporate address and state of incorporation must be shown.

12.04 A Bid by a partnership must 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 must be shown.

Copyright© 2018 National Society of Professional Engineers, American Council of Engineering Companies, and American Society of Civil Engineers. All rights reserved.

12.05 A Bid by a limited liability company must be signed in the name of the firm by a member or other authorized person and accompanied by evidence of authority to sign. The state of formation of the firm and the official address of the firm must be shown.

12.06 A Bid by an individual must show the Bidder's name and official address.

12.07 A Bid by a joint venture must be signed by an authorized representative of each joint venturer in the manner indicated on the Bid Form. The joint venture must have been formally established prior to submittal of a Bid, and the official address of the joint venture must be shown.

12.08 All names must be printed in ink below the signatures.

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

12.10 Postal and e-mail addresses and telephone number for communications regarding the Bid must be indicated on the Bid Form.

12.11 The Bid must contain evidence of Bidder's authority to do business in the state where the Project is located, or Bidder must certify in writing that it will obtain such authority within the time for acceptance of Bids and attach such certification to the Bid.

12.12 If Bidder is required to be licensed to submit a Bid or perform the Work in the state where the Project is located, the Bid must contain evidence of Bidder's licensure, or Bidder must certify in writing that it will obtain such licensure within the time for acceptance of Bids and attach such certification to the Bid. Bidder's state contractor license number, if any, must also be shown on the Bid Form.

ARTICLE 13—BASIS OF BID

13.01 *Unit Price*

A. Bidders must submit a Bid on a unit price basis for each item of Work listed in the unit price section of the Bid Form.

B. The "Bid Price" (sometimes referred to as the extended price) for each item of Unit Price Work will be the product of the "Estimated Quantity", which Owner or its representative has set forth in the Bid Form, for the item and the corresponding "Bid Unit Price" offered by the Bidder. The total of all unit price bid items will be the sum of these "Bid Prices"; such total will be used by Owner for Bid comparison purposes. The final quantities and final Contract Price will be determined in accordance with Paragraph 13.03 of the General Conditions.

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

13.02 *Cash Allowances*

A. For cash allowances the bid price (for items other than cash allowances) must include such amounts as Bidder deems proper for Contractor's overhead, handling and installation costs, profit, and other expenses on account of cash allowances, if any, named in the Contract Documents, in accordance with Paragraph 13.02.B of the General Conditions.

Copyright© 2018 National Society of Professional Engineers, American Council of Engineering Companies, and American Society of Civil Engineers. All rights reserved.

ARTICLE 14—SUBMITTAL OF BID

14.01 The Bidding Documents include the Bid Form, and, where required, the Bid Bond Form and other supplements to the Bid Form. The Bid Form and supplements (if any) is to be completed and submitted with the Bid security and the other documents required with the Bid by Article 2 of the Bid Form.

14.02 Bids must be received prior to the bid opening date and time. Bids are only accepted through Bonfire. No paper bids shall be considered.

ARTICLE 15—MODIFICATION AND WITHDRAWAL OF BID

15.01 An unopened Bid may be withdrawn via Bonfire, prior to the date and time established in the Bidding Documents for the receipt of Bids.

15.02 If a Bidder wishes to modify its Bid prior to Bid opening, Bidder must withdraw its initial Bid in the manner specified in Paragraph 15.01 of this Article and submit a new Bid prior to the date and time for established in the Bidding Documents the receipt of Bids.

15.03 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, the Bidder may withdraw its Bid, and the bid security will be returned.

ARTICLE 16—OPENING OF BIDS

16.01 Bids will be opened at the time and place indicated in the Advertisement or invitation to bid and, unless obviously non-responsive, will be 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 17—BIDS TO REMAIN SUBJECT TO ACCEPTANCE

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

ARTICLE 18—EVALUATION OF BIDS AND AWARD OF CONTRACT

18.01 Owner reserves the right to reject any or all Bids, including without limitation, nonconforming, nonresponsive, unbalanced, or conditional Bids. Owner also reserves the right to waive all minor Bid informalities not involving price, time, or changes in the Work.

18.02 Owner will reject the Bid of any Bidder that Owner finds, after reasonable inquiry and evaluation, to not be responsible. Owner may reject the Bid of any Bidder that fails to demonstrate appropriate qualifications, experience, and resources for the Work, in accordance with Article 3 of these Instructions to Bidders.

18.03 If Bidder purports to add terms or conditions to its Bid, takes exception to any provision of the Bidding Documents, or attempts to alter the contents of the Contract Documents for purposes of

Copyright© 2018 National Society of Professional Engineers, American Council of Engineering Companies, and American Society of Civil Engineers. All rights reserved.

the Bid, whether in the Bid itself or in a separate communication to Owner, then Owner will reject the Bid as nonresponsive.

18.04 *Basis for Award of Contract*

A. If Owner awards the contract for the Work, such award will be to the responsible Bidder submitting the lowest-priced, responsive Bid that has not otherwise been disqualified.

B. In order to be considered a responsible Bidder, Bidder shall be fully capable to meet all the requirements of the solicitation and subsequent contract, must possess the full capability, including financial and technical, to perform as contractually required, and must be able to fully document the ability to provide good faith performance.

C. In order to be considered a responsive Bidder, Bidder's bid shall fully conform in all material respects to the Bid and all of its requirements, including all form and substance.

18.05 *Evaluation of Bids*

A. In evaluating Bids, Owner will consider whether the Bids comply with the prescribed requirements, and such alternates, unit prices, and other data, as may be requested in the Bid Form or elsewhere in the Bidding Documents, or prior to the Notice of Award.

B. *Unit Price Work*: For the determination of the apparent low-price Bid when unit price bids are submitted, Bids will be compared on the basis of the total of the products of the estimated quantity of each item and unit price bid for that item, together with amount(s) of lump sum items (if any).

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

18.07 Owner, with or without Engineer's assistance, may conduct such investigations as Owner deems necessary to establish the responsibility, qualifications, and financial ability of Bidders and any proposed Subcontractors or Suppliers.

ARTICLE 19—BONDS AND INSURANCE

19.01 Paragraph 2.01 and Article 6 of the General Conditions, as may be modified by the Supplementary Conditions, set forth Owner's requirements as to performance and payment bonds, other required bonds (if any), and insurance. When the Successful Bidder delivers the signed Agreement to Owner (or Owner's representative), it must be accompanied by required bonds and insurance documentation.

19.02 Article 8 ("Bid Security") of these Instructions to Bidders addresses any requirements for providing bid bonds as part of the bidding process.

ARTICLE 20—SIGNING OF AGREEMENT

20.01 When Owner issues a Notice of Intent to Award to the Successful Bidder, it will be accompanied by the unsigned counterparts of the Agreement, along with the other Contract Documents as identified in the Agreement. Within 15 days thereafter, Successful Bidder must execute and

Copyright© 2018 National Society of Professional Engineers, American Council of Engineering Companies, and American Society of Civil Engineers. All rights reserved.

deliver the required number of counterparts of the Agreement and required bonds and insurance documentation (as required by the Contract Documents) to Owner.

ARTICLE 21—SALES AND USE TAXES

21.01 Bidder must include in their bid all sales, consumer, use and other similar taxes required to be paid in accordance with the Laws and Regulations applicable during the performance of the work. Forsyth County is exempt from taxes, but the successful Bidder shall pay all taxes required of him by law. Forsyth County cannot exempt others from tax. State Sales tax exemption number is 58-6000828.

ARTICLE 22—CONTRACTS TO BE ASSIGNED – (NOT USED)

Copyright© 2018 National Society of Professional Engineers, American Council of Engineering Companies, and American Society of Civil Engineers. All rights reserved.

SECTION 00 41 13
BID FORM FOR CONSTRUCTION CONTRACT

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

ARTICLE 1—OWNER AND BIDDER

1.01 This Bid is submitted to: Forsyth County, Georgia, via Euna Procurement.

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

ARTICLE 2—ATTACHMENTS TO THIS BID

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

A. Required Bid security;

B. List of Proposed Subcontractors;

C. List of Proposed Suppliers;

D. Evidence of authority to do business in the state of the Project; or a written covenant to obtain such authority within the time for acceptance of Bids;

E. Contractor's license number as evidence of Bidder's State Contractor's License or a covenant by Bidder to obtain said license within the time for acceptance of Bids;

F. Required Bidder Qualification Statement with supporting data;

G. Subcontractor Affidavit; and

H. Non-Collusion Affidavit.

ARTICLE 3—BASIS OF BID—LUMP SUM BID AND UNIT PRICES

3.01 *Lump Sum Bids*

A. Bidder will complete the Work in accordance with the Contract Documents for the following lump sum (stipulated) price(s), together with any Unit Prices indicated in Paragraph 3.02:

B. All specified cash allowance(s) are included in the price(s) set forth below, and have been computed in accordance with Paragraph 13.02 of the General Conditions.

C. All specified contingency allowances are included in the price(s) set forth below, and have been computed in accordance with Paragraph 13.02 of the General Conditions.

Copyright© 2018 National Society of Professional Engineers, American Council of Engineering Companies, and American Society of Civil Engineers. All rights reserved.

3.02 *Unit Price Bids*

A. Bidder will complete the Work in accordance with the Contract Documents for the following:

Item No.	Description	Unit	Estimated Quantity	Bid Unit Price	Bid Amount
1	Mobilization	LS	1		$
2	Mulching, Seeding, and Grassing Stabilization (Ds1, Ds2, and Ds3)	SY	6,050		$
3	Double Row Silt Fence (Sd1-S)	LF	4,000		$
4	Tree Protection (Tr)	LF	3,000		$
5	Temporary Stream Crossing (Sr-C, DV-P, Rd, Ss, Sb-S, and Ch)	LS	1		$
6	Curb Inlet Filter (Sd2-P)	EA	10		$
7	Stormdrain Outlet Protection (St)	EA	1		$
8	Erosion Control Monthly Maintenance and Monitoring	LS	1		$
9	Existing Lift Station Site and Yard Piping Demolition	LS	1		$
10	Gravel Pad Extension - Lift Station Site	SY	70		$
11	Concrete Pad Extension at Lift Station Site	CY	3		$
12	Clearing/Grubbing/Tree Removal	SY	1,500		$
13	Precast Concrete Flowmeter Vault, 6' x6'	EA	2		$
14	Chain Link Fence	LF	140		$
15	14' Wide Chain Link Swing Gate	EA	1		$
16	10' Wide Double Swing Wooden Gate	EA	1		$
17	Bollards	EA	9		$
18	Site Grading (Lift Station Area)	LS	1		$
19	6-Inch Ductile Iron Plug Valve, Valve Box, Actuator, Floor Stand, and Stem Extension	EA	1		$
20	8-Inch Ductile Iron Plug Valve, Valve Box, Actuator, Floor Stand, and Stem Extension	EA	1		$
21	6-Inch Bypass Port Assembly w/ 6" Plug Valve and Valve Box	LS	1		$
22	Ductile Iron Pipe and Fittings (Ceramic Epoxy Lined DIP) - Lift Station Area	LS	1		$
23	6-Inch Ceramic Epoxy Lined DIP, PC350	LF	2,130		$
24	8-Inch C900 PVC Pipe	LF	265		$
25	Witness Marker	EA	15		$
26	Concrete Slope Anchors	EA	3		$
27	12-Inch Steel Casing, 0.375-Inch Thickness, Open Cut	LF	80		$
28	Polymer Manhole Base (5-foot depth) - Force Main Connection Manhole	EA	1		$
29	Polymer Manhole Base (5-foot depth)	EA	1		$
30	Polymer Manhole Additional Vertical Foot Depth	VF	15		$

Copyright© 2018 National Society of Professional Engineers, American Council of Engineering Companies, and American Society of Civil Engineers. All rights reserved.

31	2" Air/Vacuum Release Valve Assembly w/ Manhole	EA	1		$
32	Manhole Vent Assembly	EA	2		$
33	Existing Gravity Sewer Connection	EA	1		$
34	Longitudinal Roadway Cut Final Backfill Replacement (Trench Width Only)	SY	600		$
35	Pavement Restoration and Restriping (1.5-Inch Mill and Overlay)	SY	2,400		$
36	Curb and Gutter Repairs	LF	500		$
37	Sidewalk Repairs	SY	50		$
38	Flowable Fill Backfill	CY	100		$
39	Sand Filter Diaphragm	EA	2		$
40	Traffic Control Plan and Implementation	LS	1		$
41	Bypass Pumping	LS	1		$
42	Complete Electrical and Instrumentation and Control Work	LS	1		$

B. All specified cash allowance(s) are included in the price(s) set forth below, and have been computed in accordance with Paragraph 13.02 of the General Conditions.

Item No.	Description	Unit	Estimated Quantity	Bid Unit Price	Bid Amount
C1	Unsuitable Soil Disposal and Replacement with Suitable Soils	CY	350		$
C2	Rock Excavation, Hauling, and Disposal	CY	100		$
C3	Pavement Restoration - Lift Station Area (1.5-Inch Mill and Overlay)	SY	400		$

C. All specified contingency allowances are included in the price(s) set forth below, and have been computed in accordance with Paragraph 13.02 of the General Conditions.

Item No.	Description	Unit	Estimated Quantity	Bid Unit Price	Bid Amount
A1	Owner Directed Allowance	LS	1	100,000	$100,000

D. Bidder acknowledges that:

1. Each Bid Unit Price includes an amount considered by Bidder to be adequate to cover Contractor's overhead and profit for each separately identified item, and
2. Estimated quantities are not guaranteed, and are solely for the purpose of comparison of Bids, and final payment for all Unit Price Work will be based on actual quantities, determined as provided in the Contract Documents.

3.03 *Total Bid Price (Lump Sum and Unit Prices)*

Total Bid Price (Total of all Lump Sum and Unit Price Bids)	$

Copyright© 2018 National Society of Professional Engineers, American Council of Engineering Companies, and American Society of Civil Engineers. All rights reserved.

ARTICLE 4—TIME OF COMPLETION

4.01 Bidder agrees that the Work will be substantially complete within **485** days after the date when the Contract Times commence to run as provided in Paragraph 4.01 of the General Conditions and completed and ready for final payment in accordance with Paragraph 15.06 of the General Conditions **60** days after substantial completion.

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

ARTICLE 5—BIDDER'S ACKNOWLEDGEMENTS: ACCEPTANCE PERIOD, INSTRUCTIONS, AND RECEIPT OF ADDENDA

5.01 *Bid Acceptance Period*

A. This Bid will remain subject to acceptance for 60 days after the Bid opening, or for such longer period of time that Bidder may agree to in writing upon request of Owner.

5.02 *Instructions to Bidders*

A. Bidder accepts all of the terms and conditions of the Instructions to Bidders, including without limitation those dealing with the disposition of Bid security.

5.03 *Receipt of Addenda*

A. Bidder hereby acknowledges receipt of the following Addenda:

Addendum Number	Addendum Date

ARTICLE 6—BIDDER'S REPRESENTATIONS AND CERTIFICATIONS

6.01 *Bidder's Representations*

A. In submitting this Bid, Bidder represents the following:

1. Bidder has examined and carefully studied the Bidding Documents, including Addenda.
2. Bidder has visited the Site, conducted a thorough visual examination of the Site and adjacent areas, and become familiar with the general, local, and Site conditions that may affect cost, progress, and performance of the Work.
3. Bidder is familiar with all Laws and Regulations that may affect cost, progress, and performance of the Work.
4. Bidder has carefully studied the reports of explorations and tests of subsurface conditions at or adjacent to the Site and the drawings of physical conditions relating to existing surface or subsurface structures at the Site that have been identified in the Supplementary Conditions, with respect to the Technical Data in such reports and drawings.
5. Bidder has carefully studied the reports and drawings relating to Hazardous Environmental Conditions, if any, at or adjacent to the Site that have been identified in

Copyright© 2018 National Society of Professional Engineers, American Council of Engineering Companies, and American Society of Civil Engineers. All rights reserved.

the Supplementary Conditions, with respect to Technical Data in such reports and drawings.

6. Bidder has considered the information known to Bidder itself; information commonly known to contractors doing business in the locality of the Site; information and observations obtained from visits to the Site; the Bidding Documents; and the Technical Data identified in the Supplementary Conditions or by definition, with respect to the effect of such information, observations, and Technical Data on (a) the cost, progress, and performance of the Work; (b) the means, methods, techniques, sequences, and procedures of construction to be employed by Bidder, if selected as Contractor; and (c) Bidder's (Contractor's) safety precautions and programs.

7. Based on the information and observations referred to in the preceding paragraph, Bidder agrees that no further examinations, investigations, explorations, tests, studies, or data are necessary for the performance of the Work at the Contract Price, within the Contract Times, and in accordance with the other terms and conditions of the Contract.

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

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

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

11. The submission of this Bid constitutes an incontrovertible representation by Bidder that without exception the Bid and all prices in the Bid are premised upon performing and furnishing the Work required by the Bidding Documents.

6.02 *Bidder's Certifications*

A. The Bidder certifies the following:

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

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

3. Bidder has not solicited or induced any individual or entity to refrain from bidding.

4. Bidder has not engaged in corrupt, fraudulent, collusive, or coercive practices in competing for the Contract. For the purposes of this Paragraph 8.02.A:

a. Corrupt practice means the offering, giving, receiving, or soliciting of anything of value likely to influence the action of a public official in the bidding process.

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

Copyright© 2018 National Society of Professional Engineers, American Council of Engineering Companies, and American Society of Civil Engineers. All rights reserved.

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

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

Copyright© 2018 National Society of Professional Engineers, American Council of Engineering Companies, and American Society of Civil Engineers. All rights reserved.

BIDDER hereby submits this Bid as set forth above:

Bidder:

_____

(typed or printed name of organization)

By: _____

(individual's signature)

Name: _____

(typed or printed)

Title: _____

(typed or printed)

Date: _____

(typed or printed)

If Bidder is a corporation, a partnership, or a joint venture, attach evidence of authority to sign.

Attest: _____

(individual's signature)

Name: _____

(typed or printed)

Title: _____

(typed or printed)

Date: _____

(typed or printed)

Address for giving notices:

_____

_____

Bidder's Contact:

Name: _____

(typed or printed)

Title: _____

(typed or printed)

Phone: _____

Email: _____

Address:

_____

_____

_____

Bidder's Contractor License No.: (if applicable) _____

Copyright© 2018 National Society of Professional Engineers, American Council of Engineering Companies, and American Society of Civil Engineers. All rights reserved.

LIST OF KEY SUPPLIERS

(TO BE ATTACHED AS PART OF THE BID FORM)

The Bidder agrees to furnish and install, in accordance with the Contract Documents, all items listed in the List of Key Suppliers as part of the Total Base Bid price stated by the Bidder.

If none of the Key Suppliers are circled for any of the product(s) listed below, the Owner reserves the right either to determine the Bidder non-responsive and reject the Bid or to designate the Key Supplier of the product(s) to be provided. No increase in the Contract Price will be allowed should the Owner elect to designate the Key Supplier of these product(s).

Changes by the Bidder to items listed in the Major Equipment/Key Supplier Schedule will not be considered after receipt of Bids.

The Contractor's bid proposal will be evaluated by the TOTAL BASE BID PRICE only. It will be at the Owner's sole discretion to evaluate and include the Alternative Manufacturers noted below (if applicable). Measurement and Payment for the Alternative Manufacturers can be found in section 1.07 of Specification Section 01 29 01 "Measurement and Basis for Payment" and Specification Section 01 23 10 "Alternates and Allowances".

SPECIFICATION SECTION	DESCRIPTION	KEY SUPPLIERS	ALTERNATE ADD/DEDUCT TO TOTAL BASE BID (Circle One)	ALTERNATE SCHEDULE IMPACT TO BASE BID (Circle One)
26 29 16	Plug Valve Motor Actuators	1. Rotork 2. Alternate: _____	Add / Deduct $	Add / Deduct _____ days
40 05 62	Plug Valves	1. DeZURIK 2. Alternate: _____	Add / Deduct $	Add / Deduct _____ days
40 71 13	Electromagnetic Flow Meters	1. Krohne Optiflux 2000 w/ IFC 300 2. Alternate: _____	Add / Deduct $	Add / Deduct _____ days

Copyright© 2018 National Society of Professional Engineers, American Council of Engineering Companies, and American Society of Civil Engineers. All rights reserved.

SECTION 00 41 13 EXHIBIT A
CORPORATE CERTIFICATE FORM

Corporate Certificate

I, _____, certify that I am the Secretary of the Corporation

named as Contractor in the foregoing bid; that _____

who signed said bid on behalf of the Contractor, was then (title) _____ of

said Corporation; that said bid was duly signed for and on behalf of said Corporation authority

of its Board of Directors, and is within the scope of its corporate powers; that said

Corporation is organized under the laws of the State of _____.

This _____ day of _____,

20___ (Signature) _____

BID BOND (PENAL SUM FORM)

Bidder Name: [Full formal name of Bidder] Address *(principal place of business)*: [Address of Bidder's principal place of business]	**Surety** Name: [Full formal name of Surety] Address *(principal place of business)*: [Address of Surety's principal place of business]
Owner Name: Forsyth County, Georgia Address *(principal place of business)*: 2435 Freedom Parkway Suite 1200 Cumming, GA 30041	**Bid** Project *(name and location)*: Kentmere LS Modifications and Force Main Design 3289 Glen Wallace Dr Cumming, Georgia 30040 Bid Due Date: July 2, 2026
Bond Penal Sum: [Amount] Date of Bond: [Date]	
Surety and Bidder, intending to be legally bound hereby, subject to the terms set forth in this Bid Bond, do each cause this Bid Bond to be duly executed by an authorized officer, agent, or representative.	
Bidder	Surety
_____ *(Full formal name of Bidder)*	_____ *(Full formal name of Surety) (corporate seal)*
By: _____ *(Signature)*	By: _____ *(Signature) (Attach Power of Attorney)*
Name: _____ *(Printed or typed)*	Name: _____ *(Printed or typed)*
Title: _____	Title: _____
Attest: _____ *(Signature)*	Attest: _____ *(Signature)*
Name: _____ *(Printed or typed)*	Name: _____ *(Printed or typed)*
Title:	Title:
Notes: (1) Note: Addresses are to be used for giving any required notice. (2) Provide execution by any additional parties, such as joint venturers, if necessary.	

EJCDC® C-430, Bid Bond (Penal Sum Form).
Copyright© 2018 National Society of Professional Engineers, American Council of Engineering Companies, and American Society of Civil Engineers. All rights reserved.

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

Copyright© 2018 National Society of Professional Engineers, American Council of Engineering Companies, and American Society of Civil Engineers. All rights reserved.

SECTION 00 52 13
AGREEMENT

BETWEEN OWNER AND CONTRACTOR
FOR CONSTRUCTION CONTRACT (STIPULATED PRICE)

This Agreement is by and between Forsyth County ("Owner"), a political subdivision of the state of Georgia and [name of contracting entity] ("Contractor").

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

Owner and Contractor hereby agree as follows:

ARTICLE 1—WORK

1.01 Contractor shall complete all Work as specified or indicated in the Contract Documents. The Work is generally described as follows: Modifications to the existing Kentmere Lift Station, installation of two (2) new flow meter vaults, approximately 20 linear feet of 8-inch ceramic epoxy lined ductile iron pipe (DIP) at the lift station site, 2,130 linear feet of 6-inch ceramic epoxy lined DIP force main, and 265 linear feet of 8-inch polyvinyl chloride (PVC) gravity sewer pipe with associated manholes, valves, and appurtenances.

ARTICLE 2—THE PROJECT

2.01 The Project, of which the Work under the Contract Documents is a part, is generally described as follows: Kentmere Lift Station Modifications and Force Main Design.

ARTICLE 3—ENGINEER

3.01 The Owner has retained Freese and Nichols, 2500 Windy Ridge Parkway SE, Atlanta, Georgia 30339 to act as Owner's representative, assume all duties and responsibilities of Engineer, and have the rights and authority assigned to Engineer in the Contract. part of the Project that pertains to the Work has been designed by "Engineer".

3.02 The part of the Project that pertains to the Work has been designed by "Engineer".

ARTICLE 4—CONTRACT TIMES

4.01 *Time is 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.

4.03 *Contract Times: Days*

A. The Work will be substantially complete within 485 days after the date when the Contract Times commence to run as provided in Paragraph 4.01 of the General Conditions, and completed and ready for final payment in accordance with Paragraph 15.06 of the General Conditions within 545 days after the date when the Contract Times commence to run.

**EJCDC® C-520, Agreement between Owner and Contractor for Construction Contract (Stipulated Price).
Copyright© 2018 National Society of Professional Engineers, American Council of Engineering Companies, and American Society of Civil Engineers. All rights reserved.**

4.05 *Liquidated Damages*

A. Contractor and Owner recognize that time is of the essence as stated in Paragraph 4.01 above and that Owner will suffer financial and other losses if the Work is not completed and Milestones not achieved within the Contract Times, as duly modified. The parties also recognize the delays, expense, and difficulties involved in proving, in a legal or arbitration proceeding, the actual loss suffered by Owner if the Work is not completed on time. Accordingly, instead of requiring any such proof, Owner and Contractor agree that as liquidated damages for delay (but not as a penalty):

1. *Substantial Completion:* Contractor shall pay Owner $2,000 for each day that expires after the time (as duly adjusted pursuant to the Contract) specified above for Substantial Completion, until the Work is substantially complete.

2. *Completion of Remaining Work:* After Substantial Completion, if Contractor shall neglect, refuse, or fail to complete the remaining Work within the Contract Times (as duly adjusted pursuant to the Contract) for completion and readiness for final payment, Contractor shall pay Owner $2,000 for each day that expires after such time until the Work is completed and ready for final payment.

3. Liquidated damages for failing to timely attain Substantial Completion and final completion are not additive, and will not be imposed concurrently.

B. If Owner recovers liquidated damages for a delay in completion by Contractor, then such liquidated damages are Owner's sole and exclusive remedy for such delay, and Owner is precluded from recovering any other damages, whether actual, direct, excess, or consequential, for such delay, except for special damages (if any) specified in this Agreement.

ARTICLE 5—CONTRACT PRICE

5.01 Owner shall pay Contractor for completion of the Work in accordance with the Contract Documents, the amounts included in Section 00 41 13 – Bid Form, subject to adjustment under the Contract:

A. For all Unit Price Work, an amount equal to the sum of the extended prices (established for each separately identified item of Unit Price Work by multiplying the unit price times the actual quantity of that item).

The extended prices for Unit Price Work set forth as of the Effective Date of the Contract are based on estimated quantities. As provided in Paragraph 13.03 of the General Conditions, estimated quantities are not guaranteed, and determinations of actual quantities and classifications are to be made by Engineer.

B. Total of Lump Sum Amount and Unit Price Work (subject to final Unit Price adjustment) $[amount].

ARTICLE 6—PAYMENT PROCEDURES

6.01 *Submittal and Processing of Payments*

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

Copyright© 2018 National Society of Professional Engineers, American Council of Engineering Companies, and American Society of Civil Engineers. All rights reserved.

6.02 *Progress Payments; Retainage*

A. Owner shall make progress payments on the basis of Contractor's Applications for Payment within fifteen days after approval by the Owner during performance of the Work as provided in Paragraph 6.02.A.1 below, provided that such Applications for Payment have been submitted in a timely manner and otherwise meet the requirements of the Contract. All such payments will be measured by the Schedule of Values established as provided in the General Conditions (and in the case of Unit Price Work based on the number of units completed) or, in the event there is no Schedule of Values, as provided elsewhere in the Contract.

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

a. 95 percent of the value of the Work completed (with the balance being retainage).

b. 95 percent of cost of materials and equipment not incorporated in the Work (with the balance being retainage).

B. Upon Substantial Completion, Owner shall pay an amount sufficient to increase total payments to Contractor to 100 percent of the Work completed, less such amounts set off by Owner pursuant to Paragraph 15.01.E of the General Conditions, and less 200 percent of Engineer's estimate of the value of Work to be completed or corrected as shown on the punch list of items to be completed or corrected prior to final payment.

C. Owner will send payment to the designated address provided by the Contractor by Automated Clearing House (ACH) for payments of up to one-hundred and fifty-thousand dollars ($150,000.00), and by Electronic Funds Transfer (EFT) or bank wire transfer for payments over one-hundred and fifty-thousand dollars ($150,000.00). Notwithstanding the above, the County retains sole discretion to remit payment on any invoice by U.S. mail or by making payment available for pick-up by Contractor's authorized representative.

6.03 *Final Payment*

A. Upon final completion and acceptance of the Work, Owner shall pay the remainder of the Contract Price in accordance with Paragraph 15.06 of the General Conditions.

6.04 *Consent of Surety*

A. Owner will not make final payment, or return or release retainage at Substantial Completion or any other time, unless Contractor submits written consent of the surety to such payment, return, or release.

ARTICLE 7—CONTRACT DOCUMENTS

7.01 *Contents*

A. The Contract Documents consist of all of the following:

1. This Agreement.

2. Bonds:

a. Performance bond (together with power of attorney).

Copyright© 2018 National Society of Professional Engineers, American Council of Engineering Companies, and American Society of Civil Engineers. All rights reserved.

b. Payment bond (together with power of attorney).

3. General Conditions.

4. Supplementary Conditions.

5. Specifications as listed in the table of contents of the project manual (copy of list attached).

6. Drawings (not attached but incorporated by reference) consisting of 28 sheets with each sheet bearing the following general title: Kentmere Lift Station Modifications and Force Main Design.

7. Addenda

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

   a. Exhibit A – Contractor Affidavit

   b. Exhibit B – Subcontractor Affidavit

   c. Exhibit C – Non-Collusion Affidavit

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

   a. Notice to Proceed.

   b. Work Change Directives.

   c. Change Orders.

   d. Field Orders.

   e. Warranty Bond, if any.

B. The Contract Documents listed in Paragraph 7.01.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 7.

D. The Contract Documents may only be amended, modified, or supplemented as provided in the Contract.

ARTICLE 8—REPRESENTATIONS, CERTIFICATIONS, AND STIPULATIONS

8.01 *Contractor's Representations*

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

1. Contractor has examined and carefully studied the Contract Documents, including Addenda.

2. Contractor has visited the Site, conducted a thorough visual examination of the Site and adjacent areas, and become familiar with the general, local, and Site conditions that may affect cost, progress, and performance of the Work.

3. Contractor is familiar with all Laws and Regulations that may affect cost, progress, and performance of the Work.

Copyright© 2018 National Society of Professional Engineers, American Council of Engineering Companies, and American Society of Civil Engineers. All rights reserved.

4. Contractor has carefully studied the reports of explorations and tests of subsurface conditions at or adjacent to the Site and the drawings of physical conditions relating to existing surface or subsurface structures at the Site that have been identified in the Supplementary Conditions, with respect to the Technical Data in such reports and drawings.

5. Contractor has carefully studied the reports and drawings relating to Hazardous Environmental Conditions, if any, at or adjacent to the Site that have been identified in the Supplementary Conditions, with respect to Technical Data in such reports and drawings.

6. Contractor has considered the information known to Contractor itself; information commonly known to contractors doing business in the locality of the Site; information and observations obtained from visits to the Site; the Contract Documents; and the Technical Data identified in the Supplementary Conditions or by definition, with respect to the effect of such information, observations, and Technical Data on (a) the cost, progress, and performance of the Work; (b) the means, methods, techniques, sequences, and procedures of construction to be employed by Contractor; and (c) Contractor's safety precautions and programs.

7. Based on the information and observations referred to in the preceding paragraph, Contractor agrees that no further examinations, investigations, explorations, tests, studies, or data are necessary for the performance of the Work at the Contract Price, within the Contract Times, and in accordance with the other terms and conditions of the Contract.

8. 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.

9. Contractor has given Engineer written notice of all conflicts, errors, ambiguities, or discrepancies that Contractor has discovered in the Contract Documents, and of discrepancies between Site conditions and the Contract Documents, and the written resolution thereof by Engineer is acceptable to Contractor.

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

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

8.02 *Contractor's Certifications*

A. Contractor certifies that it has not engaged in corrupt, fraudulent, collusive, or coercive practices in competing for or in executing the Contract. For the purposes of this Paragraph 8.02:

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

2. "fraudulent practice" means an intentional misrepresentation of facts made (a) to influence the bidding process or the execution of the Contract to the detriment of

Copyright© 2018 National Society of Professional Engineers, American Council of Engineering Companies, and American Society of Civil Engineers. All rights reserved.

Owner, (b) to establish Bid or Contract prices at artificial non-competitive levels, or (c) to deprive Owner of the benefits of free and open competition;

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

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

8.03 *Standard General Conditions*

A. Owner stipulates that if the General Conditions that are made a part of this Contract are EJCDC® C-700, Standard General Conditions for the Construction Contract (2018), published by the Engineers Joint Contract Documents Committee, and if Owner is the party that has furnished said General Conditions, then Owner has plainly shown all modifications to the standard wording of such published document to the Contractor, through a process such as highlighting or "track changes" (redline/strikeout), or in the Supplementary Conditions.

Copyright© 2018 National Society of Professional Engineers, American Council of Engineering Companies, and American Society of Civil Engineers. All rights reserved.

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

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

Forsyth County, Georgia	Contractor:
(typed or printed name of organization)	*(typed or printed name of organization)*
By: _____	By: _____
(individual's signature)	*(individual's signature)*
Date: _____	Date: _____
(date signed)	*(date signed)*
Name: _____	Name: _____
(typed or printed)	*(typed or printed)*
Title: _____	Title: _____
(typed or printed)	*(typed or printed)*
	*(If **Contractor** is a corporation, a partnership, or a joint venture, attach evidence of authority to sign.)*
Attest: _____	Attest: _____
(individual's signature)	*(individual's signature)*
Title: _____	Title: _____
(typed or printed)	*(typed or printed)*
Address for giving notices:	Address for giving notices:
2435 Freedom Parkway	
Suite 1200	
Cumming, GA 30041	
Designated Representative:	Designated Representative:
Name: Scott H. Adams	Name: _____
(typed or printed)	*(typed or printed)*
Title: Dept. of Water & Sewer Director	Title: _____
(typed or printed)	*(typed or printed)*
Address:	Address:
2435 Freedom Parkway	
Suite 1200	
Cumming, GA 30041	
Phone: 770-886-2801	Phone: _____
Email: Shadams@forsythco.com	Email: _____
*(If **Owner** is a corporation, attach evidence of authority to sign. If **Owner** is a public body, attach evidence of authority to sign and resolution or other documents authorizing execution of this Agreement.)*	License No.: _____ *(where applicable)*
	State: _____

Copyright© 2018 National Society of Professional Engineers, American Council of Engineering Companies, and American Society of Civil Engineers. All rights reserved.

EXHIBIT A - Contractor Affidavit under O.C.G.A. § 13-10-91(b)(1)

By executing this affidavit, the undersigned contractor verifies its compliance with O.C.G.A. § 13-10-91, stating affirmatively that the individual, firm or corporation which is engaged in the physical performance of services on behalf of (name of public employer) has registered with, is authorized to use and uses the federal work authorization program commonly known as E-Verify, or any subsequent replacement program, in accordance with the applicable provisions and deadlines established in O.C.G.A. § 13-10-91. Furthermore, the undersigned contractor will continue to use the federal work authorization program throughout the contract period and the undersigned contractor will contract for the physical performance of services in satisfaction of such contract only with subcontractors who present an affidavit to the contractor with the information required by O.C.G.A. § 13-10-91(b). Contractor hereby attests that its federal work authorization user identification number and date of authorization are as follows:

_____
Federal Work Authorization User Identification Number

_____
Date of Authorization

_____
Name of Contractor

_____
Name of Project

_____
Name of Public Employer

I hereby declare under penalty of perjury that the foregoing is true and correct.
Executed on _____, ___, 202__ in _____(city), _____(state).

_____
Signature of Authorized Officer or Agent

_____
Printed Name and Title of Authorized Officer or Agent

SUBSCRIBED AND SWORN BEFORE ME
ON THIS THE _____ DAY OF _____,202__.

_____
NOTARY PUBLIC

My Commission Expires:
_____

Copyright© 2018 National Society of Professional Engineers, American Council of Engineering Companies, and American Society of Civil Engineers. All rights reserved.

EXHIBIT B - Subcontractor Affidavit under O.C.G.A. § 13-10-91(b)(3)

By executing this affidavit, the undersigned subcontractor verifies its compliance with O.C.G.A. § 13-10-91, stating affirmatively that the individual, firm or corporation which is engaged in the physical performance of services under a contract with (name of contractor) on behalf of (name of public employer) has registered with, is authorized to use and uses the federal work authorization program commonly known as E-Verify, or any subsequent replacement program, in accordance with the applicable provisions and deadlines established in O.C.G.A. § 13-10-91. Furthermore, the undersigned subcontractor will continue to use the federal work authorization program throughout the contract period and the undersigned subcontractor will contract for the physical performance of services in satisfaction of such contract only with sub-subcontractors who present an affidavit to the subcontractor with the information required by O.C.G.A. § 13-10-91(b). Additionally, the undersigned subcontractor will forward notice of the receipt of an affidavit from a sub-subcontractor to the contractor within five business days of receipt. If the undersigned subcontractor receives notice that a sub-subcontractor has received an affidavit from any other contracted sub-subcontractor, the undersigned subcontractor must forward, within five business days of receipt, a copy of the notice to the contractor. Subcontractor hereby attests that its federal work authorization user identification number and date of authorization are as follows:

_____
Federal Work Authorization User Identification Number

_____
Date of Authorization

_____
Name of Subcontractor

_____
Name of Project

_____
Name of Public Employer

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

Executed on _____, ___, 202__ in _____(city), _____(state).

_____
Signature of Authorized Officer or Agent

_____
Printed Name and Title of Authorized Officer or Agent

SUBSCRIBED AND SWORN BEFORE ME
ON THIS THE _____ DAY OF _____,202__.

_____
NOTARY PUBLIC

My Commission Expires:

_____

Copyright© 2018 National Society of Professional Engineers, American Council of Engineering Companies, and American Society of Civil Engineers. All rights reserved.

EXHIBIT C - Non-Collusion Affidavit

BID DATE: 2:00 p.m., July 2, 2026

PROJECT DESCRIPTION: Kentmere Lift Station Modifications and Force Main Design
STATE OF _____ }
COUNTY OF _____ }

_____, being first duly sworn, deposes and says that (s)he is _____ (the sole owner, a partner, the president, secretary, etc.) of _____ the party making the foregoing Proposal or Bid; that such Bid is genuine and not collusive or a sham; that said Bidder has not colluded, conspired, connived, or agreed, directly or indirectly, with any Bidder or person, to put in a sham Bid, or that such other person refrain from bidding, and has not in any manner, directly or indirectly sought by agreement or collusion, or communication or conference, with any person, to fix the Bid Price of affiant or any other Bidder, or to fix any overhead, profit or cost element of said Bid Price, or that of any other Bidder, or to secure any advantage against Forsyth County, or any person interested in the proposed Contract; and that all statements in said Proposal or Bid are true; and further, that such Bidder has not, directly or indirectly submitted this Bid, or the contents thereof, or divulged information or data relative thereto, to any association or to any member or agent thereof.

Affiant: Date:

Signed and sworn to (or affirmed) before me on _____, 20____

by _____,
Printed name(s) of individual(s) making statement

who proved to me on the basis of satisfactory evidence to be the person who appeared before me.

Personally Known
Or
Produced Identification
Type and # of ID (last 4 digits)
ID Expiration Date

Notary Public
(SEAL)
My Commission Expires: _____

Copyright© 2018 National Society of Professional Engineers, American Council of Engineering Companies, and American Society of Civil Engineers. All rights reserved.

PERFORMANCE BOND

Contractor	**Surety**
Name: [Full formal name of Contractor] Address *(principal place of business)*: [Address of Contractor's principal place of business]	Name: [Full formal name of Surety] Address *(principal place of business)*: [Address of Surety's principal place of business]
Owner	**Contract**
Name: Forsyth County, Georgia Mailing address *(principal place of business)*: 2435 Freedom Parkway Suite 1200 Cumming, GA 30041	Description *(name and location)*: Kentmere LS Modifications and Force Main Design 3289 Glen Wallace Dr Cumming, Georgia 30040 Contract Price: Effective Date of Contract:

Bond

Bond Amount: [Amount]

Date of Bond: [Date]

(Date of Bond cannot be earlier than Effective Date of Contract)

Modifications to this Bond form:

☐ None ☐ See Paragraph 27

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

Contractor as Principal	Surety
_____ *(Full formal name of Contractor)*	_____ *(Full formal name of Surety) (corporate seal)*
By: _____ *(Signature)*	By: _____ *(Signature)(Attach Power of Attorney)*
Name: _____ *(Printed or typed)*	Name: _____ *(Printed or typed)*
Title: _____	Title: _____
Attest: _____ *(Signature)*	Attest: _____ *(Signature)*
Name: _____ *(Printed or typed)*	Name: _____ *(Printed or typed)*
Title: _____	Title: _____

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

Copyright© 2018 National Society of Professional Engineers, American Council of Engineering Companies, and American Society of Civil Engineers. All rights reserved.

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

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

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

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

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

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

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

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

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

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

    16.3. Obtain bids or negotiated proposals from qualified contractors acceptable to the Owner for a contract for performance and completion of the Construction Contract, arrange for a contract to be prepared for execution by the Owner and a contractor selected with the Owners concurrence, to be secured with performance and payment bonds executed by a qualified surety equivalent to the bonds issued on the Construction Contract, and pay to the Owner the amount of damages as described in Paragraph 7 in excess of the Balance of the Contract Price incurred by the Owner as a result of the Contractor Default; or

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

Copyright© 2018 National Society of Professional Engineers, American Council of Engineering Companies, and American Society of Civil Engineers. All rights reserved.

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

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

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

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

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

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

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

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

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

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

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

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

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

Copyright© 2018 National Society of Professional Engineers, American Council of Engineering Companies, and American Society of Civil Engineers. All rights reserved.

statutory or other legal requirement will be deemed incorporated herein. When so furnished, the intent is that this Bond will be construed as a statutory bond and not as a common law bond.

25. Definitions

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

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

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

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

    25.5. *Contract Documents*—All the documents that comprise the agreement between the Owner and Contractor.

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

27. Modifications to this Bond are as follows: [Describe modification or enter "None"]

Copyright© 2018 National Society of Professional Engineers, American Council of Engineering Companies, and American Society of Civil Engineers. All rights reserved.

PAYMENT BOND

Contractor	**Surety**
Name: [Full formal name of Contractor] Address *(principal place of business)*: [Address of Contractor's principal place of business]	Name: [Full formal name of Surety] Address *(principal place of business)*: [Address of Surety's principal place of business]
Owner	**Contract**
Name: Forsyth County, Georgia Mailing address *(principal place of business)*: 2435 Freedom Parkway Suite 1200 Cumming, GA 30041	Description *(name and location)*: Kentmere LS Modifications and Force Main Design 3289 Glen Wallace Dr Cumming, Georgia 30040 Contract Price: [Amount, from Contract] Effective Date of Contract: [Date, from Contract]

Bond

Bond Amount: [Amount]

Date of Bond: [Date]

(Date of Bond cannot be earlier than Effective Date of Contract)

Modifications to this Bond form:

☐ None ☐ See Paragraph 44

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

Contractor as Principal	Surety
_____ *(Full formal name of Contractor)*	_____ *(Full formal name of Surety) (corporate seal)*
By: _____ *(Signature)*	By: _____ *(Signature)(Attach Power of Attorney)*
Name: _____ *(Printed or typed)*	Name: _____ *(Printed or typed)*
Title: _____	Title: _____
Attest: _____ *(Signature)*	Attest: _____ *(Signature)*
Name: _____ *(Printed or typed)*	Name: _____ *(Printed or typed)*
Title: _____	Title: _____

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

Copyright© 2018 National Society of Professional Engineers, American Council of Engineering Companies, and American Society of Civil Engineers. All rights reserved.

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

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

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

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

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

    32.1. Claimants who do not have a direct contract with the Contractor

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

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

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

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

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

    34.1. Send an answer to the Claimant, with a copy to the Owner, within sixty (60) days after receipt of the Claim, stating the amounts that are undisputed and the basis for challenging any amounts that are disputed; and

    34.2. Pay or arrange for payment of any undisputed amounts.

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

Copyright© 2018 National Society of Professional Engineers, American Council of Engineering Companies, and American Society of Civil Engineers. All rights reserved.

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

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

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

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

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

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

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

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

43. Definitions

    43.1. *Claim*—A written statement by the Claimant including at a minimum:

        43.1.1. The name of the Claimant;

        43.1.2. The name of the person for whom the labor was done, or materials or equipment furnished;

        43.1.3. A copy of the agreement or purchase order pursuant to which labor, materials, or equipment was furnished for use in the performance of the Construction Contract;

        43.1.4. A brief description of the labor, materials, or equipment furnished;

Copyright© 2018 National Society of Professional Engineers, American Council of Engineering Companies, and American Society of Civil Engineers. All rights reserved.

43.1.5. The date on which the Claimant last performed labor or last furnished materials or equipment for use in the performance of the Construction Contract;

43.1.6. The total amount earned by the Claimant for labor, materials, or equipment furnished as of the date of the Claim;

43.1.7. The total amount of previous payments received by the Claimant; and

43.1.8. The total amount due and unpaid to the Claimant for labor, materials, or equipment furnished as of the date of the Claim.

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

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

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

43.5. *Contract Documents*—All the documents that comprise the agreement between the Owner and Contractor.

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

Modifications to this Bond are as follows: [Describe modification or enter "None"]

Copyright© 2018 National Society of Professional Engineers, American Council of Engineering Companies, and American Society of Civil Engineers. All rights reserved.

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

STANDARD GENERAL CONDITIONS OF THE CONSTRUCTION CONTRACT

Prepared By

EJCDC®
ENGINEERS JOINT CONTRACT DOCUMENTS COMMITTEE

ACEC
AMERICAN COUNCIL OF ENGINEERING COMPANIES

ASCE
AMERICAN SOCIETY OF CIVIL ENGINEERS

NSPE®
NATIONAL SOCIETY OF PROFESSIONAL ENGINEERS

Endorsed By

CSI®
Building Knowledge
Improving Project Delivery

NUCA
We Dig America

EJCDC® C-700, Standard General Conditions of the Construction Contract.
Copyright© 2018 National Society of Professional Engineers, American Council of Engineering Companies, and American Society of Civil Engineers. All rights reserved.

Copyright© 2018

National Society of Professional Engineers

1420 King Street, Alexandria, VA 22314-2794

(703) 684-2882

www.nspe.org

American Council of Engineering Companies

1015 15th Street N.W., Washington, DC 20005

(202) 347-7474

www.acec.org

American Society of Civil Engineers

1801 Alexander Bell Drive, Reston, VA 20191-4400

(800) 548-2723

www.asce.org

The copyright for this EJCDC document is owned jointly by the three sponsoring organizations listed above. The National Society of Professional Engineers is the Copyright Administrator for the EJCDC documents; please direct all inquiries regarding EJCDC copyrights to NSPE.

NOTE: EJCDC publications may be purchased at www.ejcdc.org, or from any of the sponsoring organizations above.

Copyright© 2018 National Society of Professional Engineers, American Council of Engineering Companies, and American Society of Civil Engineers. All rights reserved.

GUIDELINES FOR USE OF EJCDC® C-700, STANDARD GENERAL CONDITIONS OF THE CONSTRUCTION CONTRACT

1.0 PURPOSE AND INTENDED USE OF THE DOCUMENT

EJCDC® C-700, Standard General Conditions of the Construction Contract (2018), is the foundation document for the EJCDC Construction Series. The General Conditions define the basic rights, responsibilities, risk allocations, and contractual relationship of the Owner and Contractor, and establish how the Contract is to be administered.

2.0 OTHER DOCUMENTS

EJCDC documents are intended to be used as a system and changes in one EJCDC document may require a corresponding change in other documents. Other EJCDC documents may also serve as a reference to provide insight or guidance for the preparation of this document.

These General Conditions have been prepared for use with either EJCDC® C-520, Agreement Between Owner and Contractor for Construction Contract (Stipulated Price), or EJCDC® C-525, Agreement Between Owner and Contractor for Construction Contract (Cost-Plus-Fee) (2018 Editions). The provisions of the General Conditions and the Agreement are interrelated, and a change in one may necessitate a change in the other.

To prepare supplementary conditions that are coordinated with the General Conditions, use EJCDC® C-800, Supplementary Conditions of the Construction Contract (2018).

The full EJCDC Construction series of documents is discussed in the EJCDC® C-001, Commentary on the 2018 EJCDC Construction Documents (2018).

3.0 ORGANIZATION OF INFORMATION

All parties involved in a construction project benefit significantly from a standardized approach in the location of subject matter throughout the documents. Experience confirms the danger of addressing the same subject matter in more than one location; doing so frequently leads to confusion and unanticipated legal consequences. Careful attention should be given to the guidance provided in EJCDC® N-122/AIA® A521, Uniform Location of Subject Matter (2012 Edition) when preparing documents. EJCDC® N-122/AIA® A521 is available at no charge from the EJCDC website, www.ejcdc.org, and from the websites of EJCDC's sponsoring organizations.

If CSI MasterFormat™ is used for organizing the Project Manual, consult CSI MasterFormat™ for the appropriate document number (e.g., under 00 11 00, Advertisements and Invitations), and accordingly number the document and its pages.

4.0 EDITING THIS DOCUMENT

Remove these Guidelines for Use. Some users may also prefer to remove the two cover pages.

Although it is permissible to revise the Standard EJCDC Text of C-700 (the content beginning at page 1 and continuing to the end), it is common practice to leave the Standard EJCDC Text of C-700 intact and unaltered, with modifications and supplementation of C-700's provisions set forth in EJCDC® C-800, Supplementary Conditions of the Construction Contract (2018). If the Standard Text itself is revised, the

Copyright© 2018 National Society of Professional Engineers, American Council of Engineering Companies, and American Society of Civil Engineers. All rights reserved.

user must comply with the terms of the License Agreement, Paragraph 4.0, Document-Specific Provisions, concerning the tracking or highlighting of revisions. The following is a summary of the relevant License Agreement provisions:

1. The term "Standard EJCDC Text" for C-700 refers to all text prepared by EJCDC in the main body of the document. Document covers, logos, footers, instructions, or copyright notices are not Standard EJCDC Text for this purpose.
2. During the drafting or negotiating process for C-700, it is important that the two contracting parties are both aware of any changes that have been made to the Standard EJCDC Text. Thus, if a draft or version of C-700 purports to be or appears to be an EJCDC document, the user must plainly show all changes to the Standard EJCDC Text, using "Track Changes" (redline/strikeout), highlighting, or other means of clearly indicating additions and deletions.
3. If C-700 has been revised or altered and is subsequently presented to third parties (such as potential bidders, grant agencies, lenders, or sureties) as an EJCDC document, then the changes to the Standard EJCDC Text must be shown, or the third parties must receive access to a version that shows the changes.
4. Once the document is ready to be finalized (and if applicable executed by the contracting parties), it is no longer necessary to continue to show changes to the Standard EJCDC Text. The user may produce a final version of the document in a format in which all changes are accepted, and the document at that point does not need to include any "Track Changes," redline/strikeout, highlighting, or other indication of additions and deletions to the Standard EJCDC Text.

5.0 LICENSE AGREEMENT

This document is subject to the terms and conditions of the **License Agreement, 2018 EJCDC® Construction Series Documents**. A copy of the License Agreement was furnished at the time of purchase of this document, and is available for review at www.ejcdc.org and the websites of EJCDC's sponsoring organizations.

Copyright© 2018 National Society of Professional Engineers, American Council of Engineering Companies, and American Society of Civil Engineers. All rights reserved.

STANDARD GENERAL CONDITIONS OF THE CONSTRUCTION CONTRACT

TABLE OF CONTENTS

Page

Article 1—Definitions and Terminology 1
1.01 Defined Terms 1
1.02 Terminology 6
Article 2—Preliminary Matters 7
2.01 Delivery of Performance and Payment Bonds; Evidence of Insurance 7
2.02 Copies of Documents 7
2.03 Before Starting Construction 7
2.04 Preconstruction Conference; Designation of Authorized Representatives 8
2.05 Acceptance of Schedules 8
2.06 Electronic Transmittals 8
Article 3—Contract Documents: Intent, Requirements, Reuse 9
3.01 Intent 9
3.02 Reference Standards 9
3.03 Reporting and Resolving Discrepancies 10
3.04 Requirements of the Contract Documents 10
3.05 Reuse of Documents 11
Article 4—Commencement and Progress of the Work 11
4.01 Commencement of Contract Times; Notice to Proceed 11
4.02 Starting the Work 11
4.03 Reference Points 11
4.04 Progress Schedule 12
4.05 Delays in Contractor's Progress 12
Article 5—Site; Subsurface and Physical Conditions; Hazardous Environmental Conditions 13
5.01 Availability of Lands 13
5.02 Use of Site and Other Areas 14
5.03 Subsurface and Physical Conditions 15
5.04 Differing Subsurface or Physical Conditions 16

Copyright© 2018 National Society of Professional Engineers, American Council of Engineering Companies, and American Society of Civil Engineers. All rights reserved.

5.05 Underground Facilities 17
5.06 Hazardous Environmental Conditions at Site 19
Article 6—Bonds and Insurance 21
6.01 Performance, Payment, and Other Bonds 21
6.02 Insurance—General Provisions 22
6.03 Contractor's Insurance 24
6.04 Builder's Risk and Other Property Insurance 25
6.05 Property Losses; Subrogation 25
6.06 Receipt and Application of Property Insurance Proceeds 27
Article 7—Contractor's Responsibilities 27
7.01 Contractor's Means and Methods of Construction 27
7.02 Supervision and Superintendence 27
7.03 Labor; Working Hours 27
7.04 Services, Materials, and Equipment 28
7.05 "Or Equals" 28
7.06 Substitutes 29
7.07 Concerning Subcontractors and Suppliers 31
7.08 Patent Fees and Royalties 32
7.09 Permits 33
7.10 Taxes 33
7.11 Laws and Regulations 33
7.12 Record Documents 33
7.13 Safety and Protection 34
7.14 Hazard Communication Programs 35
7.15 Emergencies 35
7.16 Submittals 35
7.17 Contractor's General Warranty and Guarantee 38
7.18 Indemnification 39
7.19 Delegation of Professional Design Services 39
Article 8—Other Work at the Site 40
8.01 Other Work 40
8.02 Coordination 41
8.03 Legal Relationships 41

Copyright© 2018 National Society of Professional Engineers, American Council of Engineering Companies, and American Society of Civil Engineers. All rights reserved.

Article 9—Owner's Responsibilities 42
9.01 Communications to Contractor 42
9.02 Replacement of Engineer 42
9.03 Furnish Data 42
9.04 Pay When Due 42
9.05 Lands and Easements; Reports, Tests, and Drawings 43
9.06 Insurance 43
9.07 Change Orders 43
9.08 Inspections, Tests, and Approvals 43
9.09 Limitations on Owner's Responsibilities 43
9.10 Undisclosed Hazardous Environmental Condition 43
9.11 Evidence of Financial Arrangements 43
9.12 Safety Programs 43
Article 10—Engineer's Status During Construction 44
10.01 Owner's Representative 44
10.02 Visits to Site 44
10.03 Resident Project Representative 44
10.04 Engineer's Authority 44
10.05 Determinations for Unit Price Work 45
10.06 Decisions on Requirements of Contract Documents and Acceptability of Work 45
10.07 Limitations on Engineer's Authority and Responsibilities 45
10.08 Compliance with Safety Program 45
Article 11—Changes to the Contract 46
11.01 Amending and Supplementing the Contract 46
11.02 Change Orders 46
11.03 Work Change Directives 46
11.04 Field Orders 47
11.05 Owner-Authorized Changes in the Work 47
11.06 Unauthorized Changes in the Work 47
11.07 Change of Contract Price 47
11.08 Change of Contract Times 49
11.09 Change Proposals 49
11.10 Notification to Surety 50

Copyright© 2018 National Society of Professional Engineers, American Council of Engineering Companies, and American Society of Civil Engineers. All rights reserved.

Article 12—Claims 50
12.01 Claims 50
Article 13—Cost of the Work; Allowances; Unit Price Work 51
13.01 Cost of the Work 51
13.02 Allowances 55
13.03 Unit Price Work 55
Article 14—Tests and Inspections; Correction, Removal, or Acceptance of Defective Work 56
14.01 Access to Work 56
14.02 Tests, Inspections, and Approvals 56
14.03 Defective Work 57
14.04 Acceptance of Defective Work 58
14.05 Uncovering Work 58
14.06 Owner May Stop the Work 58
14.07 Owner May Correct Defective Work 59
Article 15—Payments to Contractor; Set-Offs; Completion; Correction Period 59
15.01 Progress Payments 59
15.02 Contractor's Warranty of Title 62
15.03 Substantial Completion 62
15.04 Partial Use or Occupancy 63
15.05 Final Inspection 64
15.06 Final Payment 64
15.07 Waiver of Claims 65
15.08 Correction Period 66
Article 16—Suspension of Work and Termination 67
16.01 Owner May Suspend Work 67
16.02 Owner May Terminate for Cause 67
16.03 Owner May Terminate for Convenience 68
16.04 Contractor May Stop Work or Terminate 68
Article 17—Final Resolution of Disputes 69
17.01 Methods and Procedures 69
Article 18—Miscellaneous 69
18.01 Giving Notice 69
18.02 Computation of Times 69

Copyright© 2018 National Society of Professional Engineers, American Council of Engineering Companies, and American Society of Civil Engineers. All rights reserved.

18.03 Cumulative Remedies 70
18.04 Limitation of Damages 70
18.05 No Waiver 70
18.06 Survival of Obligations 70
18.07 Controlling Law 70
18.08 Assignment of Contract 70
18.09 Successors and Assigns 70
18.10 Headings 70

Copyright© 2018 National Society of Professional Engineers, American Council of Engineering Companies, and American Society of Civil Engineers. All rights reserved.

STANDARD GENERAL CONDITIONS OF THE CONSTRUCTION CONTRACT

ARTICLE 1—DEFINITIONS AND TERMINOLOGY

1.01 *Defined Terms*

A. Wherever used in the Bidding Requirements or Contract Documents, a term printed with initial capital letters, including the term's singular and plural forms, will have the meaning indicated in the definitions below. In addition to terms specifically defined, terms with initial capital letters in the Contract Documents include references to identified articles and paragraphs, and the titles of other documents or forms.

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

2. *Agreement*—The written instrument, executed by Owner and Contractor, that sets forth the Contract Price and Contract Times, identifies the parties and the Engineer, and designates the specific items that are Contract Documents.

3. *Application for Payment*—The document prepared by Contractor, in a form acceptable to Engineer, to request progress or final payments, and which is to be accompanied by such supporting documentation as is required by the Contract Documents.

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

5. *Bidder*—An individual or entity that submits a Bid to Owner.

6. *Bidding Documents*—The Bidding Requirements, the proposed Contract Documents, and all Addenda.

7. *Bidding Requirements*—The Advertisement or invitation to bid, Instructions to Bidders, Bid Bond or other Bid security, if any, the Bid Form, and the Bid with any attachments.

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

9. *Change Proposal*—A written request by Contractor, duly submitted in compliance with the procedural requirements set forth herein, seeking an adjustment in Contract Price or Contract Times; contesting an initial decision by Engineer concerning the requirements of the Contract Documents or the acceptability of Work under the Contract Documents; challenging a set-off against payments due; or seeking other relief with respect to the terms of the Contract.

10. *Claim*

a. A demand or assertion by Owner directly to Contractor, duly submitted in compliance with the procedural requirements set forth herein, seeking an adjustment of Contract Price or Contract Times; contesting an initial decision by Engineer concerning the

Copyright© 2018 National Society of Professional Engineers, American Council of Engineering Companies, and American Society of Civil Engineers. All rights reserved.

requirements of the Contract Documents or the acceptability of Work under the Contract Documents; contesting Engineer's decision regarding a Change Proposal; seeking resolution of a contractual issue that Engineer has declined to address; or seeking other relief with respect to the terms of the Contract.

b. A demand or assertion by Contractor directly to Owner, duly submitted in compliance with the procedural requirements set forth herein, contesting Engineer's decision regarding a Change Proposal, or seeking resolution of a contractual issue that Engineer has declined to address.

c. A demand or assertion by Owner or Contractor, duly submitted in compliance with the procedural requirements set forth herein, made pursuant to Paragraph 12.01.A.4, concerning disputes arising after Engineer has issued a recommendation of final payment.

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

11. *Constituent of Concern*—Asbestos, petroleum, radioactive materials, polychlorinated biphenyls (PCBs), lead-based paint (as defined by the HUD/EPA standard), hazardous waste, and any substance, product, waste, or other material of any nature whatsoever that is or becomes listed, regulated, or addressed pursuant to Laws and Regulations regulating, relating to, or imposing liability or standards of conduct concerning, any hazardous, toxic, or dangerous waste, substance, or material.

12. *Contract*—The entire and integrated written contract between Owner and Contractor concerning the Work.

13. *Contract Documents*—Those items so designated in the Agreement, and which together comprise the Contract.

14. *Contract Price*—The money that Owner has agreed to pay Contractor for completion of the Work in accordance with the Contract Documents.

15. *Contract Times*—The number of days or the dates by which Contractor shall: (a) achieve Milestones, if any; (b) achieve Substantial Completion; and (c) complete the Work.

16. *Contractor*—The individual or entity with which Owner has contracted for performance of the Work.

17. *Cost of the Work*—See Paragraph 13.01 for definition.

18. *Drawings*—The part of the Contract that graphically shows the scope, extent, and character of the Work to be performed by Contractor.

19. *Effective Date of the Contract*—The date, indicated in the Agreement, on which the Contract becomes effective.

20. *Electronic Document*—Any Project-related correspondence, attachments to correspondence, data, documents, drawings, information, or graphics, including but not limited to Shop Drawings and other Submittals, that are in an electronic or digital format.

21. *Electronic Means*—Electronic mail (email), upload/download from a secure Project website, or other communications methods that allow: (a) the transmission or communication of Electronic Documents; (b) the documentation of transmissions, including sending and receipt; (c) printing of the transmitted Electronic Document by the

Copyright© 2018 National Society of Professional Engineers, American Council of Engineering Companies, and American Society of Civil Engineers. All rights reserved.

recipient; (d) the storage and archiving of the Electronic Document by sender and recipient; and (e) the use by recipient of the Electronic Document for purposes permitted by this Contract. Electronic Means does not include the use of text messaging, or of Facebook, Twitter, Instagram, or similar social media services for transmission of Electronic Documents.

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

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

24. *Hazardous Environmental Condition*—The presence at the Site of Constituents of Concern in such quantities or circumstances that may present a danger to persons or property exposed thereto.

    a. The presence at the Site of materials that are necessary for the execution of the Work, or that are to be incorporated into the Work, and that are controlled and contained pursuant to industry practices, Laws and Regulations, and the requirements of the Contract, is not a Hazardous Environmental Condition.

    b. The presence of Constituents of Concern that are to be removed or remediated as part of the Work is not a Hazardous Environmental Condition.

    c. The presence of Constituents of Concern as part of the routine, anticipated, and obvious working conditions at the Site, is not a Hazardous Environmental Condition.

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

26. *Liens*—Charges, security interests, or encumbrances upon Contract-related funds, real property, or personal property.

27. *Milestone*—A principal event in the performance of the Work that the Contract requires Contractor to achieve by an intermediate completion date, or by a time prior to Substantial Completion of all the Work.

28. *Notice of Award*—The written notice by Owner to a Bidder of Owner's acceptance of the Bid.

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

30. *Owner*—The individual or entity with which Contractor has contracted regarding the Work, and which has agreed to pay Contractor for the performance of the Work, pursuant to the terms of the Contract.

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

32. *Project*—The total undertaking to be accomplished for Owner by engineers, contractors, and others, including planning, study, design, construction, testing, commissioning, and start-up, and of which the Work to be performed under the Contract Documents is a part.

Copyright© 2018 National Society of Professional Engineers, American Council of Engineering Companies, and American Society of Civil Engineers. All rights reserved.

33. *Resident Project Representative*—The authorized representative of Engineer assigned to assist Engineer at the Site. As used herein, the term Resident Project Representative (RPR) includes any assistants or field staff of Resident Project Representative.

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

35. *Schedule of Submittals*—A schedule, prepared and maintained by Contractor, of required submittals and the time requirements for Engineer's review of the submittals.

36. *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.

37. *Shop Drawings*—All drawings, diagrams, illustrations, schedules, and other data or information that are specifically prepared or assembled by or for Contractor and submitted by Contractor to illustrate some portion of the Work. Shop Drawings, whether approved or not, are not Drawings and are not Contract Documents.

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

39. *Specifications*—The part of the Contract that consists of written requirements for materials, equipment, systems, standards, and workmanship as applied to the Work, and certain administrative requirements and procedural matters applicable to the Work.

40. *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.

41. *Submittal*—A written or graphic document, prepared by or for Contractor, which the Contract Documents require Contractor to submit to Engineer, or that is indicated as a Submittal in the Schedule of Submittals accepted by Engineer. Submittals may include Shop Drawings and Samples; schedules; product data; Owner-delegated designs; sustainable design information; information on special procedures; testing plans; results of tests and evaluations, source quality-control testing and inspections, and field or Site quality-control testing and inspections; warranties and certifications; Suppliers' instructions and reports; records of delivery of spare parts and tools; operations and maintenance data; Project photographic documentation; record documents; and other such documents required by the Contract Documents. Submittals, whether or not approved or accepted by Engineer, are not Contract Documents. Change Proposals, Change Orders, Claims, notices, Applications for Payment, and requests for interpretation or clarification are not Submittals.

42. *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 of such Work.

Copyright© 2018 National Society of Professional Engineers, American Council of Engineering Companies, and American Society of Civil Engineers. All rights reserved.

43. *Successful Bidder*—The Bidder to which the Owner makes an award of contract.

44. *Supplementary Conditions*—The part of the Contract that amends or supplements these General Conditions.

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

46. *Technical Data*

    a. Those items expressly identified as Technical Data in the Supplementary Conditions, with respect to either (1) existing subsurface conditions at or adjacent to the Site, or existing physical conditions at or adjacent to the Site including existing surface or subsurface structures (except Underground Facilities) or (2) Hazardous Environmental Conditions at the Site.

    b. If no such express identifications of Technical Data have been made with respect to conditions at the Site, then Technical Data is defined, with respect to conditions at the Site under Paragraphs 5.03, 5.04, and 5.06, as the data contained in boring logs, recorded measurements of subsurface water levels, assessments of the condition of subsurface facilities, laboratory test results, and other factual, objective information regarding conditions at the Site that are set forth in any geotechnical, environmental, or other Site or facilities conditions report prepared for the Project and made available to Contractor.

    c. Information and data regarding the presence or location of Underground Facilities are not intended to be categorized, identified, or defined as Technical Data, and instead Underground Facilities are shown or indicated on the Drawings.

47. *Underground Facilities*—All active or not-in-service underground lines, pipelines, conduits, ducts, encasements, cables, wires, manholes, vaults, tanks, tunnels, or other such facilities or systems at the Site, including but not limited to those facilities or systems that produce, transmit, distribute, or convey telephone or other communications, cable television, fiber optic transmissions, power, electricity, light, heat, gases, oil, crude oil products, liquid petroleum products, water, steam, waste, wastewater, storm water, other liquids or chemicals, or traffic or other control systems. An abandoned facility or system is not an Underground Facility.

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

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

50. *Work Change Directive*—A written directive to Contractor issued on or after the Effective Date of the Contract, signed by Owner and recommended by Engineer, ordering an addition, deletion, or revision in the Work.

Copyright© 2018 National Society of Professional Engineers, American Council of Engineering Companies, and American Society of Civil Engineers. All rights reserved.

1.02 *Terminology*

A. The words and terms discussed in Paragraphs 1.02.B, C, D, and E are not defined terms that require initial capital letters, but, when used in the Bidding Requirements or Contract Documents, have the indicated meaning.

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

C. *Day*: The word "day" means a calendar day of 24 hours measured from midnight to the next midnight.

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

1. does not conform to the Contract Documents;

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

3. has been damaged prior to Engineer's recommendation of final payment (unless responsibility for the protection thereof has been assumed by Owner at Substantial Completion in accordance with Paragraph 15.03 or Paragraph 15.04).

E. *Furnish, Install, Perform, Provide*

1. The word "furnish," when used in connection with services, materials, or equipment, means 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, means 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, means to furnish and install said services, materials, or equipment complete and ready for intended use.

4. If the Contract Documents establish an obligation of Contractor with respect to specific services, materials, or equipment, but do not expressly use any of the four words "furnish," "install," "perform," or "provide," then Contractor shall furnish and install said services, materials, or equipment complete and ready for intended use.

Copyright© 2018 National Society of Professional Engineers, American Council of Engineering Companies, and American Society of Civil Engineers. All rights reserved.

F. *Contract Price or Contract Times*: References to a change in "Contract Price or Contract Times" or "Contract Times or Contract Price" or similar, indicate that such change applies to (1) Contract Price, (2) Contract Times, or (3) both Contract Price and Contract Times, as warranted, even if the term "or both" is not expressed.

G. 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 Performance and Payment Bonds; Evidence of Insurance*

A. *Performance and Payment Bonds*: When Contractor delivers the signed counterparts of the Agreement to Owner, Contractor shall also deliver to Owner the performance bond and payment bond (if the Contract requires Contractor to furnish such bonds).

B. *Evidence of Contractor's Insurance*: When Contractor delivers the signed counterparts of the Agreement to Owner, Contractor shall also deliver to Owner, with copies to each additional insured (as identified in the Contract), the certificates, endorsements, and other evidence of insurance required to be provided by Contractor in accordance with Article 6, except to the extent the Supplementary Conditions expressly establish other dates for delivery of specific insurance policies.

C. *Evidence of Owner's Insurance*: After receipt of the signed counterparts of the Agreement and all required bonds and insurance documentation, Owner shall promptly deliver to Contractor, with copies to each additional insured (as identified in the Contract), the certificates and other evidence of insurance required to be provided by Owner under Article 6.

2.02 *Copies of Documents*

A. Owner shall furnish to Contractor four printed copies of the Contract (including one fully signed counterpart of the Agreement), and one copy in electronic portable document format (PDF). Additional printed copies will be furnished upon request at the cost of reproduction.

B. Owner shall maintain and safeguard at least one original printed record version of the Contract, including Drawings and Specifications signed and sealed by Engineer and other design professionals. Owner shall make such original printed record version of the Contract available to Contractor for review. Owner may delegate the responsibilities under this provision to Engineer.

2.03 *Before Starting Construction*

A. *Preliminary Schedules*: Within 10 days after the Effective Date of the Contract (or as otherwise required by the Contract Documents), Contractor shall submit to Engineer for timely review:

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

2. a preliminary Schedule of Submittals; and

3. a preliminary Schedule of Values for all of the Work which includes quantities and prices of items which when added together equal the Contract Price and subdivides the Work

Copyright© 2018 National Society of Professional Engineers, American Council of Engineering Companies, and American Society of Civil Engineers. All rights reserved.

into component parts in sufficient detail to serve as the basis for progress payments during performance of the Work. Such prices will include an appropriate amount of overhead and profit applicable to each item of Work.

2.04 *Preconstruction Conference; Designation of Authorized Representatives*

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

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

2.05 *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 the schedules submitted in accordance with Paragraph 2.03.A. No progress payment will be made to Contractor until acceptable schedules are submitted to Engineer.

1. The Progress Schedule will be acceptable to Engineer if it provides an orderly progression of the Work to completion within the Contract Times. Such acceptance will not impose on Engineer responsibility for the Progress Schedule, for sequencing, scheduling, or progress of the Work, nor interfere with or relieve Contractor from Contractor's full responsibility therefor.

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

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

4. If a schedule is not acceptable, Contractor will have an additional 10 days to revise and resubmit the schedule.

2.06 *Electronic Transmittals*

A. Except as otherwise stated elsewhere in the Contract, the Owner, Engineer, and Contractor may send, and shall accept, Electronic Documents transmitted by Electronic Means.

B. If the Contract does not establish protocols for Electronic Means, then Owner, Engineer, and Contractor shall jointly develop such protocols.

C. Subject to any governing protocols for Electronic Means, when transmitting Electronic Documents by Electronic Means, the transmitting party makes no representations as to long-term compatibility, usability, or readability of the Electronic Documents resulting from the recipient's use of software application packages, operating systems, or computer hardware differing from those used in the drafting or transmittal of the Electronic Documents.

Copyright© 2018 National Society of Professional Engineers, American Council of Engineering Companies, and American Society of Civil Engineers. All rights reserved.

ARTICLE 3—CONTRACT DOCUMENTS: INTENT, REQUIREMENTS, REUSE

3.01 *Intent*

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

B. It is the intent of the Contract Documents to describe a functionally complete Project (or part thereof) to be constructed in accordance with the Contract Documents.

C. Unless otherwise stated in the Contract Documents, if there is a discrepancy between the electronic versions of the Contract Documents (including any printed copies derived from such electronic versions) and the printed record version, the printed record version will govern.

D. The Contract supersedes prior negotiations, representations, and agreements, whether written or oral.

E. Engineer will issue clarifications and interpretations of the Contract Documents as provided herein.

F. Any provision or part of the Contract Documents held to be void or unenforceable under any Law or Regulation will be deemed stricken, and all remaining provisions will continue to be valid and binding upon Owner and Contractor, which agree that the Contract Documents will 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.

G. Nothing in the Contract Documents creates:

1. any contractual relationship between Owner or Engineer and any Subcontractor, Supplier, or other individual or entity performing or furnishing any of the Work, for the benefit of such Subcontractor, Supplier, or other individual or entity; or

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

3.02 *Reference Standards*

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

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

2. No provision of any such standard specification, manual, reference standard, or code, and no instruction of a Supplier, will be effective to change the duties or responsibilities of Owner, Contractor, or Engineer from those set forth in the part of the Contract Documents prepared by or for Engineer. No such provision or instruction shall be effective to assign to Owner or Engineer any duty or authority to supervise or direct the performance of the Work, or any duty or authority to undertake responsibility

Copyright© 2018 National Society of Professional Engineers, American Council of Engineering Companies, and American Society of Civil Engineers. All rights reserved.

inconsistent with the provisions of the part of the Contract Documents prepared by or for Engineer.

3.03 *Reporting and Resolving Discrepancies*

A. *Reporting Discrepancies*

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

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

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

B. *Resolving Discrepancies*

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

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

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

3.04 *Requirements of the Contract Documents*

A. During the performance of the Work and until final payment, Contractor and Owner shall submit to the Engineer in writing all matters in question concerning the requirements of the Contract Documents (sometimes referred to as requests for information or interpretation—RFIs), or relating to the acceptability of the Work under the Contract Documents, as soon as possible after such matters arise. Engineer will be the initial interpreter of the requirements of the Contract Documents, and judge of the acceptability of the Work.

Copyright© 2018 National Society of Professional Engineers, American Council of Engineering Companies, and American Society of Civil Engineers. All rights reserved.

B. Engineer will, with reasonable promptness, render a written clarification, interpretation, or decision on the issue submitted, or initiate an amendment or supplement to the Contract Documents. Engineer's written clarification, interpretation, or decision will be final and binding on Contractor, unless it appeals by submitting a Change Proposal, and on Owner, unless it appeals by filing a Claim.

C. If a submitted matter in question concerns terms and conditions of the Contract Documents that do not involve (1) the performance or acceptability of the Work under the Contract Documents, (2) the design (as set forth in the Drawings, Specifications, or otherwise), or (3) other engineering or technical matters, then Engineer will promptly notify Owner and Contractor in writing that Engineer is unable to provide a decision or interpretation. If Owner and Contractor are unable to agree on resolution of such a matter in question, either party may pursue resolution as provided in Article 12.

3.05 *Reuse of Documents*

A. Contractor and its Subcontractors and Suppliers shall not:

1. have or acquire any title to or ownership rights in any of the Drawings, Specifications, or other documents (or copies of any thereof) prepared by or bearing the seal of Engineer or its consultants, including electronic media versions, or reuse any such Drawings, Specifications, other documents, or copies thereof on extensions of the Project or any other project without written consent of Owner and Engineer and specific written verification or adaptation by Engineer; or

2. have or acquire any title or ownership rights in any other Contract Documents, reuse any such Contract Documents for any purpose without Owner's express written consent, or violate any copyrights pertaining to such Contract Documents.

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

ARTICLE 4—COMMENCEMENT AND PROGRESS OF THE WORK

4.01 *Commencement of Contract Times; Notice to Proceed*

A. The Contract Times will commence to run on the 30th day after the Effective Date of the Contract or, if a Notice to Proceed is given, on the day indicated in the Notice to Proceed. A Notice to Proceed may be given at any time within 30 days after the Effective Date of the Contract. In no event will the Contract Times commence to run later than the 60th day after the day of Bid opening or the 30th day after the Effective Date of the Contract, whichever date is earlier.

4.02 *Starting the Work*

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

4.03 *Reference Points*

A. Owner shall provide engineering surveys to establish reference points for construction which in Engineer's judgment are necessary to enable Contractor to proceed with the Work. Contractor shall be responsible for laying out the Work, shall protect and preserve the

Copyright© 2018 National Society of Professional Engineers, American Council of Engineering Companies, and American Society of Civil Engineers. All rights reserved.

established reference points and property monuments, and shall make no changes or relocations without the prior written approval of Owner. Contractor shall report to Engineer whenever any reference point or property monument is lost or destroyed or requires relocation because of necessary changes in grades or locations, and shall be responsible for the accurate replacement or relocation of such reference points or property monuments by professionally qualified personnel.

4.04 *Progress Schedule*

A. Contractor shall adhere to the Progress Schedule established in accordance with Paragraph 2.05 as it may be adjusted from time to time as provided below.

1. Contractor shall submit to Engineer for acceptance (to the extent indicated in Paragraph 2.05) proposed adjustments in the Progress Schedule that will not result in changing the Contract Times.

2. Proposed adjustments in the Progress Schedule that will change the Contract Times must be submitted in accordance with the requirements of Article 11.

B. Contractor shall carry on the Work and adhere to the Progress Schedule during all disputes or disagreements with Owner. No Work will be delayed or postponed pending resolution of any disputes or disagreements, or during any appeal process, except as permitted by Paragraph 16.04, or as Owner and Contractor may otherwise agree in writing.

4.05 *Delays in Contractor's Progress*

A. If Owner, Engineer, or anyone for whom Owner is responsible, delays, disrupts, or interferes with the performance or progress of the Work, then Contractor shall be entitled to an equitable adjustment in Contract Price or Contract Times.

B. Contractor shall not be entitled to an adjustment in Contract Price or Contract Times for delay, disruption, or interference caused by or within the control of Contractor. Delay, disruption, and interference attributable to and within the control of a Subcontractor or Supplier shall be deemed to be within the control of Contractor.

C. If Contractor's performance or progress is delayed, disrupted, or interfered with by unanticipated causes not the fault of and beyond the control of Owner, Contractor, and those for which they are responsible, then Contractor shall be entitled to an equitable adjustment in Contract Times. Such an adjustment will be Contractor's sole and exclusive remedy for the delays, disruption, and interference described in this paragraph. Causes of delay, disruption, or interference that may give rise to an adjustment in Contract Times under this paragraph include but are not limited to the following:

1. Severe and unavoidable natural catastrophes such as fires, floods, epidemics, and earthquakes;

2. Abnormal weather conditions;

3. Acts or failures to act of third-party utility owners or other third-party entities (other than those third-party utility owners or other third-party entities performing other work at or adjacent to the Site as arranged by or under contract with Owner, as contemplated in Article 8); and

4. Acts of war or terrorism.

Copyright© 2018 National Society of Professional Engineers, American Council of Engineering Companies, and American Society of Civil Engineers. All rights reserved.

D. Contractor's entitlement to an adjustment of Contract Times or Contract Price is limited as follows:

1. Contractor's entitlement to an adjustment of the Contract Times is conditioned on the delay, disruption, or interference adversely affecting an activity on the critical path to completion of the Work, as of the time of the delay, disruption, or interference.

2. Contractor shall not be entitled to an adjustment in Contract Price for any delay, disruption, or interference if such delay is concurrent with a delay, disruption, or interference caused by or within the control of Contractor. Such a concurrent delay by Contractor shall not preclude an adjustment of Contract Times to which Contractor is otherwise entitled.

3. Adjustments of Contract Times or Contract Price are subject to the provisions of Article 11.

E. Each Contractor request or Change Proposal seeking an increase in Contract Times or Contract Price must be supplemented by supporting data that sets forth in detail the following:

1. The circumstances that form the basis for the requested adjustment;

2. The date upon which each cause of delay, disruption, or interference began to affect the progress of the Work;

3. The date upon which each cause of delay, disruption, or interference ceased to affect the progress of the Work;

4. The number of days' increase in Contract Times claimed as a consequence of each such cause of delay, disruption, or interference; and

5. The impact on Contract Price, in accordance with the provisions of Paragraph 11.07.

Contractor shall also furnish such additional supporting documentation as Owner or Engineer may require including, where appropriate, a revised progress schedule indicating all the activities affected by the delay, disruption, or interference, and an explanation of the effect of the delay, disruption, or interference on the critical path to completion of the Work.

F. Delays, disruption, and interference to the performance or progress of the Work resulting from the existence of a differing subsurface or physical condition, an Underground Facility that was not shown or indicated by the Contract Documents, or not shown or indicated with reasonable accuracy, and those resulting from Hazardous Environmental Conditions, are governed by Article 5, together with the provisions of Paragraphs 4.05.D and 4.05.E.

G. Paragraph 8.03 addresses delays, disruption, and interference to the performance or progress of the Work resulting from the performance of certain other work at or adjacent to the Site.

ARTICLE 5—SITE; SUBSURFACE AND PHYSICAL CONDITIONS; HAZARDOUS ENVIRONMENTAL CONDITIONS

5.01 *Availability of Lands*

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

Copyright© 2018 National Society of Professional Engineers, American Council of Engineering Companies, and American Society of Civil Engineers. All rights reserved.

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

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

5.02 *Use of Site and Other Areas*

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

1. Contractor shall confine construction equipment, temporary construction facilities, the storage of materials and equipment, and the operations of workers to the Site, adjacent areas that Contractor has arranged to use through construction easements or otherwise, and other adjacent areas permitted by Laws and Regulations, and shall not unreasonably encumber the Site and such other adjacent areas with construction equipment or other materials or equipment. Contractor shall assume full responsibility for (a) damage to the Site; (b) damage to any such other adjacent areas used for Contractor's operations; (c) damage to any other adjacent land or areas, or to improvements, structures, utilities, or similar facilities located at such adjacent lands or areas; and (d) for injuries and losses sustained by the owners or occupants of any such land or areas; provided that such damage or injuries result from the performance of the Work or from other actions or conduct of the Contractor or those for which Contractor is responsible.

2. If a damage or injury claim is made by the owner or occupant of any such land or area because of the performance of the Work, or because of other actions or conduct of the Contractor or those for which Contractor is responsible, Contractor shall (a) take immediate corrective or remedial action as required by Paragraph 7.13, or otherwise; (b) promptly attempt to settle the claim as to all parties through negotiations with such owner or occupant, or otherwise resolve the claim by arbitration or other dispute resolution proceeding, or in a court of competent jurisdiction; and (c) to the fullest extent permitted by Laws and Regulations, indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them, from and against any such claim, and against all costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to any claim or action, legal or equitable, brought by any such owner or occupant against Owner, Engineer, or any other party indemnified hereunder to the extent caused directly or indirectly, in whole or in part by, or based upon, Contractor's performance of the Work, or because of other actions or conduct of the Contractor or those for which Contractor is responsible.

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

C. *Cleaning*: Prior to Substantial Completion of the Work Contractor shall clean the Site and the Work and make it ready for utilization by Owner. At the completion of the Work Contractor shall remove from the Site and adjacent areas all tools, appliances, construction equipment

Copyright© 2018 National Society of Professional Engineers, American Council of Engineering Companies, and American Society of Civil Engineers. All rights reserved.

and machinery, and surplus materials and shall restore to original condition all property not designated for alteration by the Contract Documents.

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

5.03 *Subsurface and Physical Conditions*

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

1. Those reports of explorations and tests of subsurface conditions at or adjacent to the Site that contain Technical Data;

2. Those drawings of existing physical conditions at or adjacent to the Site, including those drawings depicting existing surface or subsurface structures at or adjacent to the Site (except Underground Facilities), that contain Technical Data; and

3. Technical Data contained in such reports and drawings.

B. *Underground Facilities*: Underground Facilities are shown or indicated on the Drawings, pursuant to Paragraph 5.05, and not in the drawings referred to in Paragraph 5.03.A. Information and data regarding the presence or location of Underground Facilities are not intended to be categorized, identified, or defined as Technical Data.

C. *Reliance by Contractor on Technical Data*: Contractor may rely upon the accuracy of the Technical Data expressly identified in the Supplementary Conditions with respect to such reports and drawings, but such reports and drawings are not Contract Documents. If no such express identification has been made, then Contractor may rely upon the accuracy of the Technical Data as defined in Paragraph 1.01.A.46.b.

D. *Limitations of Other Data and Documents*: Except for such reliance on Technical Data, Contractor may not rely upon or make any claim against Owner or Engineer, or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors, with respect to:

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

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

3. the contents of other Site-related documents made available to Contractor, such as record drawings from other projects at or adjacent to the Site, or Owner's archival documents concerning the Site; or

4. any Contractor interpretation of or conclusion drawn from any Technical Data or any such other data, interpretations, opinions, or information.

Copyright© 2018 National Society of Professional Engineers, American Council of Engineering Companies, and American Society of Civil Engineers. All rights reserved.

5.04 *Differing Subsurface or Physical Conditions*

A. *Notice by Contractor*: If Contractor believes that any subsurface or physical condition that is uncovered or revealed at the Site:

1. is of such a nature as to establish that any Technical Data on which Contractor is entitled to rely as provided in Paragraph 5.03 is materially inaccurate;

2. is of such a nature as to require a change in the Drawings or Specifications;

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

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

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

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

C. *Owner's Statement to Contractor Regarding Site Condition*: After receipt of Engineer's written findings, conclusions, and recommendations, Owner shall issue a written statement to Contractor (with a copy to Engineer) regarding the subsurface or physical condition in question, addressing the resumption of Work in connection with such condition, indicating whether any change in the Drawings or Specifications will be made, and adopting or rejecting Engineer's written findings, conclusions, and recommendations, in whole or in part.

D. *Early Resumption of Work*: If at any time Engineer determines that Work in connection with the subsurface or physical condition in question may resume prior to completion of Engineer's review or Owner's issuance of its statement to Contractor, because the condition in question has been adequately documented, and analyzed on a preliminary basis, then the Engineer may at its discretion instruct Contractor to resume such Work.

E. *Possible Price and Times Adjustments*

1. Contractor shall be entitled to an equitable adjustment in Contract Price or Contract Times, to the extent that the existence of a differing subsurface or physical condition, or any related delay, disruption, or interference, causes an increase or decrease in

Copyright© 2018 National Society of Professional Engineers, American Council of Engineering Companies, and American Society of Civil Engineers. All rights reserved.

Contractor's cost of, or time required for, performance of the Work; subject, however, to the following:

a. Such condition must fall within any one or more of the categories described in Paragraph 5.04.A;

b. With respect to Work that is paid for on a unit price basis, any adjustment in Contract Price will be subject to the provisions of Paragraph 13.03; and,

c. Contractor's entitlement to an adjustment of the Contract Times is subject to the provisions of Paragraphs 4.05.D and 4.05.E.

2. Contractor shall not be entitled to any adjustment in the Contract Price or Contract Times with respect to a subsurface or physical condition if:

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

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

c. Contractor failed to give the written notice required by Paragraph 5.04.A.

3. If Owner and Contractor agree regarding Contractor's entitlement to and the amount or extent of any adjustment in the Contract Price or Contract Times, then any such adjustment will be set forth in a Change Order.

4. Contractor may submit a Change Proposal regarding its entitlement to or the amount or extent of any adjustment in the Contract Price or Contract Times, no later than 30 days after Owner's issuance of the Owner's written statement to Contractor regarding the subsurface or physical condition in question.

F. *Underground Facilities; Hazardous Environmental Conditions*: Paragraph 5.05 governs rights and responsibilities regarding the presence or location of Underground Facilities. Paragraph 5.06 governs rights and responsibilities regarding Hazardous Environmental Conditions. The provisions of Paragraphs 5.03 and 5.04 are not applicable to the presence or location of Underground Facilities, or to Hazardous Environmental Conditions.

5.05 *Underground Facilities*

A. *Contractor's Responsibilities*: Unless it is otherwise expressly provided in the Supplementary Conditions, the cost of all of the following are included in the Contract Price, and Contractor shall have full responsibility for:

1. reviewing and checking all information and data regarding existing Underground Facilities at the Site;

2. complying with applicable state and local utility damage prevention Laws and Regulations;

Copyright© 2018 National Society of Professional Engineers, American Council of Engineering Companies, and American Society of Civil Engineers. All rights reserved.

3. verifying the actual location of those Underground Facilities shown or indicated in the Contract Documents as being within the area affected by the Work, by exposing such Underground Facilities during the course of construction;

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

5. the safety and protection of all existing Underground Facilities at the Site, and repairing any damage thereto resulting from the Work.

B. *Notice by Contractor*: If Contractor believes that an Underground Facility that is uncovered or revealed at the Site was not shown or indicated on the Drawings, or was not shown or indicated on the Drawings with reasonable accuracy, then Contractor shall, promptly after becoming aware thereof and before further disturbing conditions affected thereby or performing any Work in connection therewith (except in an emergency as required by Paragraph 7.15), notify Owner and Engineer in writing regarding such Underground Facility.

C. *Engineer's Review*: Engineer will:

1. promptly review the Underground Facility and conclude whether such Underground Facility was not shown or indicated on the Drawings, or was not shown or indicated with reasonable accuracy;

2. identify and communicate with the owner of the Underground Facility; prepare recommendations to Owner (and if necessary issue any preliminary instructions to Contractor) regarding the Contractor's resumption of Work in connection with the Underground Facility in question;

3. obtain any pertinent cost or schedule information from Contractor; determine the extent, if any, to which a change is required in the Drawings or Specifications to reflect and document the consequences of the existence or location of the Underground Facility; and

4. advise Owner in writing of Engineer's findings, conclusions, and recommendations.

During such time, Contractor shall be responsible for the safety and protection of such Underground Facility.

D. *Owner's Statement to Contractor Regarding Underground Facility*: After receipt of Engineer's written findings, conclusions, and recommendations, Owner shall issue a written statement to Contractor (with a copy to Engineer) regarding the Underground Facility in question addressing the resumption of Work in connection with such Underground Facility, indicating whether any change in the Drawings or Specifications will be made, and adopting or rejecting Engineer's written findings, conclusions, and recommendations in whole or in part.

E. *Early Resumption of Work*: If at any time Engineer determines that Work in connection with the Underground Facility may resume prior to completion of Engineer's review or Owner's issuance of its statement to Contractor, because the Underground Facility in question and conditions affected by its presence have been adequately documented, and analyzed on a preliminary basis, then the Engineer may at its discretion instruct Contractor to resume such Work.

F. *Possible Price and Times Adjustments*

1. Contractor shall be entitled to an equitable adjustment in the Contract Price or Contract Times, to the extent that any existing Underground Facility at the Site that was not shown

Copyright© 2018 National Society of Professional Engineers, American Council of Engineering Companies, and American Society of Civil Engineers. All rights reserved.

or indicated on the Drawings, or was not shown or indicated with reasonable accuracy, or any related delay, disruption, or interference, causes an increase or decrease in Contractor's cost of, or time required for, performance of the Work; subject, however, to the following:

a. With respect to Work that is paid for on a unit price basis, any adjustment in Contract Price will be subject to the provisions of Paragraph 13.03;

b. Contractor's entitlement to an adjustment of the Contract Times is subject to the provisions of Paragraphs 4.05.D and 4.05.E; and

c. Contractor gave the notice required in Paragraph 5.05.B.

2. If Owner and Contractor agree regarding Contractor's entitlement to and the amount or extent of any adjustment in the Contract Price or Contract Times, then any such adjustment will be set forth in a Change Order.

3. Contractor may submit a Change Proposal regarding its entitlement to or the amount or extent of any adjustment in the Contract Price or Contract Times, no later than 30 days after Owner's issuance of the Owner's written statement to Contractor regarding the Underground Facility in question.

4. The information and data shown or indicated on the Drawings with respect to existing Underground Facilities at the Site is based on information and data (a) furnished by the owners of such Underground Facilities, or by others, (b) obtained from available records, or (c) gathered in an investigation conducted in accordance with the current edition of ASCE 38, Standard Guideline for the Collection and Depiction of Existing Subsurface Utility Data, by the American Society of Civil Engineers. If such information or data is incorrect or incomplete, Contractor's remedies are limited to those set forth in this Paragraph 5.05.F.

5.06 *Hazardous Environmental Conditions at Site*

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

1. those reports known to Owner relating to Hazardous Environmental Conditions that have been identified at or adjacent to the Site;

2. drawings known to Owner relating to Hazardous Environmental Conditions that have been identified at or adjacent to the Site; and

3. Technical Data contained in such reports and drawings.

B. *Reliance by Contractor on Technical Data Authorized*: Contractor may rely upon the accuracy of the Technical Data expressly identified in the Supplementary Conditions with respect to such reports and drawings, but such reports and drawings are not Contract Documents. If no such express identification has been made, then Contractor may rely on the accuracy of the Technical Data as defined in Paragraph 1.01.A.46.b. Except for such reliance on Technical Data, Contractor may not rely upon or make any claim against Owner or Engineer, or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors, with respect to:

1. the completeness of such reports and drawings for Contractor's purposes, including, but not limited to, any aspects of the means, methods, techniques, sequences and procedures

Copyright© 2018 National Society of Professional Engineers, American Council of Engineering Companies, and American Society of Civil Engineers. All rights reserved.

of construction to be employed by Contractor, and safety precautions and programs incident thereto;

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

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

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

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

E. If Contractor encounters, uncovers, or reveals a Hazardous Environmental Condition whose removal or remediation is not expressly identified in the Contract Documents as being within the scope of the Work, or if Contractor or anyone for whom Contractor is responsible creates a Hazardous Environmental Condition, then Contractor shall immediately: (1) secure or otherwise isolate such condition; (2) stop all Work in connection with such condition and in any area affected thereby (except in an emergency as required by Paragraph 7.15); and (3) notify Owner and Engineer (and promptly thereafter confirm such notice in writing). Owner shall promptly consult with Engineer concerning the necessity for Owner to retain a qualified expert to evaluate such condition or take corrective action, if any. Promptly after consulting with Engineer, Owner shall take such actions as are necessary to permit Owner to timely obtain required permits and provide Contractor the written notice required by Paragraph 5.06.F. If Contractor or anyone for whom Contractor is responsible created the Hazardous Environmental Condition in question, then Owner may remove and remediate the Hazardous Environmental Condition, and impose a set-off against payments to account for the associated costs.

F. Contractor shall not resume Work in connection with such Hazardous Environmental Condition or in any affected area until after Owner has obtained any required permits related thereto, and delivered written notice to Contractor either (1) specifying that such condition and any affected area is or has been rendered safe for the resumption of Work, or (2) specifying any special conditions under which such Work may be resumed safely.

G. If Owner and Contractor cannot agree as to entitlement to or on the amount or extent, if any, of any adjustment in Contract Price or Contract Times, as a result of such Work stoppage, such special conditions under which Work is agreed to be resumed by Contractor, or any costs or expenses incurred in response to the Hazardous Environmental Condition, then within 30 days of Owner's written notice regarding the resumption of Work, Contractor may submit a Change Proposal, or Owner may impose a set-off. Entitlement to any such adjustment is subject to the provisions of Paragraphs 4.05.D, 4.05.E, 11.07, and 11.08.

H. If, after receipt of such written notice, Contractor does not agree to resume such Work based on a reasonable belief it is unsafe, or does not agree to resume such Work under such special

Copyright© 2018 National Society of Professional Engineers, American Council of Engineering Companies, and American Society of Civil Engineers. All rights reserved.

conditions, then Owner may order the portion of the Work that is in the area affected by such condition to be deleted from the Work, following the contractual change procedures in Article 11. Owner may have such deleted portion of the Work performed by Owner's own forces or others in accordance with Article 8.

I. To the fullest extent permitted by Laws and Regulations, Owner shall indemnify and hold harmless Contractor, Subcontractors, and Engineer, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals, and all court, arbitration, or other dispute resolution costs) arising out of or relating to a Hazardous Environmental Condition, provided that such Hazardous Environmental Condition (1) was not shown or indicated in the Drawings, Specifications, or other Contract Documents, identified as Technical Data entitled to limited reliance pursuant to Paragraph 5.06.B, or identified in the Contract Documents to be included within the scope of the Work, and (2) was not created by Contractor or by anyone for whom Contractor is responsible. Nothing in this Paragraph 5.06.I obligates Owner to indemnify any individual or entity from and against the consequences of that individual's or entity's own negligence.

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

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

ARTICLE 6—BONDS AND INSURANCE

6.01 *Performance, Payment, and Other Bonds*

A. Contractor shall furnish a performance bond and a payment bond, each in an amount at least equal to the Contract Price, as security for the faithful performance and payment of Contractor's obligations under the Contract. These bonds must remain in effect until one year after the date when final payment becomes due or until completion of the correction period specified in Paragraph 15.08, whichever is later, except as provided otherwise by Laws or Regulations, the terms of a prescribed bond form, the Supplementary Conditions, or other provisions of the Contract.

B. Contractor shall also furnish such other bonds (if any) as are required by the Supplementary Conditions or other provisions of the Contract.

C. All bonds must be in the form included in the Bidding Documents or otherwise specified by Owner prior to execution of the Contract, except as provided otherwise by Laws or

Copyright© 2018 National Society of Professional Engineers, American Council of Engineering Companies, and American Society of Civil Engineers. All rights reserved.

Regulations, and must be issued and signed by a surety named in "Companies Holding Certificates of Authority as Acceptable Sureties on Federal Bonds and as Acceptable Reinsuring Companies" as published in Department Circular 570 (as amended and supplemented) by the Bureau of the Fiscal Service, U.S. Department of the Treasury. A bond signed by an agent or attorney-in-fact must be accompanied by a certified copy of that individual's authority to bind the surety. The evidence of authority must show that it is effective on the date the agent or attorney-in-fact signed the accompanying bond.

D. Contractor shall obtain the required bonds from surety companies that are duly licensed or authorized, in the state or jurisdiction in which the Project is located, to issue bonds in the required amounts.

E. If the surety on a bond furnished by Contractor is declared bankrupt or becomes insolvent, or the surety ceases to meet the requirements above, then Contractor shall promptly notify Owner and Engineer in writing and shall, within 20 days after the event giving rise to such notification, provide another bond and surety, both of which must comply with the bond and surety requirements above.

F. If Contractor has failed to obtain a required bond, Owner may exclude the Contractor from the Site and exercise Owner's termination rights under Article 16.

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

H. Upon request to Contractor from any Subcontractor, Supplier, or other person or entity claiming to have furnished labor, services, materials, or equipment used in the performance of the Work, Contractor shall provide a copy of the payment bond to such person or entity.

6.02 *Insurance—General Provisions*

A. Owner and Contractor shall obtain and maintain insurance as required in this article and in the Supplementary Conditions.

B. All insurance required by the Contract to be purchased and maintained by Owner or Contractor shall be obtained from insurance companies that are duly licensed or authorized in the state or jurisdiction in which the Project is located to issue insurance policies for the required limits and coverages. Unless a different standard is indicated in the Supplementary Conditions, all companies that provide insurance policies required under this Contract shall have an A.M. Best rating of A-VII or better.

C. Alternative forms of insurance coverage, including but not limited to self-insurance and "Occupational Accident and Excess Employer's Indemnity Policies," are not sufficient to meet the insurance requirements of this Contract, unless expressly allowed in the Supplementary Conditions.

D. Contractor shall deliver to Owner, with copies to each additional insured identified in the Contract, certificates of insurance and endorsements establishing that Contractor has obtained and is maintaining the policies and coverages required by the Contract. Upon request by Owner or any other insured, Contractor shall also furnish other evidence of such required insurance, including but not limited to copies of policies, documentation of applicable self-insured retentions (if allowed) and deductibles, full disclosure of all relevant exclusions, and evidence of insurance required to be purchased and maintained by

Copyright© 2018 National Society of Professional Engineers, American Council of Engineering Companies, and American Society of Civil Engineers. All rights reserved.

Subcontractors or Suppliers. In any documentation furnished under this provision, Contractor, Subcontractors, and Suppliers may block out (redact) (1) any confidential premium or pricing information and (2) any wording specific to a project or jurisdiction other than those applicable to this Contract.

E. Owner shall deliver to Contractor, with copies to each additional insured identified in the Contract, certificates of insurance and endorsements establishing that Owner has obtained and is maintaining the policies and coverages required of Owner by the Contract (if any). Upon request by Contractor or any other insured, Owner shall also provide other evidence of such required insurance (if any), including but not limited to copies of policies, documentation of applicable self-insured retentions (if allowed) and deductibles, and full disclosure of all relevant exclusions. In any documentation furnished under this provision, Owner may block out (redact) (1) any confidential premium or pricing information and (2) any wording specific to a project or jurisdiction other than those relevant to this Contract.

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

G. In addition to the liability insurance required to be provided by Contractor, the Owner, at Owner's option, may purchase and maintain Owner's own liability insurance. Owner's liability policies, if any, operate separately and independently from policies required to be provided by Contractor, and Contractor cannot rely upon Owner's liability policies for any of Contractor's obligations to the Owner, Engineer, or third parties.

H. Contractor shall require:

1. Subcontractors to purchase and maintain worker's compensation, commercial general liability, and other insurance that is appropriate for their participation in the Project, and to name as additional insureds Owner and Engineer (and any other individuals or entities identified in the Supplementary Conditions as additional insureds on Contractor's liability policies) on each Subcontractor's commercial general liability insurance policy; and

2. Suppliers to purchase and maintain insurance that is appropriate for their participation in the Project.

I. If either party does not purchase or maintain the insurance required of such party by the Contract, such party shall notify the other party in writing of such failure to purchase prior to the start of the Work, or of such failure to maintain prior to any change in the required coverage.

J. If Contractor has failed to obtain and maintain required insurance, Contractor's entitlement to enter or remain at the Site will end immediately, and Owner may impose an appropriate set-off against payment for any associated costs (including but not limited to the cost of purchasing necessary insurance coverage), and exercise Owner's termination rights under Article 16.

K. Without prejudice to any other right or remedy, if a party has failed to obtain required insurance, the other party may elect (but is in no way obligated) to obtain equivalent insurance to protect such other party's interests at the expense of the party who was required to provide such coverage, and the Contract Price will be adjusted accordingly.

Copyright© 2018 National Society of Professional Engineers, American Council of Engineering Companies, and American Society of Civil Engineers. All rights reserved.

L. Owner does not represent that insurance coverage and limits established in this Contract necessarily will be adequate to protect Contractor or Contractor's interests. Contractor is responsible for determining whether such coverage and limits are adequate to protect its interests, and for obtaining and maintaining any additional insurance that Contractor deems necessary.

M. The insurance and insurance limits required herein will not be deemed as a limitation on Contractor's liability, or that of its Subcontractors or Suppliers, under the indemnities granted to Owner and other individuals and entities in the Contract or otherwise.

N. All the policies of insurance required to be purchased and maintained under this Contract will contain a provision or endorsement that the coverage afforded will not be canceled, or renewal refused, until at least 10 days prior written notice has been given to the purchasing policyholder. Within three days of receipt of any such written notice, the purchasing policyholder shall provide a copy of the notice to each other insured and Engineer.

6.03 *Contractor's Insurance*

A. *Required Insurance*: Contractor shall purchase and maintain Worker's Compensation, Commercial General Liability, and other insurance pursuant to the specific requirements of the Supplementary Conditions.

B. *General Provisions*: The policies of insurance required by this Paragraph 6.03 as supplemented must:

1. include at least the specific coverages required;

2. be written for not less than the limits provided, or those required by Laws or Regulations, whichever is greater;

3. remain in effect at least until the Work is complete (as set forth in Paragraph 15.06.D), and longer if expressly required elsewhere in this Contract, and at all times thereafter when Contractor may be correcting, removing, or replacing defective Work as a warranty or correction obligation, or otherwise, or returning to the Site to conduct other tasks arising from the Contract;

4. apply with respect to the performance of the Work, whether such performance is 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; and

5. include all necessary endorsements to support the stated requirements.

C. *Additional Insureds*: The Contractor's commercial general liability, automobile liability, employer's liability, umbrella or excess, pollution liability, and unmanned aerial vehicle liability policies, if required by this Contract, must:

1. include and list as additional insureds Owner and Engineer, and any individuals or entities identified as additional insureds in the Supplementary Conditions;

2. include coverage for the respective officers, directors, members, partners, employees, and consultants of all such additional insureds;

3. afford primary coverage to these additional insureds for all claims covered thereby (including as applicable those arising from both ongoing and completed operations);

Copyright© 2018 National Society of Professional Engineers, American Council of Engineering Companies, and American Society of Civil Engineers. All rights reserved.

4. not seek contribution from insurance maintained by the additional insured; and

5. as to commercial general liability insurance, apply to additional insureds with respect to liability caused in whole or in part by Contractor's acts or omissions, or the acts and omissions of those working on Contractor's behalf, in the performance of Contractor's operations.

6.04 *Builder's Risk and Other Property Insurance*

A. *Builder's Risk*: Unless otherwise provided in the Supplementary Conditions, Contractor shall purchase and maintain builder's risk insurance upon the Work on a completed value basis, in the amount of the Work's full insurable replacement cost (subject to such deductible amounts as may be provided in the Supplementary Conditions or required by Laws and Regulations). The specific requirements applicable to the builder's risk insurance are set forth in the Supplementary Conditions.

B. *Property Insurance for Facilities of Owner Where Work Will Occur*: Owner is responsible for obtaining and maintaining property insurance covering each existing structure, building, or facility in which any part of the Work will occur, or to which any part of the Work will attach or be adjoined. Such property insurance will be written on a special perils (all-risk) form, on a replacement cost basis, providing coverage consistent with that required for the builder's risk insurance, and will be maintained until the Work is complete, as set forth in Paragraph 15.06.D.

C. *Property Insurance for Substantially Complete Facilities*: Promptly after Substantial Completion, and before actual occupancy or use of the substantially completed Work, Owner will obtain property insurance for such substantially completed Work, and maintain such property insurance at least until the Work is complete, as set forth in Paragraph 15.06.D. Such property insurance will be written on a special perils (all-risk) form, on a replacement cost basis, and provide coverage consistent with that required for the builder's risk insurance. The builder's risk insurance may terminate upon written confirmation of Owner's procurement of such property insurance.

D. *Partial Occupancy or Use by Owner*: If Owner will occupy or use a portion or portions of the Work prior to Substantial Completion of all the Work, as provided in Paragraph 15.04, then Owner (directly, if it is the purchaser of the builder's risk policy, or through Contractor) will provide advance notice of such occupancy or use to the builder's risk insurer, and obtain an endorsement consenting to the continuation of coverage prior to commencing such partial occupancy or use.

E. *Insurance of Other Property; Additional Insurance*: If the express insurance provisions of the Contract do not require or address the insurance of a property item or interest, then the entity or individual owning such property item will be responsible for insuring it. If Contractor elects to obtain other special insurance to be included in or supplement the builder's risk or property insurance policies provided under this Paragraph 6.04, it may do so at Contractor's expense.

6.05 *Property Losses; Subrogation*

A. The builder's risk insurance policy purchased and maintained in accordance with Paragraph 6.04 (or an installation floater policy if authorized by the Supplementary Conditions), will contain provisions to the effect that in the event of payment of any loss or damage the insurer will have no rights of recovery against any insureds thereunder, or against

Copyright© 2018 National Society of Professional Engineers, American Council of Engineering Companies, and American Society of Civil Engineers. All rights reserved.

Engineer or its consultants, or their officers, directors, members, partners, employees, agents, consultants, or subcontractors.

1. Owner and Contractor waive all rights against each other and the respective officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, for all losses and damages caused by, arising out of, or resulting from any of the perils, risks, or causes of loss covered by such policies and any other property insurance applicable to the Work; and, in addition, waive all such rights against Engineer, its consultants, all individuals or entities identified in the Supplementary Conditions as builder's risk or installation floater insureds, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, under such policies for losses and damages so caused.

2. None of the above waivers extends to the rights that any party making such waiver may have to the proceeds of insurance held by Owner or Contractor as trustee or fiduciary, or otherwise payable under any policy so issued.

B. Any property insurance policy maintained by Owner covering any loss, damage, or consequential loss to Owner's existing structures, buildings, or facilities in which any part of the Work will occur, or to which any part of the Work will attach or adjoin; to adjacent structures, buildings, or facilities of Owner; or to part or all of the completed or substantially completed Work, during partial occupancy or use pursuant to Paragraph 15.04, after Substantial Completion pursuant to Paragraph 15.03, or after final payment pursuant to Paragraph 15.06, will contain provisions to the effect that in the event of payment of any loss or damage the insurer will have no rights of recovery against any insureds thereunder, or against Contractor, Subcontractors, or Engineer, or the officers, directors, members, partners, employees, agents, consultants, or subcontractors of each and any of them, and that the insured is allowed to waive the insurer's rights of subrogation in a written contract executed prior to the loss, damage, or consequential loss.

1. 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 all losses and damages caused by, arising out of, or resulting from fire or any of the perils, risks, or causes of loss covered by such policies.

C. The waivers in this Paragraph 6.05 include the waiver of rights 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 insured peril, risk, or cause of loss.

D. Contractor shall be responsible for assuring that each Subcontract contains provisions whereby the Subcontractor waives all rights against Owner, Contractor, all individuals or entities identified in the Supplementary Conditions as insureds, the Engineer and its consultants, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, for all losses and damages caused by, arising out of, relating to, or resulting from fire or other peril, risk, or cause of loss covered by builder's risk insurance, installation floater, and any other property insurance applicable to the Work.

Copyright© 2018 National Society of Professional Engineers, American Council of Engineering Companies, and American Society of Civil Engineers. All rights reserved.

6.06 *Receipt and Application of Property Insurance Proceeds*

A. Any insured loss under the builder's risk and other policies of property insurance required by Paragraph 6.04 will be adjusted and settled with the named insured that purchased the policy. Such named insured shall act as fiduciary for the other insureds, and give notice to such other insureds that adjustment and settlement of a claim is in progress. Any other insured may state its position regarding a claim for insured loss in writing within 15 days after notice of such claim.

B. Proceeds for such insured losses may be made payable by the insurer either jointly to multiple insureds, or to the named insured that purchased the policy in its own right and as fiduciary for other insureds, subject to the requirements of any applicable mortgage clause. A named insured receiving insurance proceeds under the builder's risk and other policies of insurance required by Paragraph 6.04 shall maintain such proceeds in a segregated account, and distribute such proceeds in accordance with such agreement as the parties in interest may reach, or as otherwise required under the dispute resolution provisions of this Contract or applicable Laws and Regulations.

C. If no other special agreement is reached, Contractor shall repair or replace the damaged Work, using allocated insurance proceeds.

ARTICLE 7—CONTRACTOR'S RESPONSIBILITIES

7.01 *Contractor's Means and Methods of Construction*

A. Contractor shall be solely responsible for the means, methods, techniques, sequences, and procedures of construction.

B. If the Contract Documents note, or Contractor determines, that professional engineering or other design services are needed to carry out Contractor's responsibilities for construction means, methods, techniques, sequences, and procedures, or for Site safety, then Contractor shall cause such services to be provided by a properly licensed design professional, at Contractor's expense. Such services are not Owner-delegated professional design services under this Contract, and neither Owner nor Engineer has any responsibility with respect to (1) Contractor's determination of the need for such services, (2) the qualifications or licensing of the design professionals retained or employed by Contractor, (3) the performance of such services, or (4) any errors, omissions, or defects in such services.

7.02 *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.

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

7.03 *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 maintain good discipline and order at the Site.

Copyright© 2018 National Society of Professional Engineers, American Council of Engineering Companies, and American Society of Civil Engineers. All rights reserved.

B. Contractor shall be fully responsible to Owner and Engineer for all acts and omissions of Contractor's employees; of Suppliers and Subcontractors, and their employees; and of any other individuals or entities performing or furnishing any of the Work, just as Contractor is responsible for Contractor's own acts and omissions.

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

7.04 *Services, Materials, and Equipment*

A. Unless otherwise specified in the Contract Documents, Contractor shall provide and assume full responsibility for all services, materials, equipment, labor, transportation, construction equipment and machinery, tools, appliances, fuel, power, light, heat, telephone, water, sanitary facilities, temporary facilities, and all other facilities and incidentals necessary for the performance, testing, start up, and completion of the Work, whether or not such items are specifically called for in the Contract Documents.

B. All materials and equipment incorporated into the Work must be new and of good quality, except as otherwise provided in the Contract Documents. All special warranties and guarantees required by the Specifications will 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 must be stored, applied, installed, connected, erected, protected, used, cleaned, and conditioned in accordance with instructions of the applicable Supplier, except as otherwise may be provided in the Contract Documents.

7.05 *"Or Equals"*

A. *Contractor's Request; Governing Criteria*: Whenever an item of equipment or material is specified or described in the Contract Documents by using the names of one or more proprietary items or specific Suppliers, the Contract Price has been based upon Contractor furnishing such item as specified. The specification or description of such an item is intended to establish the type, function, appearance, and quality required. Unless the specification or description contains or is followed by words reading that no like, equivalent, or "or equal" item is permitted, Contractor may request that Engineer authorize the use of other items of equipment or material, or items from other proposed Suppliers, under the circumstances described below.

1. If Engineer in its sole discretion determines that an item of equipment or material proposed by Contractor is functionally equal to that named and sufficiently similar so that no change in related Work will be required, Engineer will deem it an "or equal" item. For the purposes of this paragraph, a proposed item of equipment or material will be considered functionally equal to an item so named if:

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

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

Copyright© 2018 National Society of Professional Engineers, American Council of Engineering Companies, and American Society of Civil Engineers. All rights reserved.

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

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

4) is not objectionable to Owner.

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

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

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

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

C. *Engineer's Evaluation and Determination*: Engineer will be allowed a reasonable time to evaluate each "or-equal" request. Engineer may require Contractor to furnish additional data about the proposed "or-equal" item. Engineer will be the sole judge of acceptability. No "or-equal" item will be ordered, furnished, installed, or utilized until Engineer's review is complete and Engineer determines that the proposed item is an "or-equal," which will be evidenced by an approved Shop Drawing or other written communication. Engineer will advise Contractor in writing of any negative determination.

D. *Effect of Engineer's Determination*: Neither approval nor denial of an "or-equal" request will result in any change in Contract Price. The Engineer's denial of an "or-equal" request will be final and binding, and may not be reversed through an appeal under any provision of the Contract.

E. *Treatment as a Substitution Request*: If Engineer determines that an item of equipment or material proposed by Contractor does not qualify as an "or-equal" item, Contractor may request that Engineer consider the item a proposed substitute pursuant to Paragraph 7.06.

7.06 *Substitutes*

A. *Contractor's Request; Governing Criteria*: Unless the specification or description of an item of equipment or material required to be furnished under the Contract Documents contains or is followed by words reading that no substitution is permitted, Contractor may request that Engineer authorize the use of other items of equipment or material under the circumstances described below. To the extent possible such requests must be made before commencement of related construction at the Site.

1. Contractor shall submit sufficient information as provided below to allow Engineer to determine if the item of material or equipment proposed is functionally equivalent to that named and an acceptable substitute therefor. Engineer will not accept requests for review of proposed substitute items of equipment or material from anyone other than Contractor.

2. The requirements for review by Engineer will be as set forth in Paragraph 7.06.B, as supplemented by the Specifications, and as Engineer may decide is appropriate under the circumstances.

Copyright© 2018 National Society of Professional Engineers, American Council of Engineering Companies, and American Society of Civil Engineers. All rights reserved.

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

    a. will certify that the proposed substitute item will:

        1) perform adequately the functions and achieve the results called for by the general design;

        2) be similar in substance to the item specified; and

        3) be suited to the same use as the item specified.

    b. will state:

        1) the extent, if any, to which the use of the proposed substitute item will necessitate a change in Contract Times;

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

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

    c. will identify:

        1) all variations of the proposed substitute item from the item specified; and

        2) available engineering, sales, maintenance, repair, and replacement services.

    d. will contain an itemized estimate of all costs or credits that will result directly or indirectly from use of such substitute item, including but not limited to changes in Contract Price, shared savings, costs of redesign, and claims of other contractors affected by any resulting change.

B. *Engineer's Evaluation and Determination*: Engineer will be allowed a reasonable time to evaluate each substitute request, and to obtain comments and direction from Owner. Engineer may require Contractor to furnish additional data about the proposed substitute item. Engineer will be the sole judge of acceptability. No substitute will be ordered, furnished, installed, or utilized until Engineer's review is complete and Engineer determines that the proposed item is an acceptable substitute. Engineer's determination will be evidenced by a Field Order or a proposed Change Order accounting for the substitution itself and all related impacts, including changes in Contract Price or Contract Times. Engineer will advise Contractor in writing of any negative determination.

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

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

Copyright© 2018 National Society of Professional Engineers, American Council of Engineering Companies, and American Society of Civil Engineers. All rights reserved.

E. *Contractor's Expense*: Contractor shall provide all data in support of any proposed substitute at Contractor's expense.

F. *Effect of Engineer's Determination*: If Engineer approves the substitution request, Contractor shall execute the proposed Change Order and proceed with the substitution. The Engineer's denial of a substitution request will be final and binding, and may not be reversed through an appeal under any provision of the Contract. Contractor may challenge the scope of reimbursement costs imposed under Paragraph 7.06.D, by timely submittal of a Change Proposal.

7.07 *Concerning Subcontractors and Suppliers*

A. Contractor may retain Subcontractors and Suppliers for the performance of parts of the Work. Such Subcontractors and Suppliers must be acceptable to Owner. The Contractor's retention of a Subcontractor or Supplier for the performance of parts of the Work will not relieve Contractor's obligation to Owner to perform and complete the Work in accordance with the Contract Documents.

B. Contractor shall retain specific Subcontractors and Suppliers for the performance of designated parts of the Work if required by the Contract to do so.

C. Subsequent to the submittal of Contractor's Bid or final negotiation of the terms of the Contract, Owner may not require Contractor to retain any Subcontractor or Supplier to furnish or perform any of the Work against which Contractor has reasonable objection.

D. Prior to entry into any binding subcontract or purchase order, Contractor shall submit to Owner the identity of the proposed Subcontractor or Supplier (unless Owner has already deemed such proposed Subcontractor or Supplier acceptable during the bidding process or otherwise). Such proposed Subcontractor or Supplier shall be deemed acceptable to Owner unless Owner raises a substantive, reasonable objection within 5 days.

E. Owner may require the replacement of any Subcontractor or Supplier. Owner also may require Contractor to retain specific replacements; provided, however, that Owner may not require a replacement to which Contractor has a reasonable objection. If Contractor has submitted the identity of certain Subcontractors or Suppliers for acceptance by Owner, and Owner has accepted it (either in writing or by failing to make written objection thereto), then Owner may subsequently revoke the acceptance of any such Subcontractor or Supplier so identified solely on the basis of substantive, reasonable objection after due investigation. Contractor shall submit an acceptable replacement for the rejected Subcontractor or Supplier.

F. If Owner requires the replacement of any Subcontractor or Supplier retained by Contractor to perform any part of the Work, then Contractor shall be entitled to an adjustment in Contract Price or Contract Times, with respect to the replacement; and Contractor shall initiate a Change Proposal for such adjustment within 30 days of Owner's requirement of replacement.

G. No acceptance by Owner of any such Subcontractor or Supplier, whether initially or as a replacement, will constitute a waiver of the right of Owner to the completion of the Work in accordance with the Contract Documents.

Copyright© 2018 National Society of Professional Engineers, American Council of Engineering Companies, and American Society of Civil Engineers. All rights reserved.

H. On a monthly basis, Contractor shall submit to Engineer a complete list of all Subcontractors and Suppliers having a direct contract with Contractor, and of all other Subcontractors and Suppliers known to Contractor at the time of submittal.

I. Contractor shall be solely responsible for scheduling and coordinating the work of Subcontractors and Suppliers.

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

K. All Work performed for Contractor by a Subcontractor or Supplier must be pursuant to an appropriate contractual agreement that specifically binds the Subcontractor or Supplier to the applicable terms and conditions of the Contract for the benefit of Owner and Engineer.

L. Owner may furnish to any Subcontractor or Supplier, to the extent practicable, information about amounts paid to Contractor for Work performed for Contractor by the Subcontractor or Supplier.

M. Contractor shall restrict all Subcontractors and Suppliers from communicating with Engineer or Owner, except through Contractor or in case of an emergency, or as otherwise expressly allowed in this Contract.

7.08 *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 an invention, design, process, product, or device is specified in the Contract Documents for use in the performance of the Work and if, to the actual knowledge of Owner or Engineer, its use is subject to patent rights or copyrights calling for the payment of any license fee or royalty to others, the existence of such rights will be disclosed 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.

Copyright© 2018 National Society of Professional Engineers, American Council of Engineering Companies, and American Society of Civil Engineers. All rights reserved.

7.09 *Permits*

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

7.10 *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.

7.11 *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. Neither Owner nor Engineer shall be responsible for monitoring Contractor's compliance with any Laws or Regulations.

B. If Contractor performs any Work or takes any other action knowing or having reason to know that it is contrary to Laws or Regulations, Contractor shall bear all resulting costs and losses, and shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such Work or other action. It is not Contractor's responsibility to make certain that the Work described in the Contract Documents is in accordance with Laws and Regulations, but this does not relieve Contractor of its obligations under Paragraph 3.03.

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

7.12 *Record Documents*

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

Copyright© 2018 National Society of Professional Engineers, American Council of Engineering Companies, and American Society of Civil Engineers. All rights reserved.

7.13 *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.

B. Contractor shall designate a qualified and experienced safety representative whose duties and responsibilities are the prevention of Work-related accidents and the maintenance and supervision of safety precautions and programs.

C. Contractor shall take all necessary precautions for the safety of, and shall provide the necessary protection to prevent damage, injury, or loss to:

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

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

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

D. All damage, injury, or loss to any property referred to in Paragraph 7.13.C.2 or 7.13.C.3 caused, directly or indirectly, in whole or in part, by Contractor, any Subcontractor, Supplier, or any other individual or entity directly or indirectly employed by any of them to perform any of the Work, or anyone for whose acts any of them may be liable, shall be remedied by Contractor at its expense (except damage or loss attributable to the fault of Drawings or Specifications or to the acts or omissions of Owner or Engineer or anyone employed by any of them, or anyone for whose acts any of them may be liable, and not attributable, directly or indirectly, in whole or in part, to the fault or negligence of Contractor or any Subcontractor, Supplier, or other individual or entity directly or indirectly employed by any of them).

E. 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.

F. Contractor shall notify Owner; the owners of adjacent property; the owners of Underground Facilities and other utilities (if the identity of such owners is known to Contractor); and other contractors and utility owners performing work at or adjacent to the Site, in writing, when Contractor knows that prosecution of the Work may affect them, and shall cooperate with them in the protection, removal, relocation, and replacement of their property or work in progress.

G. Contractor shall comply with the applicable requirements of Owner's safety programs, if any. Any Owner's safety programs that are applicable to the Work are identified or included in the Supplementary Conditions or Specifications.

H. 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.

Copyright© 2018 National Society of Professional Engineers, American Council of Engineering Companies, and American Society of Civil Engineers. All rights reserved.

I. Contractor's duties and responsibilities for safety and protection will continue until all the Work is completed, Engineer has issued a written notice to Owner and Contractor in accordance with Paragraph 15.06.C that the Work is acceptable, and Contractor has left the Site (except as otherwise expressly provided in connection with Substantial Completion).

J. Contractor's duties and responsibilities for safety and protection will resume whenever Contractor or any Subcontractor or Supplier returns to the Site to fulfill warranty or correction obligations, or to conduct other tasks arising from the Contract Documents.

7.14 *Hazard Communication Programs*

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

7.15 *Emergencies*

A. In emergencies affecting the safety or protection of persons or the Work or property at the Site or adjacent thereto, Contractor is obligated to act to prevent 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 by an emergency, or are required as a result of Contractor's response to an emergency. If Engineer determines that a change in the Contract Documents is required because of an emergency or Contractor's response, a Work Change Directive or Change Order will be issued.

7.16 *Submittals*

A. *Shop Drawing and Sample Requirements*

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

a. review and coordinate the Shop Drawing or Sample with other Shop Drawings and Samples and with the requirements of the Work and the Contract Documents;

b. determine and verify:

1) all field measurements, quantities, dimensions, specified performance and design criteria, installation requirements, materials, catalog numbers, and similar information with respect to the Submittal;

2) the suitability of all materials and equipment offered with respect to the indicated application, fabrication, shipping, handling, storage, assembly, and installation pertaining to the performance of the Work; and

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

c. confirm that the Submittal is complete with respect to all related data included in the Submittal.

2. Each Shop Drawing or Sample must bear a stamp or specific written certification that Contractor has satisfied Contractor's obligations under the Contract Documents with respect to Contractor's review of that Submittal, and that Contractor approves the Submittal.

Copyright© 2018 National Society of Professional Engineers, American Council of Engineering Companies, and American Society of Civil Engineers. All rights reserved.

3. With each Shop Drawing or Sample, Contractor shall give Engineer specific written notice of any variations that the Submittal may have from the requirements of the Contract Documents. This notice must be set forth in a written communication separate from the Submittal; and, in addition, in the case of a Shop Drawing by a specific notation made on the Shop Drawing itself.

B. *Submittal Procedures for Shop Drawings and Samples*: Contractor shall label and submit Shop Drawings and Samples to Engineer for review and approval in accordance with the accepted Schedule of Submittals.

1. *Shop Drawings*

a. Contractor shall submit the number of copies required in the Specifications.

b. Data shown on the Shop Drawings must be complete with respect to quantities, dimensions, specified performance and design criteria, materials, and similar data to show Engineer the services, materials, and equipment Contractor proposes to provide, and to enable Engineer to review the information for the limited purposes required by Paragraph 7.16.C.

2. *Samples*

a. Contractor shall submit the number of Samples required in the Specifications.

b. Contractor shall clearly identify each Sample as to material, Supplier, pertinent data such as catalog numbers, the use for which intended and other data as Engineer may require to enable Engineer to review the Submittal for the limited purposes required by Paragraph 7.16.C.

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

C. *Engineer's Review of Shop Drawings and Samples*

1. Engineer will provide timely review of Shop Drawings and Samples in accordance with the accepted Schedule of Submittals. 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, comply with the requirements of the Contract Documents, and be compatible with the design concept of the completed Project as a functioning whole as indicated by the Contract Documents.

2. Engineer's review and approval will not extend to means, methods, techniques, sequences, or procedures of construction, or to safety precautions or programs incident thereto.

3. Engineer's review and approval of a separate item as such will not indicate approval of the assembly in which the item functions.

4. Engineer's review and approval of a Shop Drawing or Sample will not relieve Contractor from responsibility for any variation from the requirements of the Contract Documents unless Contractor has complied with the requirements of Paragraph 7.16.A.3 and Engineer has given written approval of each such variation by specific written notation thereof incorporated in or accompanying the Shop Drawing or Sample. Engineer will

Copyright© 2018 National Society of Professional Engineers, American Council of Engineering Companies, and American Society of Civil Engineers. All rights reserved.

document any such approved variation from the requirements of the Contract Documents in a Field Order or other appropriate Contract modification.

5. Engineer's review and approval of a Shop Drawing or Sample will not relieve Contractor from responsibility for complying with the requirements of Paragraphs 7.16.A and B.

6. Engineer's review and approval of a Shop Drawing or Sample, or of a variation from the requirements of the Contract Documents, will not, under any circumstances, change the Contract Times or Contract Price, unless such changes are included in a Change Order.

7. Neither Engineer's receipt, review, acceptance, or approval of a Shop Drawing or Sample will result in such item becoming a Contract Document.

8. Contractor shall perform the Work in compliance with the requirements and commitments set forth in approved Shop Drawings and Samples, subject to the provisions of Paragraph 7.16.C.4.

D. *Resubmittal Procedures for Shop Drawings and Samples*

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

2. Contractor shall furnish required Shop Drawing and Sample submittals with sufficient information and accuracy to obtain required approval of an item with no more than two resubmittals. Engineer will record Engineer's time for reviewing a third or subsequent resubmittal of a Shop Drawing or Sample, and Contractor shall be responsible for Engineer's charges to Owner for such time. Owner may impose a set-off against payments due Contractor to secure reimbursement for such charges.

3. If Contractor requests a change of a previously approved Shop Drawing or Sample, Contractor shall be responsible for Engineer's charges to Owner for its review time, and Owner may impose a set-off against payments due Contractor to secure reimbursement for such charges, unless the need for such change is beyond the control of Contractor.

E. *Submittals Other than Shop Drawings, Samples, and Owner-Delegated Designs*

1. The following provisions apply to all Submittals other than Shop Drawings, Samples, and Owner-delegated designs:

   a. Contractor shall submit all such Submittals to the Engineer in accordance with the Schedule of Submittals and pursuant to the applicable terms of the Contract Documents.

   b. Engineer will provide timely review of all such Submittals in accordance with the Schedule of Submittals and return such Submittals with a notation of either Accepted or Not Accepted. Any such Submittal that is not returned within the time established in the Schedule of Submittals will be deemed accepted.

   c. Engineer's review will be only to determine if the Submittal is acceptable under the requirements of the Contract Documents as to general form and content of the Submittal.

Copyright© 2018 National Society of Professional Engineers, American Council of Engineering Companies, and American Society of Civil Engineers. All rights reserved.

d. If any such Submittal is not accepted, Contractor shall confer with Engineer regarding the reason for the non-acceptance, and resubmit an acceptable document.

2. Procedures for the submittal and acceptance of the Progress Schedule, the Schedule of Submittals, and the Schedule of Values are set forth in Paragraphs 2.03. 2.04, and 2.05.

F. Owner-delegated Designs: Submittals pursuant to Owner-delegated designs are governed by the provisions of Paragraph 7.19.

7.17 *Contractor's General Warranty and Guarantee*

A. Contractor warrants and guarantees to Owner that all Work will be in accordance with the Contract Documents and will not be defective. Engineer is entitled to rely on Contractor's warranty and guarantee.

B. Owner's rights under this warranty and guarantee are in addition to, and are not limited by, Owner's rights under the correction period provisions of Paragraph 15.08. The time in which Owner may enforce its warranty and guarantee rights under this Paragraph 7.17 is limited only by applicable Laws and Regulations restricting actions to enforce such rights; provided, however, that after the end of the correction period under Paragraph 15.08:

1. Owner shall give Contractor written notice of any defective Work within 60 days of the discovery that such Work is defective; and

2. Such notice will be deemed the start of an event giving rise to a Claim under Paragraph 12.01.B, such that any related Claim must be brought within 30 days of the notice.

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

1. abuse, or improper modification, 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.

D. Contractor's obligation to perform and complete the Work in accordance with the Contract Documents is absolute. None of the following will constitute an acceptance of Work that is not in accordance with the Contract Documents, a release of Contractor's obligation to perform the Work in accordance with the Contract Documents, or a release of Owner's warranty and guarantee rights under this Paragraph 7.17:

1. Observations by Engineer;

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

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

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

5. Any review and approval of a Shop Drawing or Sample submittal;

6. The issuance of a notice of acceptability by Engineer;

7. The end of the correction period established in Paragraph 15.08;

8. Any inspection, test, or approval by others; or

Copyright© 2018 National Society of Professional Engineers, American Council of Engineering Companies, and American Society of Civil Engineers. All rights reserved.

9. Any correction of defective Work by Owner.

E. If the Contract requires the Contractor to accept the assignment of a contract entered into by Owner, then the specific warranties, guarantees, and correction obligations contained in the assigned contract will govern with respect to Contractor's performance obligations to Owner for the Work described in the assigned contract.

7.18 *Indemnification*

A. To the fullest extent permitted by Laws and Regulations, and in addition to any other obligations of Contractor under the Contract or otherwise, Contractor shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them, from losses, damages, costs, and judgments (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 from third-party claims or actions relating to or resulting from the performance or furnishing of the Work, provided that any such claim, action, loss, cost, judgment or damage is attributable to bodily injury, sickness, disease, or death, or to damage to or destruction of tangible property (other than the Work itself), including the loss of use resulting therefrom, but only to the extent caused by any negligent act or omission of Contractor, any Subcontractor, any Supplier, or any individual or entity directly or indirectly employed by any of them to perform any of the Work, or anyone for whose acts any of them may be liable.

B. In any and all claims against Owner or Engineer, or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors, by any employee (or the survivor or personal representative of such employee) of Contractor, any Subcontractor, any Supplier, or any individual or entity directly or indirectly employed by any of them to perform any of the Work, or anyone for whose acts any of them may be liable, the indemnification obligation under Paragraph 7.18.A will 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.

7.19 *Delegation of Professional Design Services*

A. Owner may require Contractor to provide professional design services for a portion of the Work by express delegation in the Contract Documents. Such delegation will specify the performance and design criteria that such services must satisfy, and the Submittals that Contractor must furnish to Engineer with respect to the Owner-delegated design.

B. Contractor shall cause such Owner-delegated professional design services to be provided pursuant to the professional standard of care by a properly licensed design professional, whose signature and seal must appear on all drawings, calculations, specifications, certifications, and Submittals prepared by such design professional. Such design professional must issue all certifications of design required by Laws and Regulations.

C. If a Shop Drawing or other Submittal related to the Owner-delegated design is prepared by Contractor, a Subcontractor, or others for submittal to Engineer, then such Shop Drawing or other Submittal must bear the written approval of Contractor's design professional when submitted by Contractor to Engineer.

Copyright© 2018 National Society of Professional Engineers, American Council of Engineering Companies, and American Society of Civil Engineers. All rights reserved.

D. Owner and Engineer shall be entitled to rely upon the adequacy, accuracy, and completeness of the services, certifications, and approvals performed or provided by the design professionals retained or employed by Contractor under an Owner-delegated design, subject to the professional standard of care and the performance and design criteria stated in the Contract Documents.

E. Pursuant to this Paragraph 7.19, Engineer's review, approval, and other determinations regarding design drawings, calculations, specifications, certifications, and other Submittals furnished by Contractor pursuant to an Owner-delegated design will be only for the following limited purposes:

1. Checking for conformance with the requirements of this Paragraph 7.19;

2. Confirming that Contractor (through its design professionals) has used the performance and design criteria specified in the Contract Documents; and

3. Establishing that the design furnished by Contractor is consistent with the design concept expressed in the Contract Documents.

F. Contractor shall not be responsible for the adequacy of performance or design criteria specified by Owner or Engineer.

G. Contractor is not required to provide professional services in violation of applicable Laws and Regulations.

ARTICLE 8—OTHER WORK AT THE SITE

8.01 *Other Work*

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

B. If Owner performs other work at or adjacent to the Site with Owner's employees, or through contracts for such other work, then Owner shall give Contractor written notice thereof prior to starting any such other work. If Owner has advance information regarding the start of any third-party utility work that Owner has arranged to take place at or adjacent to the Site, Owner shall provide such information to Contractor.

C. Contractor shall afford proper and safe access to the Site to each contractor that performs such other work, each utility owner performing other work, and Owner, if Owner is performing other work with Owner's employees, and provide a reasonable opportunity for the introduction and storage of materials and equipment and the execution of such other work.

D. 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.

Copyright© 2018 National Society of Professional Engineers, American Council of Engineering Companies, and American Society of Civil Engineers. All rights reserved.

E. If the proper execution or results of any part of Contractor's Work depends upon work performed by others, 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.

F. The provisions of this article are not applicable to work that is performed by third-party utilities or other third-party entities without a contract with Owner, or that is performed without having been arranged by Owner. If such work occurs, then any related delay, disruption, or interference incurred by Contractor is governed by the provisions of Paragraph 4.05.C.3.

8.02 *Coordination*

A. If Owner intends to contract with others for the performance of other work at or adjacent to the Site, to perform other work at or adjacent to the Site with Owner's employees, or to arrange to have utility owners perform work at or adjacent to the Site, the following will be set forth in the Supplementary Conditions or provided to Contractor prior to the start of any such other work:

1. The identity of the individual or entity that will have authority and responsibility for coordination of the activities among the various contractors;

2. An itemization of the specific matters to be covered by such authority and responsibility; and

3. The extent of such authority and responsibilities.

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

8.03 *Legal Relationships*

A. If, in the course of performing other work for Owner at or adjacent to the Site, the Owner's employees, any other contractor working for Owner, or any utility owner that Owner has arranged to perform work, causes damage to the Work or to the property of Contractor or its Subcontractors, or delays, disrupts, interferes with, or increases the scope or cost of the performance of the Work, through actions or inaction, then Contractor shall be entitled to an equitable adjustment in the Contract Price or the Contract Times. Contractor must submit any Change Proposal seeking an equitable adjustment in the Contract Price or the Contract Times under this paragraph within 30 days of the damaging, delaying, disrupting, or interfering event. The entitlement to, and extent of, any such equitable adjustment will take into account information (if any) regarding such other work that was provided to Contractor in the Contract Documents prior to the submittal of the Bid or the final negotiation of the terms of the Contract, and any remedies available to Contractor under Laws or Regulations concerning utility action or inaction. When applicable, any such equitable adjustment in Contract Price will be conditioned on Contractor assigning to Owner all Contractor's rights against such other contractor or utility owner with respect to the damage, delay, disruption, or interference that is the subject of the adjustment. Contractor's entitlement to an adjustment of the Contract Times or Contract Price is subject to the provisions of Paragraphs 4.05.D and 4.05.E.

Copyright© 2018 National Society of Professional Engineers, American Council of Engineering Companies, and American Society of Civil Engineers. All rights reserved.

B. Contractor shall take reasonable and customary measures to avoid damaging, delaying, disrupting, or interfering with the work of Owner, any other contractor, or any utility owner performing other work at or adjacent to the Site.

1. If Contractor fails to take such measures and as a result damages, delays, disrupts, or interferes with the work of any such other contractor or utility owner, then Owner may impose a set-off against payments due Contractor, and assign to such other contractor or utility owner the Owner's contractual rights against Contractor with respect to the breach of the obligations set forth in this Paragraph 8.03.B.

2. When Owner is performing other work at or adjacent to the Site with Owner's employees, Contractor shall be liable to Owner for damage to such other work, and for the reasonable direct delay, disruption, and interference costs incurred by Owner as a result of Contractor's failure to take reasonable and customary measures with respect to Owner's other work. In response to such damage, delay, disruption, or interference, Owner may impose a set-off against payments due Contractor.

C. If Contractor damages, delays, disrupts, or interferes with the work of any other contractor, or any utility owner performing other work at or adjacent to the Site, through Contractor's failure to take reasonable and customary measures to avoid such impacts, or if any claim arising out of Contractor's actions, inactions, or negligence in performance of the Work at or adjacent to the Site is made by any such other contractor or utility owner against Contractor, Owner, or Engineer, then Contractor shall (1) promptly attempt to settle the claim as to all parties through negotiations with such other contractor or utility owner, or otherwise resolve the claim by arbitration or other dispute resolution proceeding or at law, and (2) indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them from and against any such claims, and against all costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such damage, delay, disruption, or interference.

ARTICLE 9—OWNER'S RESPONSIBILITIES

9.01 *Communications to Contractor*

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

9.02 *Replacement of Engineer*

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

9.03 *Furnish Data*

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

9.04 *Pay When Due*

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

Copyright© 2018 National Society of Professional Engineers, American Council of Engineering Companies, and American Society of Civil Engineers. All rights reserved.

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

A. Owner's duties with respect to providing lands and easements are set forth in Paragraph 5.01.

B. Owner's duties with respect to providing engineering surveys to establish reference points are set forth in Paragraph 4.03.

C. Article 5 refers to Owner's identifying and making available to Contractor copies of reports of explorations and tests of conditions at the Site, and drawings of physical conditions relating to existing surface or subsurface structures at the Site.

9.06 *Insurance*

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

9.07 *Change Orders*

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

9.08 *Inspections, Tests, and Approvals*

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

9.09 *Limitations on Owner's Responsibilities*

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

9.10 *Undisclosed Hazardous Environmental Condition*

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

9.11 *Evidence of Financial Arrangements*

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

9.12 *Safety Programs*

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

B. Owner shall furnish copies of any applicable Owner safety programs to Contractor.

Copyright© 2018 National Society of Professional Engineers, American Council of Engineering Companies, and American Society of Civil Engineers. All rights reserved.

ARTICLE 10—ENGINEER'S STATUS DURING CONSTRUCTION

10.01 *Owner's Representative*

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

10.02 *Visits to Site*

A. Engineer will make visits to the Site at intervals appropriate to the various stages of construction as Engineer deems necessary in order to observe, as an experienced and qualified design professional, the progress that has been made and the quality of the various aspects of Contractor's executed Work. Based on information obtained during such visits and observations, Engineer, for the benefit of Owner, will determine, in general, if the Work is proceeding in accordance with the Contract Documents. Engineer will not be required to make exhaustive or continuous inspections on the Site to check the quality or quantity of the Work. Engineer's efforts will be directed toward providing for Owner a greater degree of confidence that the completed Work will conform generally to the Contract Documents. On the basis of such visits and observations, Engineer will keep Owner informed of the progress of the Work and will endeavor to guard Owner against defective Work.

B. Engineer's visits and observations are subject to all the limitations on Engineer's authority and responsibility set forth in Paragraph 10.07. Particularly, but without limitation, during or as a result of Engineer's visits or observations of Contractor's Work, Engineer will not supervise, direct, control, or have authority over or be responsible for Contractor's means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of Contractor to comply with Laws and Regulations applicable to the performance of the Work.

10.03 *Resident Project Representative*

A. If Owner and Engineer have agreed that Engineer will furnish a Resident Project Representative to represent Engineer at the Site and assist Engineer in observing the progress and quality of the Work, then the authority and responsibilities of any such Resident Project Representative will be as provided in the Supplementary Conditions, and limitations on the responsibilities thereof will be as provided in the Supplementary Conditions and in Paragraph 10.07.

B. If Owner designates an individual or entity who is not Engineer's consultant, agent, or employee to represent Owner at the Site, then the responsibilities and authority of such individual or entity will be as provided in the Supplementary Conditions.

10.04 *Engineer's Authority*

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

B. Engineer's authority as to Submittals is set forth in Paragraph 7.16.

C. Engineer's authority as to design drawings, calculations, specifications, certifications and other Submittals from Contractor in response to Owner's delegation (if any) to Contractor of professional design services, is set forth in Paragraph 7.19.

D. Engineer's authority as to changes in the Work is set forth in Article 11.

Copyright© 2018 National Society of Professional Engineers, American Council of Engineering Companies, and American Society of Civil Engineers. All rights reserved.

E. Engineer's authority as to Applications for Payment is set forth in Article 15.

10.05 *Determinations for Unit Price Work*

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

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

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

10.07 *Limitations on Engineer's Authority and Responsibilities*

A. Neither Engineer's authority or responsibility under this Article 10 or under any other provision of the Contract, nor any decision made by Engineer in good faith either to exercise or not exercise such authority or responsibility or the undertaking, exercise, or performance of any authority or responsibility by Engineer, will 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 Contractor under Paragraph 15.06.A, will only be to determine generally that their content complies with the requirements of, and in the case of certificates of inspections, tests, and approvals, that the results certified indicate compliance with the Contract Documents.

E. The limitations upon authority and responsibility set forth in this Paragraph 10.07 also apply to the Resident Project Representative, if any.

10.08 *Compliance with Safety Program*

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

Copyright© 2018 National Society of Professional Engineers, American Council of Engineering Companies, and American Society of Civil Engineers. All rights reserved.

ARTICLE 11—CHANGES TO THE CONTRACT

11.01 *Amending and Supplementing the Contract*

A. The Contract may be amended or supplemented by a Change Order, a Work Change Directive, or a Field Order.

B. If an amendment or supplement to the Contract includes a change in the Contract Price or the Contract Times, such amendment or supplement must be set forth in a Change Order.

C. All changes to the Contract that involve (1) the performance or acceptability of the Work, (2) the design (as set forth in the Drawings, Specifications, or otherwise), or (3) other engineering or technical matters, must be supported by Engineer's recommendation. Owner and Contractor may amend other terms and conditions of the Contract without the recommendation of the Engineer.

11.02 *Change Orders*

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

1. Changes in Contract Price or Contract Times which are agreed to by the parties, including any undisputed sum or amount of time for Work actually performed in accordance with a Work Change Directive;

2. Changes in Contract Price resulting from an Owner set-off, unless Contractor has duly contested such set-off;

3. Changes in the Work which are: (a) ordered by Owner pursuant to Paragraph 11.05, (b) required because of Owner's acceptance of defective Work under Paragraph 14.04 or Owner's correction of defective Work under Paragraph 14.07, or (c) agreed to by the parties, subject to the need for Engineer's recommendation if the change in the Work involves the design (as set forth in the Drawings, Specifications, or otherwise) or other engineering or technical matters; and

4. Changes that embody the substance of any final and binding results under: Paragraph 11.03.B, resolving the impact of a Work Change Directive; Paragraph 11.09, concerning Change Proposals; Article 12, Claims; Paragraph 13.02.D, final adjustments resulting from allowances; Paragraph 13.03.D, final adjustments relating to determination of quantities for Unit Price Work; and similar provisions.

B. If Owner or Contractor refuses to execute a Change Order that is required to be executed under the terms of Paragraph 11.02.A, it will be deemed to be of full force and effect, as if fully executed.

11.03 *Work Change Directives*

A. A Work Change Directive will not change the Contract Price or the Contract Times but is evidence that the parties expect that the modification ordered or documented by a Work Change Directive will be incorporated in a subsequently issued Change Order, following negotiations by the parties as to the Work Change Directive's effect, if any, on the Contract Price and Contract Times; or, if negotiations are unsuccessful, by a determination under the terms of the Contract Documents governing adjustments, expressly including Paragraph 11.07 regarding change of Contract Price.

Copyright© 2018 National Society of Professional Engineers, American Council of Engineering Companies, and American Society of Civil Engineers. All rights reserved.

B. If Owner has issued a Work Change Directive and:

1. Contractor believes that an adjustment in Contract Times or Contract Price is necessary, then Contractor shall submit any Change Proposal seeking such an adjustment no later than 30 days after the completion of the Work set out in the Work Change Directive.

2. Owner believes that an adjustment in Contract Times or Contract Price is necessary, then Owner shall submit any Claim seeking such an adjustment no later than 60 days after issuance of the Work Change Directive.

11.04 *Field Orders*

A. Engineer may authorize minor changes in the Work if the changes do not involve an adjustment in the Contract Price or the Contract Times and are compatible with the design concept of the completed Project as a functioning whole as indicated by the Contract Documents. Such changes will be accomplished by a Field Order and will be binding on Owner and also on Contractor, which shall perform the Work involved promptly.

B. If Contractor believes that a Field Order justifies an adjustment in the Contract Price or Contract Times, then before proceeding with the Work at issue, Contractor shall submit a Change Proposal as provided herein.

11.05 *Owner-Authorized Changes in the Work*

A. Without invalidating the Contract and without notice to any surety, Owner may, at any time or from time to time, order additions, deletions, or revisions in the Work. Changes involving the design (as set forth in the Drawings, Specifications, or otherwise) or other engineering or technical matters will be supported by Engineer's recommendation.

B. Such changes in the Work may be accomplished by a Change Order, if Owner and Contractor have agreed as to the effect, if any, of the changes on Contract Times or Contract Price; or by a Work Change Directive. Upon receipt of any such document, Contractor shall promptly proceed with the Work involved; or, in the case of a deletion in the Work, promptly cease construction activities with respect to such deleted Work. Added or revised Work must be performed under the applicable conditions of the Contract Documents.

C. Nothing in this Paragraph 11.05 obligates Contractor to undertake work that Contractor reasonably concludes cannot be performed in a manner consistent with Contractor's safety obligations under the Contract Documents or Laws and Regulations.

11.06 *Unauthorized Changes in the Work*

A. Contractor shall not be entitled to an increase in the Contract Price or an extension of the Contract Times with respect to any work performed that is not required by the Contract Documents, as amended, modified, or supplemented, except in the case of an emergency as provided in Paragraph 7.15 or in the case of uncovering Work as provided in Paragraph 14.05.C.2.

11.07 *Change of Contract Price*

A. The Contract Price may only be changed by a Change Order. Any Change Proposal for an adjustment in the Contract Price must comply with the provisions of Paragraph 11.09. Any Claim for an adjustment of Contract Price must comply with the provisions of Article 12.

B. An adjustment in the Contract Price will be determined as follows:

Copyright© 2018 National Society of Professional Engineers, American Council of Engineering Companies, and American Society of Civil Engineers. All rights reserved.

1. Where the Work involved is covered by unit prices contained in the Contract Documents, then by application of such unit prices to the quantities of the items involved (subject to the provisions of Paragraph 13.03);

2. Where the Work involved is not covered by unit prices contained in the Contract Documents, then by a mutually agreed lump sum (which may include an allowance for overhead and profit not necessarily in accordance with Paragraph 11.07.C.2); or

3. Where the Work involved is not covered by unit prices contained in the Contract Documents and the parties do not reach mutual agreement to a lump sum, then on the basis of the Cost of the Work (determined as provided in Paragraph 13.01) plus a Contractor's fee for overhead and profit (determined as provided in Paragraph 11.07.C).

C. *Contractor's Fee*: When applicable, the Contractor's fee for overhead and profit will be determined as follows:

1. A mutually acceptable fixed fee; or

2. If a fixed fee is not agreed upon, then a fee based on the following percentages of the various portions of the Cost of the Work:

a. For costs incurred under Paragraphs 13.01.B.1 and 13.01.B.2, the Contractor's fee will be 15 percent;

b. For costs incurred under Paragraph 13.01.B.3, the Contractor's fee will be 5 percent;

c. Where one or more tiers of subcontracts are on the basis of Cost of the Work plus a fee and no fixed fee is agreed upon, the intent of Paragraphs 11.07.C.2.a and 11.07.C.2.b is that the Contractor's fee will be based on: (1) a fee of 15 percent of the costs incurred under Paragraphs 13.01.B.1 and 13.01.B.2 by the Subcontractor that actually performs the Work, at whatever tier, and (2) with respect to Contractor itself and to any Subcontractors of a tier higher than that of the Subcontractor that actually performs the Work, a fee of 5 percent of the amount (fee plus underlying costs incurred) attributable to the next lower tier Subcontractor; provided, however, that for any such subcontracted Work the maximum total fee to be paid by Owner will be no greater than 27 percent of the costs incurred by the Subcontractor that actually performs the Work;

d. No fee will be payable on the basis of costs itemized under Paragraphs 13.01.B.4, 13.01.B.5, and 13.01.C;

e. The amount of credit to be allowed by Contractor to Owner for any change which results in a net decrease in Cost of the Work will be the amount of the actual net decrease in Cost of the Work and a deduction of an additional amount equal to 5 percent of such actual net decrease in Cost of the Work; and

f. When both additions and credits are involved in any one change or Change Proposal, the adjustment in Contractor's fee will be computed by determining the sum of the costs in each of the cost categories in Paragraph 13.01.B (specifically, payroll costs, Paragraph 13.01.B.1; incorporated materials and equipment costs, Paragraph 13.01.B.2; Subcontract costs, Paragraph 13.01.B.3; special consultants costs, Paragraph 13.01.B.4; and other costs, Paragraph 13.01.B.5) and applying to each such cost category sum the appropriate fee from Paragraphs 11.07.C.2.a through 11.07.C.2.e, inclusive.

Copyright© 2018 National Society of Professional Engineers, American Council of Engineering Companies, and American Society of Civil Engineers. All rights reserved.

11.08 *Change of Contract Times*

A. The Contract Times may only be changed by a Change Order. Any Change Proposal for an adjustment in the Contract Times must comply with the provisions of Paragraph 11.09. Any Claim for an adjustment in the Contract Times must comply with the provisions of Article 12.

B. Delay, disruption, and interference in the Work, and any related changes in Contract Times, are addressed in and governed by Paragraph 4.05.

11.09 *Change Proposals*

A. *Purpose and Content*: Contractor shall submit a Change Proposal to Engineer to request an adjustment in the Contract Times or Contract Price; contest an initial decision by Engineer concerning the requirements of the Contract Documents or relating to the acceptability of the Work under the Contract Documents; challenge a set-off against payment due; or seek other relief under the Contract. The Change Proposal will specify any proposed change in Contract Times or Contract Price, or other proposed relief, and explain the reason for the proposed change, with citations to any governing or applicable provisions of the Contract Documents. Each Change Proposal will address only one issue, or a set of closely related issues.

B. *Change Proposal Procedures*

1. *Submittal*: Contractor shall submit each Change Proposal to Engineer within 30 days after the start of the event giving rise thereto, or after such initial decision.

2. *Supporting Data*: The Contractor shall submit supporting data, including the proposed change in Contract Price or Contract Time (if any), to the Engineer and Owner within 15 days after the submittal of the Change Proposal.

    a. Change Proposals based on or related to delay, interruption, or interference must comply with the provisions of Paragraphs 4.05.D and 4.05.E.

    b. Change proposals related to a change of Contract Price must include full and detailed accounts of materials incorporated into the Work and labor and equipment used for the subject Work.

    The supporting data must be accompanied by a written statement that the supporting data are accurate and complete, and that any requested time or price adjustment is the entire adjustment to which Contractor believes it is entitled as a result of said event.

3. *Engineer's Initial Review*: Engineer will advise Owner regarding the Change Proposal, and consider any comments or response from Owner regarding the Change Proposal. If in its discretion Engineer concludes that additional supporting data is needed before conducting a full review and making a decision regarding the Change Proposal, then Engineer may request that Contractor submit such additional supporting data by a date specified by Engineer, prior to Engineer beginning its full review of the Change Proposal.

4. *Engineer's Full Review and Action on the Change Proposal*: Upon receipt of Contractor's supporting data (including any additional data requested by Engineer), Engineer will conduct a full review of each Change Proposal and, within 30 days after such receipt of the Contractor's supporting data, either approve the Change Proposal in whole, deny it in whole, or approve it in part and deny it in part. Such actions must be in writing, with a copy provided to Owner and Contractor. If Engineer does not take action on the Change

Copyright© 2018 National Society of Professional Engineers, American Council of Engineering Companies, and American Society of Civil Engineers. All rights reserved.

Proposal within 30 days, then either Owner or Contractor may at any time thereafter submit a letter to the other party indicating that as a result of Engineer's inaction the Change Proposal is deemed denied, thereby commencing the time for appeal of the denial under Article 12.

5. *Binding Decision*: Engineer's decision is final and binding upon Owner and Contractor, unless Owner or Contractor appeals the decision by filing a Claim under Article 12.

C. *Resolution of Certain Change Proposals*: If the Change Proposal does not involve the design (as set forth in the Drawings, Specifications, or otherwise), the acceptability of the Work, or other engineering or technical matters, then Engineer will notify the parties in writing that the Engineer is unable to resolve the Change Proposal. For purposes of further resolution of such a Change Proposal, such notice will be deemed a denial, and Contractor may choose to seek resolution under the terms of Article 12.

D. *Post-Completion*: Contractor shall not submit any Change Proposals after Engineer issues a written recommendation of final payment pursuant to Paragraph 15.06.B.

11.10 *Notification to Surety*

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

ARTICLE 12—CLAIMS

12.01 *Claims*

A. *Claims Process*: The following disputes between Owner and Contractor are subject to the Claims process set forth in this article:

1. Appeals by Owner or Contractor of Engineer's decisions regarding Change Proposals;

2. Owner demands for adjustments in the Contract Price or Contract Times, or other relief under the Contract Documents;

3. Disputes that Engineer has been unable to address because they do not involve the design (as set forth in the Drawings, Specifications, or otherwise), the acceptability of the Work, or other engineering or technical matters; and

4. Subject to the waiver provisions of Paragraph 15.07, any dispute arising after Engineer has issued a written recommendation of final payment pursuant to Paragraph 15.06.B.

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

Copyright© 2018 National Society of Professional Engineers, American Council of Engineering Companies, and American Society of Civil Engineers. All rights reserved.

and belief the amount of time or money requested accurately reflects the full amount to which Contractor is entitled.

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

D. *Mediation*

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

2. If Owner and Contractor agree to mediation, then after 60 days from such agreement, either Owner or Contractor may unilaterally terminate the mediation process, and the Claim submittal and decision process will resume as of the date of the termination. If the mediation proceeds but is unsuccessful in resolving the dispute, the Claim submittal and decision process will resume as of the date of the conclusion of the mediation, as determined by the mediator.

3. Owner and Contractor shall each pay one-half of the mediator's fees and costs.

E. *Partial Approval*: If the party receiving a Claim approves the Claim in part and denies it in part, such action will be final and binding unless within 30 days of such action the other party invokes the procedure set forth in Article 17 for final resolution of disputes.

F. *Denial of Claim*: If efforts to resolve a Claim are not successful, the party receiving the Claim may deny it by giving written notice of denial to the other party. If the receiving party does not take action on the Claim within 90 days, then either Owner or Contractor may at any time thereafter submit a letter to the other party indicating that as a result of the inaction, the Claim is deemed denied, thereby commencing the time for appeal of the denial. A denial of the Claim will be final and binding unless within 30 days of the denial the other party invokes the procedure set forth in Article 17 for the final resolution of disputes.

G. *Final and Binding Results*: If the parties reach a mutual agreement regarding a Claim, whether through approval of the Claim, direct negotiations, mediation, or otherwise; or if a Claim is approved in part and denied in part, or denied in full, and such actions become final and binding; then the results of the agreement or action on the Claim will be incorporated in a Change Order or other written document to the extent they affect the Contract, including the Work, the Contract Times, or the Contract Price.

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

13.01 *Cost of the Work*

A. *Purposes for Determination of Cost of the Work*: The term Cost of the Work means the sum of all costs necessary for the proper performance of the Work at issue, as further defined below. The provisions of this Paragraph 13.01 are used for two distinct purposes:

1. To determine Cost of the Work when Cost of the Work is a component of the Contract Price, under cost-plus-fee, time-and-materials, or other cost-based terms; or

Copyright© 2018 National Society of Professional Engineers, American Council of Engineering Companies, and American Society of Civil Engineers. All rights reserved.

2. When needed to determine the value of a Change Order, Change Proposal, Claim, set-off, or other adjustment in Contract Price. When the value of any such adjustment is determined on the basis of Cost of the Work, Contractor is entitled only to those additional or incremental costs required because of the change in the Work or because of the event giving rise to the adjustment.

B. *Costs Included*: Except as otherwise may be agreed to in writing by Owner, costs included in the Cost of the Work will be in amounts no higher than those commonly incurred in the locality of the Project, will not include any of the costs itemized in Paragraph 13.01.C, and will 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 in advance of the subject Work. Such employees include, without limitation, superintendents, foremen, safety managers, safety representatives, and other personnel employed full time on the Work. Payroll costs for employees not employed full time on the Work will be apportioned on the basis of their time spent on the Work. Payroll costs include, but are not limited to, salaries and wages plus the cost of fringe benefits, which include social security contributions, unemployment, excise, and payroll taxes, workers' compensation, health and retirement benefits, sick leave, and vacation and holiday pay applicable thereto. The expenses of performing Work outside of regular working hours, on Saturday, Sunday, or legal holidays, will 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 accrue to Contractor unless Owner deposits funds with Contractor with which to make payments, in which case the cash discounts will accrue to Owner. All trade discounts, rebates, and refunds and returns from sale of surplus materials and equipment will 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, which 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 will be determined in the same manner as Contractor's Cost of the Work and fee as provided in this Paragraph 13.01.

4. Costs of special consultants (including but not limited to engineers, architects, testing laboratories, surveyors, attorneys, and accountants) employed or retained for services specifically related to the Work.

5. Other costs consisting of 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, which are

Copyright© 2018 National Society of Professional Engineers, American Council of Engineering Companies, and American Society of Civil Engineers. All rights reserved.

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.

1) In establishing included costs for materials such as scaffolding, plating, or sheeting, consideration will be given to the actual or the estimated life of the material for use on other projects; or rental rates may be established on the basis of purchase or salvage value of such items, whichever is less. Contractor will not be eligible for compensation for such items in an amount that exceeds the purchase cost of such item.

c. *Construction Equipment Rental*

1) Rentals of all construction equipment and machinery, and the parts thereof, in accordance with rental agreements approved by Owner as to price (including any surcharge or special rates applicable to overtime use of the construction equipment or machinery), and the costs of transportation, loading, unloading, assembly, dismantling, and removal thereof. All such costs will be in accordance with the terms of said rental agreements. The rental of any such equipment, machinery, or parts must cease when the use thereof is no longer necessary for the Work.

2) Costs for equipment and machinery owned by Contractor or a Contractor-related entity will be paid at a rate shown for such equipment in the equipment rental rate book specified in the Supplementary Conditions. An hourly rate will be computed by dividing the monthly rates by 176. These computed rates will include all operating costs.

3) With respect to Work that is the result of a Change Order, Change Proposal, Claim, set-off, or other adjustment in Contract Price ("changed Work"), included costs will be based on the time the equipment or machinery is in use on the changed Work and the costs of transportation, loading, unloading, assembly, dismantling, and removal when directly attributable to the changed Work. The cost of any such equipment or machinery, or parts thereof, must cease to accrue when the use thereof is no longer necessary for the changed 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 builder's risk or other property insurance established in accordance with Paragraph 6.04), 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 include settlements made with the written consent and approval of Owner. No such losses, damages, and expenses will be included in the Cost of the Work for the purpose of determining Contractor's fee.

Copyright© 2018 National Society of Professional Engineers, American Council of Engineering Companies, and American Society of Civil Engineers. All rights reserved.

g. The cost of utilities, fuel, and sanitary facilities at the Site.

h. Minor expenses such as communication service at the Site, express and courier services, and similar petty cash items in connection with the Work.

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

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

1. Payroll costs and other compensation of Contractor's officers, executives, principals, general 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 13.01.B.1 or specifically covered by Paragraph 13.01.B.4. The payroll costs and other compensation excluded here are to be considered administrative costs covered by the Contractor's fee.

2. The cost of purchasing, renting, or furnishing small tools and hand tools.

3. Expenses of Contractor's principal and branch offices other than Contractor's office at the Site.

4. Any part of Contractor's capital expenses, including interest on Contractor's capital employed for the Work and charges against Contractor for delinquent payments.

5. 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.

6. Expenses incurred in preparing and advancing Claims.

7. Other overhead or general expense costs of any kind and the costs of any item not specifically and expressly included in Paragraph 13.01.B.

D. *Contractor's Fee*

1. When the Work as a whole is performed on the basis of cost-plus-a-fee, then:

a. Contractor's fee for the Work set forth in the Contract Documents as of the Effective Date of the Contract will be determined as set forth in the Agreement.

b. for any Work covered by a Change Order, Change Proposal, Claim, set-off, or other adjustment in Contract Price on the basis of Cost of the Work, Contractor's fee will be determined as follows:

1) When the fee for the Work as a whole is a percentage of the Cost of the Work, the fee will automatically adjust as the Cost of the Work changes.

2) When the fee for the Work as a whole is a fixed fee, the fee for any additions or deletions will be determined in accordance with Paragraph 11.07.C.2.

2. When the Work as a whole is performed on the basis of a stipulated sum, or any other basis other than cost-plus-a-fee, then Contractor's fee for any Work covered by a Change

Copyright© 2018 National Society of Professional Engineers, American Council of Engineering Companies, and American Society of Civil Engineers. All rights reserved.

Order, Change Proposal, Claim, set-off, or other adjustment in Contract Price on the basis of Cost of the Work will be determined in accordance with Paragraph 11.07.C.2.

E. *Documentation and Audit*: Whenever the Cost of the Work for any purpose is to be determined pursuant to this Article 13, Contractor and pertinent Subcontractors will establish and maintain records of the costs in accordance with generally accepted accounting practices. Subject to prior written notice, Owner will be afforded reasonable access, during normal business hours, to all Contractor's accounts, records, books, correspondence, instructions, drawings, receipts, vouchers, memoranda, and similar data relating to the Cost of the Work and Contractor's fee. Contractor shall preserve all such documents for a period of three years after the final payment by Owner. Pertinent Subcontractors will afford such access to Owner, and preserve such documents, to the same extent required of Contractor.

13.02 *Allowances*

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

B. *Cash Allowances*: Contractor agrees that:

1. the cash allowances include the cost to Contractor (less any applicable trade discounts) of materials and equipment required by the allowances to be delivered at the Site, and all applicable taxes; and

2. Contractor's costs for unloading and handling on the Site, labor, installation, overhead, profit, and other expenses contemplated for the cash allowances have been included in the Contract Price and not in the allowances, and no demand for additional payment for any of the foregoing will be valid.

C. *Owner's Contingency Allowance*: Contractor agrees that an Owner's 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 for Work covered by allowances, and the Contract Price will be correspondingly adjusted.

13.03 *Unit Price Work*

A. Where the Contract Documents provide that all or part of the Work is to be Unit Price Work, initially the Contract Price will be deemed to include for all Unit Price Work an amount equal to the sum of the unit price for each separately identified item of Unit Price Work times the estimated quantity of each item as indicated in the Agreement.

B. The estimated quantities of items of Unit Price Work are not guaranteed and are solely for the purpose of comparison of Bids and determining an initial Contract Price. Payments to Contractor for Unit Price Work will be based on actual quantities.

C. Each unit price will be deemed to include an amount considered by Contractor to be adequate to cover Contractor's overhead and profit for each separately identified item.

D. Engineer will determine the actual quantities and classifications of Unit Price Work performed by Contractor. Engineer will review with Contractor the Engineer's preliminary determinations on such matters before rendering a written decision thereon (by recommendation of an Application for Payment or otherwise). Engineer's written decision

Copyright© 2018 National Society of Professional Engineers, American Council of Engineering Companies, and American Society of Civil Engineers. All rights reserved.

thereon will be final and binding (except as modified by Engineer to reflect changed factual conditions or more accurate data) upon Owner and Contractor, and the final adjustment of Contract Price will be set forth in a Change Order, subject to the provisions of the following paragraph.

E. *Adjustments in Unit Price*

1. Contractor or Owner shall be entitled to an adjustment in the unit price with respect to an item of Unit Price Work if:

a. the quantity of the item of Unit Price Work performed by Contractor differs materially and significantly from the estimated quantity of such item indicated in the Agreement; and

b. Contractor's unit costs to perform the item of Unit Price Work have changed materially and significantly as a result of the quantity change.

2. The adjustment in unit price will account for and be coordinated with any related changes in quantities of other items of Work, and in Contractor's costs to perform such other Work, such that the resulting overall change in Contract Price is equitable to Owner and Contractor.

3. Adjusted unit prices will apply to all units of that item.

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

14.01 *Access to Work*

A. Owner, Engineer, their consultants and other representatives and personnel of Owner, independent testing laboratories, and authorities having jurisdiction 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 with such procedures and programs as applicable.

14.02 *Tests, Inspections, and Approvals*

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

B. Owner shall retain and pay for the services of an independent inspector, testing laboratory, or other qualified individual or entity to perform all inspections and tests expressly required by the Contract Documents to be furnished and paid for by Owner, except that costs incurred in connection with tests or inspections of covered Work will be governed by the provisions of Paragraph 14.05.

C. If Laws or Regulations of any public body having jurisdiction require any Work (or part thereof) specifically to be inspected, tested, or approved by an employee or other representative of such public body, Contractor shall assume full responsibility for arranging and obtaining such inspections, tests, or approvals, pay all costs in connection therewith, and furnish Engineer the required certificates of inspection or approval.

Copyright© 2018 National Society of Professional Engineers, American Council of Engineering Companies, and American Society of Civil Engineers. All rights reserved.

D. Contractor shall be responsible for arranging, obtaining, and paying for all inspections and tests required:

1. by the Contract Documents, unless the Contract Documents expressly allocate responsibility for a specific inspection or test to Owner;

2. to attain Owner's and Engineer's acceptance of materials or equipment to be incorporated in the Work;

3. by manufacturers of equipment furnished under the Contract Documents;

4. for testing, adjusting, and balancing of mechanical, electrical, and other equipment to be incorporated into the Work; and

5. for acceptance of materials, mix designs, or equipment submitted for approval prior to Contractor's purchase thereof for incorporation in the Work.

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

E. If the Contract Documents require the Work (or part thereof) to be approved by Owner, Engineer, or another designated individual or entity, then Contractor shall assume full responsibility for arranging and obtaining such approvals.

F. If any Work (or the work of others) that is to be inspected, tested, or approved is covered by Contractor without written concurrence of Engineer, Contractor shall, if requested by Engineer, uncover such Work for observation. Such uncovering will be at Contractor's expense unless Contractor had given Engineer timely notice of Contractor's intention to cover the same and Engineer had not acted with reasonable promptness in response to such notice.

14.03 *Defective Work*

A. *Contractor's Obligation*: It is Contractor's obligation to assure that the Work is not defective.

B. *Engineer's Authority*: Engineer has the authority to determine whether Work is defective, and to reject defective Work.

C. *Notice of Defects*: Prompt written notice of all defective Work of which Owner or Engineer has actual knowledge will be given to Contractor.

D. *Correction, or Removal and Replacement*: Promptly after receipt of written notice of defective Work, Contractor shall correct all such defective Work, whether or not fabricated, installed, or completed, or, if Engineer has rejected the defective Work, remove it from the Project and replace it with Work that is not defective.

E. *Preservation of Warranties*: When correcting defective Work, Contractor shall take no action that would void or otherwise impair Owner's special warranty and guarantee, if any, on said Work.

F. *Costs and Damages*: In addition to its correction, removal, and replacement obligations with respect to defective Work, Contractor shall pay all claims, costs, losses, and damages arising out of or relating to defective Work, including but not limited to the cost of the inspection, testing, correction, removal, replacement, or reconstruction of such defective Work, fines levied against Owner by governmental authorities because the Work is defective, and the costs of repair or replacement of work of others resulting from defective Work. Prior to final payment, if Owner and Contractor are unable to agree as to the measure of such claims, costs,

Copyright© 2018 National Society of Professional Engineers, American Council of Engineering Companies, and American Society of Civil Engineers. All rights reserved.

losses, and damages resulting from defective Work, then Owner may impose a reasonable set-off against payments due under Article 15.

14.04 *Acceptance of Defective Work*

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

14.05 *Uncovering Work*

A. Engineer has the authority to require additional inspection or testing of the Work, whether or not the Work is fabricated, installed, or completed.

B. If any Work is covered contrary to the written request of Engineer, then Contractor shall, if requested by Engineer, uncover such Work for Engineer's observation, and then replace the covering, all at Contractor's expense.

C. If Engineer considers it necessary or advisable that covered Work be observed by Engineer or inspected or tested by others, then Contractor, at Engineer's request, shall uncover, expose, or otherwise make available for observation, inspection, or testing as Engineer may require, that portion of the Work in question, and provide all necessary labor, material, and equipment.

1. If it is found that the uncovered Work is defective, Contractor shall be responsible for all claims, costs, losses, and damages arising out of or relating to such uncovering, exposure, observation, inspection, and testing, and of satisfactory replacement or reconstruction (including but not limited to all costs of repair or replacement of work of others); and pending Contractor's full discharge of this responsibility the Owner shall be entitled to impose a reasonable set-off against payments due under Article 15.

2. If the uncovered Work is not found to be defective, Contractor shall be allowed an increase in the Contract Price or an extension of the Contract Times, directly attributable to such uncovering, exposure, observation, inspection, testing, replacement, and reconstruction. If the parties are unable to agree as to the amount or extent thereof, then Contractor may submit a Change Proposal within 30 days of the determination that the Work is not defective.

14.06 *Owner May Stop the Work*

A. If the Work is defective, or Contractor fails to supply sufficient skilled workers or suitable materials or equipment, or fails to perform the Work in such a way that the completed Work will conform to the Contract Documents, then Owner may order Contractor to stop the Work,

Copyright© 2018 National Society of Professional Engineers, American Council of Engineering Companies, and American Society of Civil Engineers. All rights reserved.

or any portion thereof, until the cause for such order has been eliminated; however, this right of Owner to stop the Work will not give rise to any duty on the part of Owner to exercise this right for the benefit of Contractor, any Subcontractor, any Supplier, any other individual or entity, or any surety for, or employee or agent of any of them.

14.07 *Owner May Correct Defective Work*

A. If Contractor fails within a reasonable time after written notice from Engineer to correct defective Work, or to remove and replace defective Work as required by Engineer, then Owner may, after 7 days' written notice to Contractor, correct or remedy any such deficiency.

B. In exercising the rights and remedies under this Paragraph 14.07, Owner shall proceed expeditiously. In connection with such corrective or remedial action, Owner may exclude Contractor from all or part of the Site, take possession of all or part of the Work and suspend Contractor's services related thereto, and incorporate in the Work all materials and equipment stored at the Site or for which Owner has paid Contractor but which are stored elsewhere. Contractor shall allow Owner, Owner's representatives, agents and employees, Owner's other contractors, and Engineer and Engineer's consultants access to the Site to enable Owner to exercise the rights and remedies under this paragraph.

C. All claims, costs, losses, and damages incurred or sustained by Owner in exercising the rights and remedies under this Paragraph 14.07 will be charged against Contractor as set-offs against payments due under Article 15. Such claims, costs, losses and damages will include but not be limited to all costs of repair, or replacement of work of others destroyed or damaged by correction, removal, or replacement of Contractor's defective Work.

D. Contractor shall not be allowed an extension of the Contract Times because of any delay in the performance of the Work attributable to the exercise by Owner of Owner's rights and remedies under this Paragraph 14.07.

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

15.01 *Progress Payments*

A. *Basis for Progress Payments*: The Schedule of Values established as provided in Article 2 will serve as the basis for progress payments and will be incorporated into a form of Application for Payment acceptable to Engineer. Progress payments for Unit Price Work will be based on the number of units completed during the pay period, as determined under the provisions of Paragraph 13.03. Progress payments for cost-based Work will be based on Cost of the Work completed by Contractor during the pay period.

B. *Applications for Payments*

1. At least 20 days before the date established in the Agreement for each progress payment (but not more often than once a month), Contractor shall submit to Engineer for review an Application for Payment filled out and signed by Contractor covering the Work completed as of the date of the Application and accompanied by such supporting documentation as is required by the Contract Documents.

2. 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 must also be accompanied by: (a) a bill of sale, invoice, copies of subcontract or purchase order payments, or other documentation

Copyright© 2018 National Society of Professional Engineers, American Council of Engineering Companies, and American Society of Civil Engineers. All rights reserved.

establishing full payment by Contractor for the materials and equipment; (b) at Owner's request, documentation warranting that Owner has received the materials and equipment free and clear of all Liens; and (c) evidence that the materials and equipment are covered by appropriate property insurance, a warehouse bond, or other arrangements to protect Owner's interest therein, all of which must be satisfactory to Owner.

3. Beginning with the second Application for Payment, each Application must include an affidavit of Contractor stating that all previous progress payments received by Contractor have been applied to discharge Contractor's legitimate obligations associated with prior Applications for Payment.

4. The amount of retainage with respect to progress payments will be as stipulated in the Agreement.

C. *Review of Applications*

1. Engineer will, within 10 days after receipt of each Application for Payment, including each resubmittal, either indicate in writing a recommendation of payment and present the Application to Owner, or return the Application to Contractor indicating in writing Engineer's reasons for refusing to recommend payment. In the latter case, Contractor may make the necessary corrections and resubmit the Application.

2. Engineer's recommendation of any payment requested in an Application for Payment will constitute a representation by Engineer to Owner, based on Engineer's observations of the executed Work as an experienced and qualified design professional, and on Engineer's review of the Application for Payment and the accompanying data and schedules, that to the best of Engineer's knowledge, information and belief:

   a. the Work has progressed to the point indicated;

   b. the quality of the Work is generally in accordance with the Contract Documents (subject to an evaluation of the Work as a functioning whole prior to or upon Substantial Completion, the results of any subsequent tests called for in the Contract Documents, a final determination of quantities and classifications for Unit Price Work under Paragraph 13.03, and any other qualifications stated in the recommendation); and

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

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

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

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

Copyright© 2018 National Society of Professional Engineers, American Council of Engineering Companies, and American Society of Civil Engineers. All rights reserved.

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;

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

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

    d. to make any examination to ascertain how or for what purposes Contractor has used the money paid by Owner; or

    e. to determine that title to any of the Work, materials, or equipment has passed to Owner free and clear of any Liens.

5. Engineer may refuse to recommend the whole or any part of any payment if, in Engineer's opinion, it would be incorrect to make the representations to Owner stated in Paragraph 15.01.C.2.

6. Engineer will recommend reductions in payment (set-offs) necessary in Engineer's opinion to protect Owner from loss because:

    a. the Work is defective, requiring correction or replacement;

    b. the Contract Price has been reduced by Change Orders;

    c. Owner has been required to correct defective Work in accordance with Paragraph 14.07, or has accepted defective Work pursuant to Paragraph 14.04;

    d. Owner has been required to remove or remediate a Hazardous Environmental Condition for which Contractor is responsible; or

    e. Engineer has actual knowledge of the occurrence of any of the events that would constitute a default by Contractor and therefore justify termination for cause under the Contract Documents.

D. *Payment Becomes Due*

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

E. *Reductions in Payment by Owner*

1. In addition to any reductions in payment (set-offs) recommended by Engineer, Owner is entitled to impose a set-off against payment based on any of the following:

    a. Claims have been made against Owner based on Contractor's conduct in the performance or furnishing of the Work, or Owner has incurred costs, losses, or damages resulting from Contractor's conduct in the performance or furnishing of the Work, including but not limited to claims, costs, losses, or damages from workplace injuries, adjacent property damage, non-compliance with Laws and Regulations, and patent infringement;

Copyright© 2018 National Society of Professional Engineers, American Council of Engineering Companies, and American Society of Civil Engineers. All rights reserved.

b. Contractor has failed to take reasonable and customary measures to avoid damage, delay, disruption, and interference with other work at or adjacent to the Site;

c. Contractor has failed to provide and maintain required bonds or insurance;

d. Owner has been required to remove or remediate a Hazardous Environmental Condition for which Contractor is responsible;

e. Owner has incurred extra charges or engineering costs related to submittal reviews, evaluations of proposed substitutes, tests and inspections, or return visits to manufacturing or assembly facilities;

f. The Work is defective, requiring correction or replacement;

g. Owner has been required to correct defective Work in accordance with Paragraph 14.07, or has accepted defective Work pursuant to Paragraph 14.04;

h. The Contract Price has been reduced by Change Orders;

i. An event has occurred that would constitute a default by Contractor and therefore justify a termination for cause;

j. Liquidated or other damages have accrued as a result of Contractor's failure to achieve Milestones, Substantial Completion, or final completion of the Work;

k. Liens have been filed in connection with the Work, except where Contractor has delivered a specific bond satisfactory to Owner to secure the satisfaction and discharge of such Liens; or

l. Other items entitle Owner to a set-off against the amount recommended.

2. If Owner imposes any set-off against payment, whether based on its own knowledge or on the written recommendations of Engineer, Owner will give Contractor immediate written notice (with a copy to Engineer) stating the reasons for such action and the specific amount of the reduction, and promptly pay Contractor any amount remaining after deduction of the amount so withheld. Owner shall promptly pay Contractor the amount so withheld, or any adjustment thereto agreed to by Owner and Contractor, if Contractor remedies the reasons for such action. The reduction imposed will be binding on Contractor unless it duly submits a Change Proposal contesting the reduction.

3. Upon a subsequent determination that Owner's refusal of payment was not justified, the amount wrongfully withheld will be treated as an amount due as determined by Paragraph 15.01.D.1 and subject to interest as provided in the Agreement.

15.02 *Contractor's Warranty of Title*

A. Contractor warrants and guarantees that title to all Work, materials, and equipment furnished under the Contract will pass to Owner free and clear of (1) all Liens and other title defects, and (2) all patent, licensing, copyright, or royalty obligations, no later than 7 days after the time of payment by Owner.

15.03 *Substantial Completion*

A. When Contractor considers the entire Work ready for its intended use Contractor shall notify Owner and Engineer in writing that the entire Work is substantially complete and request that Engineer issue a certificate of Substantial Completion. Contractor shall at the same time

Copyright© 2018 National Society of Professional Engineers, American Council of Engineering Companies, and American Society of Civil Engineers. All rights reserved.

submit to Owner and Engineer an initial draft of punch list items to be completed or corrected before final payment.

B. Promptly after Contractor's notification, Owner, Contractor, and Engineer shall make an inspection of the Work to determine the status of completion. If Engineer does not consider the Work substantially complete, Engineer will notify Contractor in writing giving the reasons therefor.

C. If Engineer considers the Work substantially complete, Engineer will deliver to Owner a preliminary certificate of Substantial Completion which will fix the date of Substantial Completion. Engineer shall attach to the certificate a punch list of items to be completed or corrected before final payment. Owner shall have 7 days after receipt of the preliminary certificate during which to make written objection to Engineer as to any provisions of the certificate or attached punch list. If, after considering the objections to the provisions of the preliminary certificate, Engineer concludes that the Work is not substantially complete, Engineer will, within 14 days after submission of the preliminary certificate to Owner, notify Contractor in writing that the Work is not substantially complete, stating the reasons therefor. If Owner does not object to the provisions of the certificate, or if despite consideration of Owner's objections Engineer concludes that the Work is substantially complete, then Engineer will, within said 14 days, execute and deliver to Owner and Contractor a final certificate of Substantial Completion (with a revised punch list of items to be completed or corrected) reflecting such changes from the preliminary certificate as Engineer believes justified after consideration of any objections from Owner.

D. At the time of receipt of the preliminary certificate of Substantial Completion, Owner and Contractor will confer regarding Owner's use or occupancy of the Work following Substantial Completion, review the builder's risk insurance policy with respect to the end of the builder's risk coverage, and confirm the transition to coverage of the Work under a permanent property insurance policy held by Owner. Unless Owner and Contractor agree otherwise in writing, Owner shall bear responsibility for security, operation, protection of the Work, property insurance, maintenance, heat, and utilities upon Owner's use or occupancy of the Work.

E. After Substantial Completion the Contractor shall promptly begin work on the punch list of items to be completed or corrected prior to final payment. In appropriate cases Contractor may submit monthly Applications for Payment for completed punch list items, following the progress payment procedures set forth above.

F. Owner shall have the right to exclude Contractor from the Site after the date of Substantial Completion subject to allowing Contractor reasonable access to remove its property and complete or correct items on the punch list.

15.04 *Partial Use or Occupancy*

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

Copyright© 2018 National Society of Professional Engineers, American Council of Engineering Companies, and American Society of Civil Engineers. All rights reserved.

significant interference with Contractor's performance of the remainder of the Work, subject to the following conditions:

1. At any time, Owner may request in writing that Contractor permit Owner to use or occupy any such part of the Work that Owner believes to be substantially complete. If and when Contractor agrees that such part of the Work is substantially complete, Contractor, Owner, and Engineer will follow the procedures of Paragraph 15.03.A through 15.03.E for that part of the Work.

2. At any time, Contractor may notify Owner and Engineer in writing that Contractor considers any such part of the Work substantially complete and request Engineer to issue a certificate of Substantial Completion for that part of the Work.

3. Within a reasonable time after either such request, Owner, Contractor, and Engineer shall make an inspection of that part of the Work to determine its status of completion. If Engineer does not consider that part of the Work to be substantially complete, Engineer will notify Owner and Contractor in writing giving the reasons therefor. If Engineer considers that part of the Work to be substantially complete, the provisions of Paragraph 15.03 will apply with respect to certification of Substantial Completion of that part of the Work and the division of responsibility in respect thereof and access thereto.

4. No use or occupancy or separate operation of part of the Work may occur prior to compliance with the requirements of Paragraph 6.04 regarding builder's risk or other property insurance.

15.05 *Final Inspection*

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

15.06 *Final Payment*

A. *Application for Payment*

1. After Contractor has, in the opinion of Engineer, satisfactorily completed all corrections identified during the final inspection and has delivered, in accordance with the Contract Documents, all maintenance and operating instructions, schedules, guarantees, bonds, certificates or other evidence of insurance, certificates of inspection, annotated record documents (as provided in Paragraph 7.12), and other documents, Contractor may make application for final payment.

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

   a. all documentation called for in the Contract Documents;

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

   c. satisfactory evidence that all title issues have been resolved such that title to all Work, materials, and equipment has passed to Owner free and clear of any Liens or other title defects, or will so pass upon final payment.

Copyright© 2018 National Society of Professional Engineers, American Council of Engineering Companies, and American Society of Civil Engineers. All rights reserved.

d. a list of all duly pending Change Proposals and Claims; and

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

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

B. *Engineer's Review of Final Application and Recommendation of Payment*: If, on the basis of Engineer's observation of the Work during construction and final inspection, and Engineer's review of the final Application for Payment and accompanying documentation as required by the Contract Documents, Engineer is satisfied that the Work has been completed and Contractor's other obligations under the Contract have been fulfilled, Engineer will, within 10 days after receipt of the final Application for Payment, indicate in writing Engineer's recommendation of final payment and present the final Application for Payment to Owner for payment. Such recommendation will account for any set-offs against payment that are necessary in Engineer's opinion to protect Owner from loss for the reasons stated above with respect to progress payments. 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. *Notice of Acceptability*: In support of its recommendation of payment of the final Application for Payment, Engineer will also give written notice to Owner and Contractor that the Work is acceptable, subject to stated limitations in the notice and to the provisions of Paragraph 15.07.

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

E. *Final Payment Becomes Due*: Upon receipt from Engineer of the final Application for Payment and accompanying documentation, Owner shall set off against the amount recommended by Engineer for final payment any further sum to which Owner is entitled, including but not limited to set-offs for liquidated damages and set-offs allowed under the provisions of this Contract with respect to progress payments. Owner shall pay the resulting balance due to Contractor within 30 days of Owner's receipt of the final Application for Payment from Engineer.

15.07 *Waiver of Claims*

A. By making final payment, Owner waives its claim or right to liquidated damages or other damages for late completion by Contractor, except as set forth in an outstanding Claim,

Copyright© 2018 National Society of Professional Engineers, American Council of Engineering Companies, and American Society of Civil Engineers. All rights reserved.

appeal under the provisions of Article 17, set-off, or express reservation of rights by Owner. Owner reserves all other claims or rights after final payment.

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

15.08 *Correction Period*

A. If within one year after the date of Substantial Completion (or such longer period of time as may be prescribed by the Supplementary Conditions or the terms of any applicable special guarantee required by the Contract Documents), Owner gives Contractor written notice that any Work has been found to be defective, or that Contractor's repair of any damages to the Site or adjacent areas has been found to be defective, then after receipt of such notice of defect Contractor shall promptly, without cost to Owner and in accordance with Owner's written instructions:

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

B. Owner shall give any such notice of defect within 60 days of the discovery that such Work or repairs is defective. If such notice is given within such 60 days but after the end of the correction period, the notice will be deemed a notice of defective Work under Paragraph 7.17.B.

C. If, after receipt of a notice of defect within 60 days and within the correction period, Contractor does not promptly comply with the terms of Owner's written instructions, or in an emergency where delay would cause serious risk of loss or damage, Owner may have the defective Work corrected or repaired or may have the rejected Work removed and replaced. Contractor shall pay all 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). Contractor's failure to pay such costs, losses, and damages within 10 days of invoice from Owner will be deemed the start of an event giving rise to a Claim under Paragraph 12.01.B, such that any related Claim must be brought within 30 days of the failure to pay.

D. 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.

E. Where defective Work (and damage to other Work resulting therefrom) has been corrected or removed and replaced under this paragraph, the correction period hereunder with respect to such Work will be extended for an additional period of one year after such correction or removal and replacement has been satisfactorily completed.

Copyright© 2018 National Society of Professional Engineers, American Council of Engineering Companies, and American Society of Civil Engineers. All rights reserved.

F. Contractor's obligations under this paragraph are in addition to all other obligations and warranties. The provisions of this paragraph are not to be construed as a substitute for, or a waiver of, the provisions of any applicable statute of limitation or repose.

ARTICLE 16—SUSPENSION OF WORK AND TERMINATION

16.01 *Owner May Suspend Work*

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

16.02 *Owner May Terminate for Cause*

A. The occurrence of any one or more of the following events will constitute a default by Contractor and justify termination for cause:

1. Contractor's persistent failure to perform the Work in accordance with the Contract Documents (including, but not limited to, failure to supply sufficient skilled workers or suitable materials or equipment, or failure to adhere to the Progress Schedule);

2. Failure of Contractor to perform or otherwise to comply with a material term of the Contract Documents;

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

4. Contractor's repeated disregard of the authority of Owner or Engineer.

B. If one or more of the events identified in Paragraph 16.02.A occurs, then after giving Contractor (and any surety) 10 days' written notice that Owner is considering a declaration that Contractor is in default and termination of the Contract, Owner may proceed to:

1. declare Contractor to be in default, and give Contractor (and any surety) written notice that the Contract is terminated; and

2. enforce the rights available to Owner under any applicable performance bond.

C. Subject to the terms and operation of any applicable performance bond, if Owner has terminated the Contract for cause, Owner may exclude Contractor from the Site, take possession of the Work, incorporate in the Work all materials and equipment stored at the Site or for which Owner has paid Contractor but which are stored elsewhere, and complete the Work as Owner may deem expedient.

D. Owner may not proceed with termination of the Contract under Paragraph 16.02.B if Contractor within 7 days of receipt of notice of intent to terminate begins to correct its failure to perform and proceeds diligently to cure such failure.

E. If Owner proceeds as provided in Paragraph 16.02.B, Contractor shall not be entitled to receive any further payment until the Work is completed. If the unpaid balance of the Contract Price exceeds the cost to complete the Work, including all related claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects,

Copyright© 2018 National Society of Professional Engineers, American Council of Engineering Companies, and American Society of Civil Engineers. All rights reserved.

attorneys, and other professionals) sustained by Owner, such excess will be paid to Contractor. If the cost to complete the Work including such related claims, costs, losses, and damages exceeds such unpaid balance, Contractor shall pay the difference to Owner. Such claims, costs, losses, and damages incurred by Owner will be reviewed by Engineer as to their reasonableness and, when so approved by Engineer, incorporated in a Change Order. When exercising any rights or remedies under this paragraph, Owner shall not be required to obtain the lowest price for the Work performed.

F. Where Contractor's services have been so terminated by Owner, the termination will not affect any rights or remedies of Owner against Contractor then existing or which may thereafter accrue, or any rights or remedies of Owner against Contractor or any surety under any payment bond or performance bond. Any retention or payment of money due Contractor by Owner will not release Contractor from liability.

G. If and to the extent that Contractor has provided a performance bond under the provisions of Paragraph 6.01.A, the provisions of that bond will govern over any inconsistent provisions of Paragraphs 16.02.B and 16.02.D.

16.03 *Owner May Terminate for Convenience*

A. Upon 7 days' written notice to Contractor and Engineer, Owner may, without cause and without prejudice to any other right or remedy of Owner, terminate the Contract. In such case, Contractor shall be paid for (without duplication of any items):

1. completed and acceptable Work executed in accordance with the Contract Documents prior to the effective date of termination, including fair and reasonable sums for overhead and profit on such Work;

2. expenses sustained prior to the effective date of termination in performing services and furnishing labor, materials, or equipment as required by the Contract Documents in connection with uncompleted Work, plus fair and reasonable sums for overhead and profit on such expenses; and

3. other reasonable expenses directly attributable to termination, including costs incurred to prepare a termination for convenience cost proposal.

B. Contractor shall not be paid for any loss of anticipated profits or revenue, post-termination overhead costs, or other economic loss arising out of or resulting from such termination.

16.04 *Contractor May Stop Work or Terminate*

A. If, through no act or fault of Contractor, (1) the Work is suspended for more than 90 consecutive days by Owner or under an order of court or other public authority, or (2) Engineer fails to act on any Application for Payment within 30 days after it is submitted, or (3) Owner fails for 30 days to pay Contractor any sum finally determined to be due, then Contractor may, upon 7 days' written notice to Owner and Engineer, and provided Owner or Engineer do not remedy such suspension or failure within that time, terminate the contract and recover from Owner payment on the same terms as provided in Paragraph 16.03.

B. In lieu of terminating the Contract and without prejudice to any other right or remedy, if Engineer has failed to act on an Application for Payment within 30 days after it is submitted, or Owner has failed for 30 days to pay Contractor any sum finally determined to be due, Contractor may, 7 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

Copyright© 2018 National Society of Professional Engineers, American Council of Engineering Companies, and American Society of Civil Engineers. All rights reserved.

provisions of this paragraph are not intended to preclude Contractor from submitting a Change Proposal for an adjustment in Contract Price or Contract Times or otherwise for expenses or damage directly attributable to Contractor's stopping the Work as permitted by this paragraph.

ARTICLE 17—FINAL RESOLUTION OF DISPUTES

17.01 *Methods and Procedures*

A. *Disputes Subject to Final Resolution*: The following disputed matters are subject to final resolution under the provisions of this article:

1. A timely appeal of an approval in part and denial in part of a Claim, or of a denial in full, pursuant to Article 12; and

2. Disputes between Owner and Contractor concerning the Work, or obligations under the Contract Documents, that arise after final payment has been made.

B. *Final Resolution of Disputes*: For any dispute subject to resolution under this article, Owner or Contractor may:

1. elect in writing to invoke the dispute resolution process provided for in the Supplementary Conditions;

2. agree with the other party to submit the dispute to another dispute resolution process; or

3. if no dispute resolution process is provided for in the Supplementary Conditions or mutually agreed to, give written notice to the other party of the intent to submit the dispute to a court of competent jurisdiction.

ARTICLE 18—MISCELLANEOUS

18.01 *Giving Notice*

A. Whenever any provision of the Contract requires the giving of written notice to Owner, Engineer, or Contractor, it will be deemed to have been validly given only if delivered:

1. in person, by a commercial courier service or otherwise, to the recipient's place of business;

2. by registered or certified mail, postage prepaid, to the recipient's place of business; or

3. by e-mail to the recipient, with the words "Formal Notice" or similar in the e-mail's subject line.

18.02 *Computation of Times*

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

Copyright© 2018 National Society of Professional Engineers, American Council of Engineering Companies, and American Society of Civil Engineers. All rights reserved.

18.03 *Cumulative Remedies*

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

18.04 *Limitation of Damages*

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

18.05 *No Waiver*

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

18.06 *Survival of Obligations*

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

18.07 *Controlling Law*

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

18.08 *Assignment of Contract*

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

18.09 *Successors and Assigns*

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

18.10 *Headings*

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

Copyright© 2018 National Society of Professional Engineers, American Council of Engineering Companies, and American Society of Civil Engineers. All rights reserved.

SUPPLEMENTARY CONDITIONS

OF THE CONSTRUCTION CONTRACT

TABLE OF CONTENTS

Page

Article 1— Definitions and Terminology 1

Article 2— Preliminary Matters 1

Article 3— Contract Documents: Intent, Requirements, Reuse 2

Article 4— Commencement and Progress of the Work 2

Article 5— Site, Subsurface and Physical Conditions, Hazardous Environmental Conditions 4

5.02 Use of Site and Other Areas 4

Article 6— Bonds and Insurance 5

Article 7— Contractor's Responsibilities 9

7.08 Patent Fees and Royalties 10

SC-7.08 Delete Paragraph 7.08.B in its entirety. 10

Article 8— Other Work at the Site 10

Article 9— Owner's Responsibilities 11

Article 10— Engineer's Status During Construction 11

Article 11— Changes to the Contract 13

Article 12— Claims 13

Article 13— Cost of Work; Allowances, Unit Price Work 14

Article 14— Tests and Inspections; Correction, Removal, or Acceptance of Defective Work 15

Article 15— Payments to Contractor, Set Offs; Completions; Correction Period 16

Article 16— SUSPENSION OF WORK AND TERMINATION 16

No Supplementary Conditions in this Article. 16

Article 17— Final Resolutions of Disputes 16

Article 18— Miscellaneous 17

Copyright© 2018 National Society of Professional Engineers, American Council of Engineering Companies, and American Society of Civil Engineers. All rights reserved.

SUPPLEMENTARY CONDITIONS

OF THE CONSTRUCTION CONTRACT

These Supplementary Conditions amend or supplement EJCDC® C-700, Standard General Conditions of the Construction Contract (2018). The General Conditions remain in full force and effect except as amended.

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

The paragraph address system used in these Supplementary Conditions is the same as the paragraph address system used in the General Conditions, with the prefix "SC" added—for example, “Paragraph SC-4.05.”

ARTICLE 1—DEFINITIONS AND TERMINOLOGY

SC-1.01.A.40 Add the following to Paragraph 1.01.A.40:

Trucking, shipping, delivery firms, consultants, and entities performing testing or inspection retained by Contractor or any Subcontractor are considered to be Subcontractors.

SC-1.01.A.42 Add the following to Paragraph 1.01.A.42:

Substantial Completion is further defined as (i) that degree of completion of the Project’s operating facilities or systems sufficient to provide Owner the full time, uninterrupted, and continuous beneficial operation of the Work; and (ii) required functional, performance and acceptance, or startup testing has been successfully demonstrated for components, devices, equipment, and instrumentation and control to the satisfaction of Engineer in accordance with the requirements of the Specifications.

SC-1.01.A.45 Add the following to Paragraph 1.01.A.45:

Entities that rent construction equipment or machinery, but are not incorporated into the Work, are considered to be Suppliers. If such rental entity furnishes both equipment and one or more personnel to operate and maintain the equipment, such entity is a Subcontractor.

ARTICLE 2—PRELIMINARY MATTERS

2.01 *Delivery of Bonds and Evidence of Insurance*

SC-2.01 Delete Paragraphs 2.01.B. and C. in their entirety and insert the following in their place:

B. *Evidence of Contractor’s Insurance:* When Contractor delivers the signed counterparts of the Agreement to Owner, Contractor shall also deliver to Owner copies of the policies (including all endorsements, and identification of applicable self-insured retentions and deductibles) of insurance required to be provided by Contractor in this Contract. Contractor may block out (redact) any confidential premium or pricing information contained in any policy or endorsement furnished under this provision.

Copyright© 2018 National Society of Professional Engineers, American Council of Engineering Companies, and American Society of Civil Engineers. All rights reserved.

2.02 *Copies of Documents*

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

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

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

A. Owner shall furnish to Contractor one copy of conformed Contract Documents incorporating and integrating all Addenda and amendments, if any, negotiated prior to the Effective Date of the Contract (including one fully signed counterpart of the Agreement), and one copy in electronic portable document format (PDF). Additional paper copies of the conformed Contract Documents will be furnished upon request at the cost of reproduction.

2.06 *Electronic Transmittals*

SC-2.06 Add the following to paragraph 2.06.D:

A. The Owner will use Procore as the construction management tool for the Project, including Owner's license and use fees. Contractor shall integrate with Owner and utilize Procore for the management of the project.

ARTICLE 3—CONTRACT DOCUMENTS: INTENT, REQUIREMENTS, REUSE

3.01 *Intent*

SC-3.01 Add the following new paragraphs immediately after Paragraph 3.01.E:

F. The Specifications and other verbal components of the Contract Documents may vary in form, format, and style. Some Specification sections are written in varying degrees of streamlined or declarative style and some Specifications sections may, in comparison, employ a more-narrative style. Omissions of such words and phrases as "Contractor shall," "in conformity with," "as shown," or "as specified" are intentional in streamlined language in the Contract Documents. Omitted words and phrases are incorporated by inference. Similar types of provisions may appear in various parts of a Specifications section or elsewhere in the Contract Documents. Contractor shall not attempt to take advantage of any variation of form, format or style in Change Proposal(s) and Claim(s).

G. Cross referencing of Specification sections in a Specifications section's heading "Related Sections includes, but are not necessarily limited to: "and elsewhere within each Specifications section is provided as an aid and convenience to Contractor. Contractor shall not rely on cross referencing indicated and is responsible for coordinating the entire Work and providing a complete Project whether or not cross referencing is provided in each Specifications section or whether or not cross referencing is complete.

ARTICLE 4—COMMENCEMENT AND PROGRESS OF THE WORK

4.01 *Commencement of Contract Times; Notice to Proceed*

Copyright© 2018 National Society of Professional Engineers, American Council of Engineering Companies, and American Society of Civil Engineers. All rights reserved.

SC-4.01 Delete Paragraph 4.01.A in its entirety and insert the following paragraph in its place:

A. The Contract Times will commence to run on the day indicated in the Notice to Proceed.

4.05 *Delays in Contractor's Progress*

SC-4.05.C Amend Paragraph 4.05.C by adding the following subparagraphs:

5. *Weather-Related Delays*

a. If "abnormal weather conditions" as set forth in Paragraph 4.05.C.2 of the General Conditions are the basis for a request for an equitable adjustment in the Contract Times, such request must be documented by data substantiating each of the following: (1) that weather conditions were abnormal for the period of time in which the delay occurred, (2) that such weather conditions could not have been reasonably anticipated, and (3) that such weather conditions had an adverse effect on the Work on the critical path at the time of the delay.

b. The existence of abnormal weather conditions will be determined on a month-by-month basis in accordance with the following:

1) Every workday on which one or more of the following conditions exist will be considered a "bad weather day":

i) Total precipitation (as rain equivalent) occurring between 7:00 p.m. on the preceding day (regardless of whether such preceding day is a workday) through 7:00 p.m. on the workday in question equals or exceeds [threshold precipitation quantity] of precipitation (as rain equivalent, based on the snow/rain conversion indicated in Table SC-4.05.C-1—Foreseeable Bad Weather Days .

ii) Ambient outdoor air temperature at 11:00 a.m. is equal to or less than the following low temperature threshold: [temperature] degrees Fahrenheit; or, at 3:00 p.m. the ambient outdoor temperature is equal to or greater than the following high temperature threshold: [temperature] degrees Fahrenheit.

2) Determination of actual bad weather days during performance of the Work will be based on the weather records measured and recorded by [name of the entity operating the weather station] weather monitoring station at [location of the weather monitoring station].

3) Contractor shall anticipate the number of foreseeable bad weather days per month indicated in Table SC-4.05-C-1—Foreseeable Bad Weather Days.

4) In each month, every bad weather day exceeding the number of foreseeable bad weather days established in Table SC-4.05.C-1—Foreseeable Bad Weather Days, will be considered as "abnormal weather conditions." The existence of abnormal weather conditions will not relieve Contractor of the obligation to demonstrate and document that delays caused by abnormal weather are specific to the planned work activities or that such activities thus delayed were on Contractor's then-current Progress Schedule's critical path for the Project.

Copyright© 2018 National Society of Professional Engineers, American Council of Engineering Companies, and American Society of Civil Engineers. All rights reserved.

Table SC-4.05.C-1—Foreseeable Bad Weather Days

Month	Number of Foreseeable Weather Days in Month Based on Precipitation as Rain Equivalent (inches) (1)	Ambient Outdoor Air Temperature (degrees F)	
		Number of foreseeable Bad Weather Days in Month Based on Low Temperature (at 11:00 a.m.)	Number of Foreseeable Bad Weather days in Month Based on High Temperature (at 3:00 p.m.)
January	8	4	0
February	9	1	0
March	8	0	0
April	7	0	0
May	8	0	0
June	7	0	1
July	8	0	1
August	7	0	1
September	5	0	0
October	5	0	0
November	5	0	0
December	9	1	0

Notes:

1. Two Inches of sleet equal one inch of rain. Five inches of wet, heavy snow equal one inch of rain. Fifteen inches of "dry" powder snow equals one inch of rain.

ARTICLE 5—SITE, SUBSURFACE AND PHYSICAL CONDITIONS, HAZARDOUS ENVIRONMENTAL CONDITIONS

5.02 *Use of Site and Other Areas*

SC-5.02 Add the following language to the end of Paragraph 5.02.A.1:

Contractor shall not enter upon nor use property not under Owner control until appropriate easements have been executed and a copy is on file at the Site.

5.03 *Subsurface and Physical Conditions*

SC-5.03 Add the following new paragraphs immediately after Paragraph 5.03.D:

E. There are no reports of explorations or tests of subsurface conditions at or adjacent to the Site that contain Technical Data upon which Contractor may rely.

F. There are no drawings of existing physical conditions at or adjacent to the Site, including those drawings depicting existing surface or subsurface structures at or adjacent to the Site upon which Contractor may rely.

Copyright© 2018 National Society of Professional Engineers, American Council of Engineering Companies, and American Society of Civil Engineers. All rights reserved.

5.04 *Differing Subsurface or Physical Conditions*

SC-5.04.A Add the following new paragraph immediately after Paragraph 5.04.A.4:

5. Contractor encounters human remains, recognizes the existence of burial markers, archaeological sites, historical sites, artifacts of potential archaeological or historical interest, or wetlands not shown or indicated in the Contract Documents, Contractor shall immediately cease operations that may disturb such area(s) and secure the adjacent Work; and Owner shall promptly take any action necessary to obtain governmental authorization required to resume the operations (Contractor shall continue to suspend such operations until otherwise instructed by Owner but shall continue with all other operations that do not affect those remains or features);

SC-5.06 Add the following new paragraphs immediately after Paragraph 5.06.A.3:

5.06.A.4 No reports or drawings related to Hazardous Environmental Conditions are known to the Owner.

ARTICLE 6—BONDS AND INSURANCE

6.01 *Performance, Payment, and Other Bonds*

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

1. *Required Performance Bond Form:* The performance bond that Contractor furnishes will be in the form of EJCDC® C-610, Performance Bond (2018 edition).
2. *Required Payment Bond Form:* The payment bond that Contractor furnishes will be in the form of EJCDC® C-615, Payment Bond (2018 edition).

SC-6.01 Change Paragraph 6.01.E to read as follows:

"…above, then Contractor shall promptly notify Owner and Engineer and shall, within 10 days after the event giving rise to such notification, provide another bond and surety, both of which shall comply with the requirements of Paragraph 6.01.B and 6.02.

6.02 *Insurance—General Provisions*

SC-6.02 Change Paragraph 6.02.B to read as follows:

1. "…all companies that provide insurance policies required under this contract shall have an A.M. Best rating of A+ or better."

6.03 *Contractor's Insurance*

SC-6.03 Supplement Paragraph 6.03 with the following provisions after Paragraph 6.03.C:

D. *Other Additional Insureds:* As a supplement to the provisions of Paragraph 6.03.C of the General Conditions, the commercial general liability, automobile liability, umbrella or excess, pollution liability, and unmanned aerial vehicle liability policies must include as additional insureds (in addition to Owner and Engineer) the following: Forsyth County Water and Sewer Department, 2435 Freedom Parkway, Suite 1200, Cumming, GA 30041; Forsyth County Board of Commissioners, 2435 Freedom Parkway, Suite 1200, Cumming, GA 30041; Freese and Nichols, Inc., 2500 Windy Ridge Parkway, Suite 1200, Atlanta, GA 30339.

Copyright© 2018 National Society of Professional Engineers, American Council of Engineering Companies, and American Society of Civil Engineers. All rights reserved.

D. *Workers' Compensation and Employer's Liability:* Contractor shall purchase and maintain workers' compensation and employer's liability insurance, including, as applicable, United States Longshoreman and Harbor Workers' Compensation Act, Jones Act, stop-gap employer's liability coverage for monopolistic states, and foreign voluntary workers' compensation (from available sources, notwithstanding the jurisdictional requirement of Paragraph 6.02.B of the General Conditions).

Workers' Compensation and Related Policies	**Policy limits of not less than:**
Workers' Compensation	
State	Statutory
Applicable Federal (e.g., Longshoreman's)	Statutory
Foreign voluntary workers' compensation (employer's responsibility coverage), if applicable	Statutory
Jones Act (if applicable)	
Bodily injury by accident—each accident	$1,000,000
Bodily injury by disease—aggregate	$1,000,000
Employer's Liability	
Each accident	$500,000
Each employee	$500,000
Policy limit	$500,000

F. *Commercial General Liability—Claims Covered:* Contractor shall purchase and maintain commercial general liability insurance, covering all operations by or on behalf of Contractor, on an occurrence basis, against claims for:

1. damages because of bodily injury, sickness or disease, or death of any person other than Contractor's employees,
2. damages insured by reasonably available personal injury liability coverage, and
3. damages because of injury to or destruction of tangible property wherever located, including loss of use resulting therefrom.

G. *Commercial General Liability—Form and Content:* Contractor's commercial liability policy must be written on a 1996 (or later) Insurance Services Organization, Inc. (ISO) commercial general liability form (occurrence form) and include the following coverages and endorsements:

1. Products and completed operations coverage.
    a. Such insurance must be maintained for three years after final payment.

Copyright© 2018 National Society of Professional Engineers, American Council of Engineering Companies, and American Society of Civil Engineers. All rights reserved.

b. Contractor shall furnish Owner and each other additional insured (as identified in the Supplementary Conditions or elsewhere in the Contract) evidence of continuation of such insurance at final payment and three years thereafter.

2. Blanket contractual liability coverage, including but not limited to coverage of Contractor's contractual indemnity obligations in Paragraph 7.18.

3. Severability of interests and no insured-versus-insured or cross-liability exclusions.

4. Underground, explosion, and collapse coverage.

5. Personal injury coverage.

6. Additional insured endorsements that include both ongoing operations and products and completed operations coverage through ISO Endorsements CG 20 10 10 01 and CG 20 37 10 01 (together). If Contractor demonstrates to Owner that the specified ISO endorsements are not commercially available, then Contractor may satisfy this requirement by providing equivalent endorsements.

7. For design professional additional insureds, ISO Endorsement CG 20 32 07 04 "Additional Insured—Engineers, Architects or Surveyors Not Engaged by the Named Insured" or its equivalent.

H. *Commercial General Liability—Excluded Content:* The commercial general liability insurance policy, including its coverages, endorsements, and incorporated provisions, must not include any of the following:

1. Any modification of the standard definition of "insured contract" (except to delete the railroad protective liability exclusion if Contractor is required to indemnify a railroad or others with respect to Work within 50 feet of railroad property).

2. Any exclusion for water intrusion or water damage.

3. Any provisions resulting in the erosion of insurance limits by defense costs other than those already incorporated in ISO form CG 00 01.

4. Any exclusion of coverage relating to earth subsidence or movement.

5. Any exclusion for the insured's vicarious liability, strict liability, or statutory liability (other than worker's compensation).

6. Any limitation or exclusion based on the nature of Contractor's work.

7. Any professional liability exclusion broader in effect than the most recent edition of ISO form CG 22 79.

I. *Commercial General Liability—Minimum Policy Limits*

Commercial General Liability	**Policy limits of not less than:**
General Aggregate	$2,000,000
Products—Completed Operations Aggregate	$2,000,000
Personal and Advertising Injury	$1,000,000

Copyright© 2018 National Society of Professional Engineers, American Council of Engineering Companies, and American Society of Civil Engineers. All rights reserved.

Commercial General Liability	Policy limits of not less than:
Bodily Injury and Property Damage—Each Occurrence	$1,000,000

J. *Automobile Liability:* Contractor shall purchase and maintain automobile liability insurance for damages because of bodily injury or death of any person or property damage arising out of the ownership, maintenance, or use of any motor vehicle. The automobile liability policy must be written on an occurrence basis.

Automobile Liability	Policy limits of not less than:
Bodily Injury	
Each Person	$1,000,000
Each Accident	$1,000,000
Property Damage	
Each Accident	$1,000,000
Combined Single Limit	
Combined Single Limit (Bodily Injury and Property Damage)	$1,000,000

K. *Umbrella or Excess Liability:* Contractor shall purchase and maintain umbrella or excess liability insurance written over the underlying employer's liability, commercial general liability, and automobile liability insurance described in the Paragraphs above. The coverage afforded must be at least as broad as that of each and every one of the underlying policies.

Excess or Umbrella Liability	Policy limits of not less than:
Each Occurrence	$2,000,000
General Aggregate	$2,000,000

L. *Using Umbrella or Excess Liability Insurance to Meet CGL and Other Policy Limit Requirements:* Contractor may meet the policy limits specified for employer's liability, commercial general liability, and automobile liability through the primary policies alone, or through combinations of the primary insurance policy's policy limits and partial attribution of the policy limits of an umbrella or excess liability policy that is at least as broad in coverage as that of the underlying policy, as specified herein. If such umbrella or excess liability policy was required under this Contract, at a specified minimum policy limit, such umbrella or excess policy must retain a minimum limit of $10,000,000 after accounting for partial attribution of its limits to underlying policies, as allowed above.

M. *Contractor's Pollution Liability Insurance:* Contractor shall purchase and maintain a policy covering third-party injury and property damage, including cleanup costs, as a result of

Copyright© 2018 National Society of Professional Engineers, American Council of Engineering Companies, and American Society of Civil Engineers. All rights reserved.

pollution conditions arising from Contractor's operations and completed operations. This insurance must be maintained for no less than three years after final completion.

Contractor's Pollution Liability	Policy limits of not less than:
Each Occurrence/Claim	$1,000,000
General Aggregate	$1,000,000

N. *Contractor's Professional Liability Insurance:* If Contractor will provide or furnish professional services under this *Contract*, through a delegation of professional design services or otherwise, then Contractor shall be responsible for purchasing and maintaining applicable professional liability insurance. This insurance must cover negligent acts, errors, or omissions in the performance of professional design or related services by the insured or others for whom the insured is legally liable. The insurance must be maintained throughout the duration of the Contract and for a minimum of two years after Substantial Completion. The retroactive date on the policy must pre-date the commencement of furnishing services on the Project.

Contractor's Professional Liability	Policy limits of not less than:
Each Claim	$1,000,000
Annual Aggregate	$1,000,000

ARTICLE 7—CONTRACTOR'S RESPONSIBILITIES

7.02 *Supervision and Superintendence*

SC-7.02 Add the following to Paragraph 7.02, following Paragraph 7.02.B:

C. Unless Owner otherwise agrees in writing, the superintendent will be Contractor's representative at the Site and shall have authority to act on behalf of Contractor. All communications given to or received from the superintendent shall be binding on Contractor.

7.03 *Labor; Working Hours*

SC-7.03 Add the following new subparagraphs immediately after Paragraph 7.03.C:

1. Regular working hours will be 7:00 a.m. to 7:00 p.m. Monday through Friday, 8:00 a.m. to 6:00 p.m. on Saturday, and on Sunday only with permission of the FCDWS Director.

2. Owner's legal holidays are New Year's Day, Martin Luther King Day, Memorial Day, Independence Day, Labor Day, Veteran's Day, Thanksgiving Day, the Friday after Thanksgiving, Christmas Eve, and Christmas Day .

Copyright© 2018 National Society of Professional Engineers, American Council of Engineering Companies, and American Society of Civil Engineers. All rights reserved.

SC-7.03 Add the following new paragraph immediately after Paragraph 7.03.C:

D. Contractor shall be responsible for the cost of overtime pay and other expense incurred by Owner for Engineer's services (including those of the Resident Project Representative, if any), Owner's representative, and construction observation services, occasioned by the performance of Work on Saturday, Sunday, any legal holiday, or as overtime on any regular work day. If Contractor is responsible but does not pay, or if the parties are unable to agree as to the amount owed, then Owner may impose a reasonable set-off against payments due under Article 15.

7.06 *Substitutes*

SC-7.06 Add the following new subparagraph immediately after Paragraph 7.06.D:

D. Reimbursement rates for Engineer or their officers, directors, members, partners, employees, agents, and other consultants and subcontractors for evaluation of proposed substitutes shall be on the basis established in Article 15 of these Supplementary Conditions.

7.07 *Concerning Subcontractors and Suppliers*

SC-7.07 Add the following language at the end of Paragraph 7.07.A:

A. Contractor shall perform a minimum of 25 percent of the onsite labor with its own employees.

7.08 *Patent Fees and Royalties*

SC-7.08 Delete Paragraph 7.08.B in its entirety.

7.14 *Hazard Communication Programs*

SC-7.14 Add the following new paragraph immediately after Paragraph 7.14.A:

B *Single Prime Contract*: Contractor shall be responsible for coordinating exchange of 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 and Regulations. Contractor shall provide a centralized location for the maintenance of the safety data sheets or other hazard communication information required to be made available by any employer on the Site. Location of the material safety data sheets or other hazard communication information shall be readily accessible to the employees of employers on the Site.

ARTICLE 8—OTHER WORK AT THE SITE

SC-8.01 Add the following new paragraph immediately after Paragraph 8.01.B:

Contractor shall ensure work does not interfere with for public right of way access, access for businesses, homes, school vehicles, emergency vehicles, material storage, and storage of contractor equipment along roadways. Road closures will need to be approved by Owner and any impacted parties to prevent conflicts with other work activities.

Copyright© 2018 National Society of Professional Engineers, American Council of Engineering Companies, and American Society of Civil Engineers. All rights reserved.

ARTICLE 9—OWNER'S RESPONSIBILITIES

9.09 Limitations on Owner's Responsibilities

SC-9.09 Add the following new paragraph immediately after Paragraph 9.09.A:

9.09B - Notwithstanding anything to the contrary herein, nothing contained in this Contract shall be construed to be a waiver of Owner's sovereign immunity or any individual's qualified good faith or official immunities. Any provision of the Contract requiring Owner to indemnify anyone, including Contractor, is only valid to the extent allowed by Georgia law and Owner shall be under no obligation to procure any additional or specific insurance regarding any obligations hereunder.

ARTICLE 10—ENGINEER'S STATUS DURING CONSTRUCTION

10.03 *Resident Project Representative*

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

C. The Resident Project Representative (RPR) will be Owner's representative at the Site. RPR's dealings in matters pertaining to the Work in general will be with Engineer and Contractor. RPR's dealings with Subcontractors will only be through or with the full knowledge or approval of Contractor. The RPR will:

1. *Schedules:* Review and monitor Progress Schedule, Schedule of Submittals, and Schedule of Values as prepared by Contractor and consult with Engineer concerning acceptability.

2. *Conferences and Meetings:* Attend meetings with Contractor, such as preconstruction conferences, progress meetings, job conferences, and other Project-related meetings (but not including Contractor's safety meetings), and as appropriate prepare and circulate copies of minutes thereof.

3. *Liaison*

   a. Serve as Engineer's liaison with Contractor. Working principally through Contractor's authorized representative or designee, assist in providing information regarding the provisions and intent of the Contract Documents.

   b. Assist Engineer in serving as Owner's liaison with Contractor when Contractor's operations affect Owner's on-Site operations.

4. Interpretation of Contract Documents:

   a. Inform Engineer when clarifications and interpretations of the Contract Documents are needed and transmit to Contractor clarifications and interpretations as issued by Engineer.

5. *Submittals*

   a. Receive submittals that are furnished at the Site by Contractor, and notify Engineer of availability for examination. Advise Engineer and Contractor of the commencement of any Work or arrival of materials and equipment at Site, when recognized, requiring a Shop Drawing or Sample if the submittal has not been approved by Engineer.

6. Modifications

Copyright© 2018 National Society of Professional Engineers, American Council of Engineering Companies, and American Society of Civil Engineers. All rights reserved.

a. Consider and evaluate Contractor's suggestions for modifications in Drawings or Specifications and provide recommendations to Engineer; transmit to Contractor, in writing decisions as issued by Engineer.

7. *Review of Work; Defective Work*

   a. Conduct on-Site observations of the Work to assist Engineer in determining, to the extent set forth in Paragraph 10.02, if the Work is in general proceeding in accordance with the Contract Documents.

   b. Observe whether any Work in place appears to be defective. This does not impose on either RPR or Engineer any obligation to find all, or any specific element of, defective Work, for which Contractor remains solely responsible.

   b. Observe whether any Work in place should be uncovered for observation, or requires special testing, inspection or approval.

8. *Inspections and Tests*

   a. Observe Contractor-arranged inspections required by Laws and Regulations, including but not limited to (1) code-required tests and special inspections, and (2) those performed by public or other agencies having jurisdiction over the Work.

   b. Observe specific tests, inspections, and other field quality control required by the Contract Documents and performed by Contractor, Subcontractor, Supplier, or by testing or laboratories retained by any of them, .

   c. Accompany visiting inspectors representing public or other agencies having jurisdiction over the Work.

9. *Records*:

   a. Maintain records for use in preparing Project documentation;

   b. Keep a diary or log book recording pertinent Site conditions, activities, decisions and events;

   c. Record names, addresses, fax numbers, e-mail addresses, web site locations, and telephone numbers of Contractors, Subcontractors, and major Suppliers of materials and equipment.

10. *Reports*:

    a. Furnish Engineer periodic reports of progress of the Work and of Contractor's compliance with the Progress Schedule and Schedule of Submittals;

    b. Immediately notify Engineer of the occurrence of Site accidents, emergencies, acts of God endangering the Work, damage to property by fire or other causes, or the discovery of any Hazardous Environmental Condition; and

    c. Assist Engineer in drafting proposed Change Orders, Work Change Directives, and Field Orders; obtain backup material from Contractor as appropriate.

11. *Payment Requests:* Review Applications for Payment with Contractor and advise Contractor regarding quantities or extent of the Work eligible for payment.

Copyright© 2018 National Society of Professional Engineers, American Council of Engineering Companies, and American Society of Civil Engineers. All rights reserved.

12. *Certificates, Operation and Maintenance Manuals*: During the course of the Work, verify materials and equipment certificates and operation and maintenance manuals and other data required by Specifications to be assembled and furnished by Contractor are applicable to the items actually installed and in accordance with the Contract Documents, and have these documents been delivered to Engineer for review and forwarding to Owner prior to payment for that part of the Work.

13. *Completion*

    a. Participate in Engineer's visits regarding inspection for Substantial Completion.

    b. Assist in the augmenting or amending the punch list of items to be completed or corrected prior to final inspection.

    c. *Final Inspection*: Participate in Engineer's visit to the Site, in the company of Owner and Contractor, regarding completion of the Work, and prepare a final punch list (if any) of items to be completed or corrected by Contractor.

    d. Observe whether items on the final punch list have been completed or corrected.

14. Record Documents: Periodically during the Work, review with Contractor the status of Contractor's record documents required by the Contract Documents and advise Contractor on whether such record documents appear to comply with the Contract's requirements for record documents. Review final record documents submitted by Contractor.

D. The RPR will not:

1. Authorize any deviation from the Contract Documents or substitution of materials, equipment (including "or-equal" items), or procedures or sequences indicated in the Contract Documents.

2. Exceed limitations of Engineer's authority as set forth in the Contract Documents.

3. Undertake any of the responsibilities of Contractor, Subcontractors, or Suppliers.

4. Advise on, issue directions relative to, or assume control or responsibility over any aspect of the means, methods, techniques, sequences or procedures of construction.

5. Advise on, issue directions regarding, or assume control over security protection, or safety practices, precautions, and programs in connection with the activities or operations of Owner or Contractor.

6. Participate in specialized field or laboratory tests or inspections conducted off-site by others except as specifically authorized by Engineer.

7. Accept Shop Drawings or Samples from anyone other than Contractor.

ARTICLE 11—CHANGES TO THE CONTRACT

No Supplementary Conditions in this Article.

ARTICLE 12—CLAIMS

No Supplementary Conditions in this Article.

Copyright© 2018 National Society of Professional Engineers, American Council of Engineering Companies, and American Society of Civil Engineers. All rights reserved.

ARTICLE 13—COST OF WORK; ALLOWANCES, UNIT PRICE WORK

13.01 *Cost of the Work*

SC-13.01.B.5.c.(1) Supplement Paragraph 13.01.B.5.c.(1) by adding the following subparagraphs:

a) Prior to commencing Work at the Site, submit to Owner, through Engineer, copies of the equipment rental agreements for Owner's approval.

b) Should Contractor perform Work using rented construction equipment or machinery without Owner's written approval of the associated rental agreement and the parties subsequently disagree on the applicable rental rates, use of such construction equipment and machinery will be compensated on the basis of the rental rate book indicated in Paragraph SC-13.01.B.5.c.(2).

c) When the rental rate book is used basis for determining compensation for construction equipment and machinery leased from a rental firm, the hourly rate for such equipment shall be determined in accordance with Paragraph 13.01.B.5.(2) of the General Conditions.

SC-13.01.B.5.c.(2) Supplement Paragraph 13.01.B.5.c.(2) by adding the following sentence:

The equipment rental rate book that governs the included costs for the rental of machinery and equipment owned by Contractor (or a related entity) under the Cost of the Work provisions of this Contract is the most current edition of Rental Rate Blue Book published by Equipment Watch. An hourly rate will be computed by dividing the monthly rates by 176. These computed rates will include all operating costs. Costs will include the time the equipment or machinery is in use on the changed Work and the costs of transportation, loading, unloading, assembly, dismantling, and removal when directly attributable to the changed Work. The cost of such equipment or machinery, or parts thereof, shall cease to accrue when the use thereof is no longer necessary for the changed Work.

SC-13.01.B.5.c Supplement Paragraph 13.01.B.5.c by adding the following subparagraphs:

4) *Inactive Equipment and Machinery*: Rental of construction equipment and machinery shall cease when the use thereof is no longer necessary for the Work. Periods of inactivity for such construction equipment or machinery will not be compensable unless agreed upon in writing by Owner, unless the costs of disassembly, removal, transportation, reassembly, and remobilization, as submitted to and accepted by Owner (with advice of Engineer) would exceed the cost of continuing to rent the item(s) during the period(s) of inactivity. Contractor is responsible for obtaining Owner's written approval for compensation for construction equipment and machinery for periods of inactivity. Owner is not responsible for retroactively approving such inactivity. "Period of inactivity" for such items includes periods when the construction equipment or machinery is not used or necessary for the logical and efficient progression of the Work, or when other, available equipment or machinery is suitable for performing the given task.

5) *Condition of Equipment and Machinery*: Construction equipment and machinery will be compensable only for serviceable construction equipment and machinery capable of efficiently performing its intended function at the Site. Construction equipment

Copyright© 2018 National Society of Professional Engineers, American Council of Engineering Companies, and American Society of Civil Engineers. All rights reserved.

and machinery not in compliance with this Paragraph SC-13.01.B.5.c.5) is not eligible for compensation.

6) *Capped Compensation*: Compensation paid Contractor for a given item of Contractor-owned construction equipment or machinery will be capped at, and shall not exceed, the comparable purchase price of such item of equal or comparable capacity and capability.

SC-13.01.C.2 Supplement Paragraph 13.01.C.2 by adding the following definition of small tools and hand tools:

a. For purposes of this paragraph, "small tools and hand tools" means items in one or more of the following categories: (1) Items that are ordinarily required for the performing worker's job function, including but not limited to equipment which ordinarily has no associated licensing, insurance, or substantive storage costs; such as hammers, wrenches, socket tools, manual saws, power saws, chainsaws, common power tools, impact drills, threaders, benders, transits and theodolites and related equipment, and other tools transportable by hand, regardless of ownership of such items; (2) Items such as gang-boxes, ladders, hand carts and similar wheeled items manually operated by workers, extension cords, and similar items; (3) common testing equipment such as insulation testers (megger-testing equipment), amp meters, gas detectors, pressure gauges, and similar items; (4) A purchase price (if purchased new, at retail) of $1000, although such limit is not absolute, and certain items may be deemed by Owner or Engineer as "small tools or hand tools" (and not eligible for compensation) even though such item may have a purchase price greater than the amount indicated in this Paragraph 13.01.C.2.

SC-13.01.B.5 Add the following to the end of Paragraph 13.01.B.5.H:

Express and courier services must be approved prior to use.

SC-13.01.E.1 Add the following new paragraph immediately after Paragraph 13.01.E:

In the event Contractor submits request for additional compensation as a result of a change or differing Site conditions, or as a result of delays, acceleration, or loss of productivity, Owner reserves right, upon written request, to audit and inspect Contractor's books and records relating to the Project. Upon written request for an audit, Contractor shall make its books and records available within 14 days of request. Owner shall specifically designate identity of auditor. As part of audit, Contractor shall make available its books and records relating to the Project, including but not limited to Bidding Documents, cost reports, payroll records, material invoices, subcontracts, purchase orders, daily timesheets, and daily diaries. Audit shall be limited to those cost items which are sought by Contractor in a change order or claim submission to Owner.

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

14.02 *Tests, Inspections, and Approvals*

SC-14.02.D Add the following language at the end of Paragraph 14.02.D:

Tests required by Contract Documents to be performed by Contractor that require test certificates be submitted to Owner or Engineer for acceptance shall be made by an independent testing laboratory or agency licensed or certified in accordance with Laws and Regulations and applicable state and local statutes. In the event state license or certification is not required, testing laboratories or agencies shall meet the following applicable requirements:

Copyright© 2018 National Society of Professional Engineers, American Council of Engineering Companies, and American Society of Civil Engineers. All rights reserved.

14.02.D.6. Basic requirements of ASTM E329, "Standard Specification for Agencies Engaged in Construction Inspection, Testing, or Special Inspection" as applicable.

14.02.D.7. Calibrate testing equipment at reasonable intervals by devices of accuracy, traceable to the National Institute of Standards and Technology or accepted values of natural physical constants.

ARTICLE 15—PAYMENTS TO CONTRACTOR, SET OFFS; COMPLETIONS; CORRECTION PERIOD

15.01 *Progress Payments*

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

A. Twenty days after presentation of the Application for Payment to Owner with Engineer's recommendation, the amount recommended will (subject to the provisions of Paragraph 15.01.E.) become due and when due will be paid by Owner to Contractor.

SC-15.01 Add the following new paragraph immediately after Paragraph 15.01.E.1.a.l:

15.01.E.1.M. Overtime worked by Contractor necessitating Engineer, and their officers, directors, members, partners, employees, agents, and other consultants and subcontractors of each, Resident Project Representative or Resident Project Representative's Site staff, if any, to work extraordinary overtime in accordance with Paragraph 7.03C. of these Supplementary Conditions. For purposes of administering this requirement, additional extraordinary overtime costs are defined as $165 per each extra personnel hour for labor plus expenses.

SC-15.01 Add the following new subparagraph to Paragraph 15.03.B:

SC 15.03.B.1. If some or all of the Work has been determined not to be at a point of Substantial Completion and will require re-inspection or re-testing by Engineer, the cost of such re-inspection or re-testing, including the cost of time, travel and living expenses, shall be paid by Contractor to Owner. If Contractor does not pay, or the parties are unable to agree as to the amount owed, then Owner may impose a reasonable set-off against payments due under Article 15.

SC-15.03.B Add the following new subparagraph to Paragraph 15.03.B:

1. If some or all of the Work has been determined by Engineer not to be at a point of Substantial Completion and will require re-inspection or re-testing by Engineer or other entity retained by Owner, the cost of such re-inspection or re-testing, including the cost of time, travel and living expenses, will be paid by Contractor to Owner. If Contractor does not pay, or the parties are unable to agree as to the amount owed, then Owner may impose a reasonable set-off against payments due under this Article 15.

ARTICLE 16—SUSPENSION OF WORK AND TERMINATION

No Supplementary Conditions in this Article.

ARTICLE 17—FINAL RESOLUTIONS OF DISPUTES

No Supplementary Conditions in this Article.

Copyright© 2018 National Society of Professional Engineers, American Council of Engineering Companies, and American Society of Civil Engineers. All rights reserved.

ARTICLE 18—MISCELLANEOUS

18.08 *Assignment of Contract*

SC-18.12 Add a new paragraph immediately after Paragraph 18.11, to read as follows:

SC-18.12 *Publicity*

A. Contractor shall not disclose to any third party the nature of its Work on the Project, nor engage in publicity or public media disclosures with respect to the Project without the prior written consent of Owner.

Copyright© 2018 National Society of Professional Engineers, American Council of Engineering Companies, and American Society of Civil Engineers. All rights reserved.

DIVISION 01

GENERAL REQUIREMENTS

01 11 00 SUMMARY OF WORK

PART 1 - GENERAL

1.01 SUMMARY

A. Construct Work as described in the Contract Documents.

1. Provide the materials, equipment, and incidentals required to make the Project completely and fully operable.
2. Provide the labor, equipment, tools, and consumable supplies required for a complete Project.
3. Provide the civil, architectural, structural, mechanical, electrical, instrumentation, and all other Work required for a complete and operable Project.
4. Test and place the completed Project in operation.
5. Provide the special tools, spare parts, lubricants, supplies, or other materials as indicated in the Contract Documents for the operation and maintenance of the Project.
6. The Contract Documents do not indicate or describe all Work required to complete the Project. Additional details required for the correct installation of selected products are to be provided by the Contractor and coordinated with the Construction Manager.

1.02 DESCRIPTION OF WORK

A. Work is described in general, non-inclusive terms as:

1. Modifications to the existing Kentmere Lift Station pump control logic and wetwell control elevations, including the installation of two wetwell float switches.
2. Installation of two (2) new flow meter vaults with associated two (2) new magnetic flow meters (6-inch and 8-inch), one 6-inch and one 8-inch actuated plug valves, new yard piping and valves, and associated controls.
3. Approximately 20 linear feet of 8-inch ceramic epoxy lined ductile iron pipe (DIP) at the lift station site, 2,130 linear feet of 6-inch ceramic epoxy lined DIP force main and 265 linear feet of 8-inch polyvinyl chloride (PVC) gravity sewer pipe with associated manholes, valves, and appurtenances.

1.03 WORK UNDER OTHER CONTRACTS

A. Owner has no knowledge of work, other than the Work included in this Contract, which may impact construction scheduling, testing, and startup.

B. Bring any discrepancies in the list to the attention of the Construction Manager. It will be deemed that the Contractor included the more expensive listing in the Contract Price if the Contractor fails to bring any discrepancies to the attention of the Construction Manager prior to executing the Agreement.

C. Completion of the Work described in this Contract may impact the construction and testing of the items listed above.

1. Coordinate construction activities through the Construction Manager.
2. Pay claims for damages which result from the late completion of the Project or any specified Milestones.

1.04 WORK BY OWNER

A. Owner has no knowledge of work, other than the Work included in this Contract that may impact construction scheduling, testing, and startup.

B. Bring any discrepancies between the projects listed above and those specified elsewhere in the Contract Documents to the attention of the Construction Manager. It will be deemed that the Contractor included the more expensive listing in the Contract Price if the Contractor fails to bring any discrepancies to the attention of the Construction Manager prior to executing the Agreement.

C. Completion of the Work described in this Contract may impact the construction and testing of the items listed above.

1. Coordinate construction activities through the Construction Manager.
2. Pay claims for damages which result from the late completion of the Project or any specified Milestones.

D. Owner will provide normal operation and maintenance of the existing facilities during construction, unless otherwise stated.

1.05 CONSTRUCTION OF UTILITIES

A. Existing utilities will be used for this Project. Coordinate with others performing Work associated with this Project.

B. Power and Electrical Services:

1. Provide permanent power connections for the Site through the power utility unless indicated otherwise in the Contract Documents.
2. Pay for permits and for providing permanent power.
3. Coordinate and cooperate with others performing this Work.
4. Power utility will provide the construction to the point shown on the Drawings.
5. Provide conduit, conductors, pull boxes, manholes, and other appurtenances for the installation of power cable between the property line and the transformer and between the transformer and the main power switch unless the Contract Documents indicate otherwise.
6. Test conductors in accordance with the Specifications and requirements of the power utility and coordinate with the power utility to energize the system when ready.
7. Pay for temporary power including construction cost, meter connection, fees, and permits.
8. Contractor may use the permanent power source in lieu of temporary power source when permanent power is available at the Site.

a. Notify Construction Manager and Owner of intent to use the permanent power source.

b. Arrange with the power utility and pay the charges for connections and monthly charges for use of this power.

9. Pay for the power consumed until the Project has been accepted as Substantially Complete unless noted otherwise.

1.06 DEFINITIONS

A. The following abbreviations utilized in this contract are defined below:

1. CM = Construction Manager
2. CP = Change Proposal
3. OPT = Owner's Project Team
4. RPR = Resident Project Representative

END OF SECTION

01 23 10 ALTERNATES AND ALLOWANCES

PART 1 - GENERAL

1.01 SUMMARY

A. Alternates:

1. This Section describes each alternate by number and describes the basic changes to be incorporated into the Work when this alternate is made a part of the Work in the Agreement.
2. The Drawings and Specifications will outline the extent of Work to be included in the alternate Contract Price.
3. Coordinate related Work and modify surrounding Work as required to properly integrate the Work under each alternate, and provide a complete and functional Project as required by the Contract Documents.
4. Alternate Bids or Proposals may be accepted or rejected at the option of the Owner.
5. Owner may incorporate these alternates in the Contract when executed, or may issue a Change Order to incorporate these alternates within 120 days of the opening of Contractor's Bid or Proposal at the prices offered in the Contractor's Bid or Proposal, unless noted otherwise. A Request for a Change Proposal may be issued after 120 days or other designated time period to negotiate a new price for incorporating the Work into the Project.
6. Reference specification section 01 29 01 "Measurement and Basis for Payment" for Alternates included in this project.

B. Allowances:

1. Include the specified allowance amounts in the Contract Price.
2. The amount of each allowance includes:
    a. The cost of the product to the Contractor less any applicable trade discounts;
    b. Delivery to the Site; and
    c. Applicable taxes.
3. Include in the Contract Price all costs for:
    a. Handling at the Site, including unloading, uncrating, and storage per Section 01 31 00 "Project Management and Coordination."
    b. Cost for labor and equipment for installation and finishing.
    c. Cost for related products not specifically listed in the allowance required for installation, including consumable supplies and materials.
    d. All overhead, profit, and related costs.
4. Assist Owner in the selection of products.
    a. Identify qualified Suppliers.

b. Obtain bids or proposals from qualified Suppliers.

c. Present available alternates to the Owner through the Construction Manager. Notify Construction Manager of:

1) Any objections to a particular Supplier or product.

2) Effect on the construction schedule anticipated by the selection of each option.

3) Cost of each option.

5. Upon selection of the product:

a. Purchase and install the product.

b. Contractor's responsibilities for products will be the same as for products selected by the Contractor.

6. Submit a Change Proposal per Section 01 26 00 "Change Management" to adjust the Contract Price if the net cost of the product is more or less than the specified amount.

a. Adjust the unit cost applied to the quantities installed per the method of payment described in General Conditions for products specified as Unit Price Work.

b. Do not perform Work until selection of alternate has been approved by the Owner.

c. Provide actual invoices for the materials.

7. Reference specification section 01 29 01 "Measurement and Basis for Payment" for Allowances included in this project.

1.02 DOCUMENTATION

A. Provide documents for materials furnished as part of each alternate in accordance with Section 01 33 00 "Document Management."

END OF SECTION

01 26 00 CHANGE MANAGEMENT

PART 1 - GENERAL

1.01 REQUESTS FOR CHANGE PROPOSAL

A. Construction Manager will initiate Modifications by issuing a Request for Change Proposal (RCP).

1. Construction Manager and Design Professional will prepare a description of proposed Modifications.

2. Construction Manager will issue the Request for Change Proposal form to Contractor. A number will be assigned to the Request for a Change Proposal when issued.

3. Return a Change Proposal in accordance with Paragraph 1.02 for evaluation by the OPT.

1.02 CHANGE PROPOSALS

A. Submit a Change Proposal (CP) to the Construction Manager for Contractor initiated changes in the Contract Documents or in response to a Request for Change Proposal. Submit the Change Proposal and attach the forms provided by the Construction Manager.

1. Use the Change Proposal form provided by the Construction Manager.

2. Include with the Change Proposal:

a. A complete description of the proposed Modification if Contractor initiated or proposed changes to the OPT's description of the proposed Modification.

b. The reason the Modification is requested, if not in response to a Request for a Change Proposal.

c. A detailed breakdown of the cost of the change if the Modification requires a change in Contract Price. The itemized breakdown is to include:

1) List of materials and equipment to be installed;

2) Man hours for labor by classification;

3) Equipment used in construction;

4) Consumable supplies, fuels, and materials;

5) Royalties and patent fees;

6) Bonds and insurance;

7) Overhead and profit;

8) Field office costs;

9) Home office cost; and

10) Other items of cost.

d. Provide the level of detail outlined in the paragraph above for each Subcontractor or Supplier actually performing the Work if Work is to be provided by a

Subcontractor or Supplier. Indicate appropriate Contractor mark ups for Work provided through Subcontractors and Suppliers. Provide the level of detail outlined in the paragraph above for self-performed Work.

e. Submit Change Proposals that comply with the General Conditions for Cost of Work.

f. Provide a revised schedule. Show the effect of the change on the Project Schedule and the Contract Times.

B. Submit a Change Proposal to the Construction Manager to request a Field Order.

C. A Change Proposal is required for all substitutions or deviations from the Contract Documents.

D. Request changes to products in accordance with Section 01 33 02 “Shop Drawings.”

1.03 CONSTRUCTION MANAGER WILL EVALUATE THE REQUEST FOR A MODIFICATION

A. Construction Manager will issue a Modification per the General Conditions if the Change Proposal is acceptable to the Owner. Construction Manager will issue a Change Order or Contract Amendment for any changes in Contract Price or Contract Times.

1. Change Orders and Contract Amendments will be sent to the Contractor for execution with a copy to the Owner recommending approval. A Work Change Directive may be issued if Work needs to progress before the Change Order or Contract Amendment can be authorized by the Owner.

2. Work Change Directives, Change Orders, and Contract Amendments can only be approved by the Owner.

a. Work performed on the Change Proposal prior to receiving a Work Change Directive or approval of the Change Order or Contract Amendment is performed at the Contractor’s risk.

b. No payment will be made for Work on Change Orders or Contract Amendments until approved by the Owner.

B. Contractor may be informed that the Change Proposal is not approved and construction is to proceed in accordance with the Contract Documents.

1.04 EQUAL NON-SPECIFIED PRODUCTS

A. The products of the listed manufacturers are to be furnished where the Specifications list several manufacturers and do not specifically list “or equal” or “or approved equal” products. Use of any products other than those specifically listed is a substitution. Follow the procedures in Paragraph 1.05 for a substitution.

B. Contractor may submit other manufacturers’ products that are in full compliance with the Specifications where Specifications list one or more manufacturers followed by the phrase “or equal” or “or approved equal.”

1. Submit a Shop Drawing as required by Section 01 33 02 “Shop Drawings” to document that the proposed product is equal or superior to the specified product.

2. Prove that the product is equal. It is not the OPT's responsibility to prove the product is not equal.

    a. Indicate on a point-by-point basis for each specified feature that the product is equal to the Contract Document requirements.

    b. Make a direct comparison with the specified manufacturer's published data sheets and available information. Provide this printed material with the Shop Drawing.

    c. The decision of the Design Professional regarding the acceptability of the proposed product is final.

3. Provide a certification that, in furnishing the proposed product as an equal, the Contractor:

    a. Has thoroughly examined the proposed product and has determined that it is equal or superior in all respects to the product specified.

    b. Has determined that the product will perform in the same manner and result in the same process as the specified product.

    c. Will provide the same warranties and/or bonds as for the product specified.

    d. Will assume all responsibility to coordinate any modifications that may be necessary to incorporate the product into the construction and will waive all claims for additional Work which may be necessary to incorporate the product into the Project which may subsequently become apparent.

    e. Will maintain the same time schedule as for the specified product.

C. A Change Proposal is not required for any product that is in full compliance with the Contract Documents. If the product is not in full compliance, it may be offered as a Substitution.

1.05 SUBSTITUTIONS

A. Substitutions are defined as any product that the Contractor proposes to provide for the Project in lieu of the specified product. Submit a Change Proposal per Paragraph 1.02 along with documents required for a Shop Drawing as required by Section 01 33 02 "Shop Drawings" to request approval of a substitution.

B. Prove that the product is acceptable as a substitute. It is not the Design Professional's responsibility to prove the product is not acceptable as a substitute.

1. Indicate on a point-by-point basis for each specified feature that the product is acceptable to meet the intent of the Contract Documents requirements.

2. Make a direct comparison with the specified Suppliers published data sheets and available information. Provide this printed material with the Shop Drawing.

3. The decision of the Design Professional regarding the acceptability of the proposed substitute product is final.

C. Provide a certification that, in making the substitution request, the Contractor:

1. Has determined that the substituted product will perform in substantially the same manner and result in the same ability to meet the specified performance as the specified product;
2. Will provide the same warranties and/or bonds for the substituted product as specified or as would be provided by the manufacturer of the specified product;
3. Will assume all responsibility to coordinate any modifications that may be necessary to incorporate the substituted product into the Project and will waive all claims for additional Work which may be necessary to incorporate the substituted product into the Project which may subsequently become apparent; and
4. Will maintain the same time schedule as for the specified product.

D. Pay for review of substitutions in accordance with Section 01 33 02 “Shop Drawings.”

END OF SECTION

01 29 01 MEASUREMENT AND BASIS FOR PAYMENT

PART 1 - GENERAL

1.01 PAYMENT FOR MATERIALS AND EQUIPMENT

A. Payment will be made for materials and equipment materials properly stored and successfully incorporated into the Project less the specified retainage.

B. Provide a bill of sale, invoice, or other documentation warranting that Owner has received the materials and equipment free and clear of Liens. Provide documentation of payment for materials and equipment with the next Application for Payment. Remove items from the tabulation of materials and equipment if this documentation is not provided with the next Application for Payment.

C. Provide evidence that the materials and equipment are covered by appropriate property insurance or other arrangements to protect Owner's interest.

D. The Work covered by progress payments becomes the property of the Owner at the time of payment. The Contractor's obligations with regard to proper care and maintenance, insurance, and other requirements are not changed by this transfer of ownership until final acceptance in accordance with the General Conditions.

E. Payment for materials and equipment does not constitute acceptance of the product.

1.02 MEASUREMENT AND BASIS FOR PAYMENTS ON LUMP SUM ITEMS

A. Measurement for progress payments is the invoice value for stored materials and the earned value for all other cost for constructing each item. Earned value is expressed as the value of the Work completed divided by the total value of installation cost. The total amount paid will be equal to the total lump sum amount for that item.

1.03 MEASUREMENT AND BASIS FOR PAYMENTS ON UNIT PRICE ITEMS

A. Measure the Work using the unit of measure indicated in this Section for each unit price line item. Payment will be made only for the actual measured unit and/or computed length, area, solid contents, number, and weight unless other provisions are made in the Contract Documents. Payment on a unit price basis will not be made for Work outside dimensions shown in the Contract Documents.

B. Payment will be made for the actual quantity of Work completed and for materials and equipment stored during the payment period. Payment amount is the Work quantity measured per Paragraph A above multiplied by the unit price for that line item in the Agreement.

1.04 MEASUREMENT AND BASIS FOR PAYMENT FOR BASE ITEMS

A. Item 1 − Mobilization:

1. Measurement: Mobilization shall be measured and paid for on a lump sum basis.

2. Payment: Payment for this item includes the expenses incurred by the Contractor for moving−in of minimum major equipment required for the project and moving out of the same after final acceptance of the work including cleaning−up. Mobilization will

only be allowed for the percentage cost (max 5%) for the Total Base Bid (exclusive of Allowances, Contingencies, and Alternates) for the project. Seventy−five percent (75%) of the total amount shall be payable after mobilization while the remaining twenty−five percent (25%) will be payable after acceptance of the completed project.

B. Item 2 − Disturbed Area Stabilization − Mulching, Grassing, and Seeding (Ds1, Ds2, and Ds3)

1. Measurement: Disturbed area stabilization shall be measured and paid for per square yard (SY). Area measured for payment will be limited to a strip not to exceed the width of the Limits of Disturbance, unless directed by the Engineer / Owner.

2. Payment: The unit price shall include all labor, ground surface preparation, application of fertilizer, lime, mulch and seed and equipment necessary for furnishing, placing, maintenance, inspection, and monitoring of grass. No additional payment shall be made for maintenance or replacement of mulch or grass.

C. Item 3 − Double Row Silt Fence − Sensitive (Sd1−S)

1. Measurement: Silt fence shall be measured per linear foot of double row silt fence complete in place.

2. Payment: The unit price shall include all labor, equipment, and materials necessary for furnishing, placing, maintenance, inspection, monitoring, reporting, and removal of temporary silt fence as specified in the contract documents. No additional payment shall be made for maintenance or replacement of Silt Fence.

D. Item 4 − Tree Protection (Tr)

1. Measurement: Orange barrier fence shall be measured per linear foot complete in place and shall be paid on unit price per LF basis.

2. Payment: The unit price shall include all labor, equipment, and materials necessary for furnishing, placing, maintenance, inspection, monitoring, reporting, and removal of the orange barrier fence as specified in the contract documents. No additional payment shall be made for maintenance or replacement of orange barrier fence.

E. Item 5 − Temporary Stream Crossing (Sr−C, DV−P, Rd, Ss, Sb−S, and Ch)

1. Measurement: Measurement and Payment shall be Lump Sum (LS) for all stream crossings within this contract suitably installed, maintained, and removed per the Manual for Erosion and Sediment control of Georgia, latest edition.

2. Payment: This bid item shall be invoiced as a percentage completed and agreed to with the contractor and the CM. Prior to installation of the temporary stream crossing, the Contractor shall be required to submit construction plans to include sizing of the pipe diameter to convey the required flow. Plans shall be sealed by a registered Professional Engineer in the State of Georgia. Payment shall constitute full compensation for all costs associated with temporary stream crossings and shall include all necessary materials and labor to install, maintain, remove, and dispose. This bid item shall also include restoration of the stream banks meeting GSWCC minimum requirements. This bid item shall include cost of materials and labor for streambank stabilization, slope stabilization, diversion pumping, rock filter dams, rolled erosion control products, and channel stabilization associated with stream crossing. Cost of aggregate, pipe, rip rap and concrete supports shall be included under this item and not in any other bid items.

F. Item 6 − Curb Inlet Filter (Sd2−P)

1. Measurement: Curb inlet filters shall be measured per each installed in place.

2. Payment: The unit price shall include all labor, equipment, and materials necessary for furnishing, placing, maintenance, inspection, monitoring, reporting, and removal of curb inlet filters as specified in the contract documents. No additional payment shall be made for maintenance or replacement of curb inlet filters.

G. Item 7 − Stormdrain Outlet Protection (St)

1. Measurement: Storm drain outlet protection will be counted in place and paid for at the unit price bid for each.

2. Payment: Payment shall be full compensation for all labor, tools, equipment, materials and any incidentals necessary to install, maintain and remove outlet protection. No payment will be made for outlet protection placed without the approval of the Engineer

H. Item 8 − Erosion Control Monthly Maintenance and Monitoring

1. Measurement: Erosion Control Monthly Maintenance and Monitoring shall be paid as a lump sum percentage of the months complete in the project versus the months remaining, per the Contractor Schedule.

2. Payment: The unit price shall include all GSWCC required maintenance and monitoring of erosion control BMPs as well as the maintenance and monitoring items stated in the contract documents.

I. Item 9 − Existing Lift Station Site and Yard Piping Demolition

1. Measurement: Measurement and Payment shall be LS for all demolition and removal of items indicated on the design drawings.

2. Payment: This bid item shall be invoiced as a percentage completed and agreed to with the contractor and the CM. Payment shall constitute full compensation for all costs associated with the existing lift station site and yard piping demolition and shall include all necessary materials and labor to remove and dispose of all materials.

J. Item 10 − Gravel Pad Extension − Lift Station Site

1. Measurement: Gravel shall be measured and paid for per square yard.

2. Payment: Unit price shall include full compensation for all labor, tools, equipment, materials and any incidentals necessary to install gravel on project site.

K. Item 11 − Concrete Pad Extension at Lift Station Site

1. Measurement: Concrete shall be measured and paid for per cubic yard.

2. Payment: Unit price shall include full compensation for all labor, formwork, rebar, trucking costs, tools, equipment, finishing, materials and any incidentals necessary to install concrete on project site.

L. Item 12 – Clearing/Grubbing/Tree Removal

1. Measurement: Clearing, grubbing, and tree removal shall be measured and paid for per square yard. Limits of removal shall be defined by the edge of easement or the limit of disturbance within ROW boundaries.

2. Payment: Payment for the work specified will be made at the square yard price bid for “Clearing and Grubbing”, which payment shall constitute full compensation for labor, equipment, tools, and incidentals necessary to complete the specified work, including refilling of depressions. All costs shall be included in the appropriate bid price of the type of work involved. Bid price to be inclusive of Contractor providing a qualified biologist, per the general notes, to conduct presence/absence surveys prior to execution of clearing, grubbing, or tree removal.

M. Item 13 − Precast Concrete Flowmeter Vault, 6’ x 6’

1. Measurement: Valve vaults will be counted in place and paid for at the unit price bid for each.

2. Payment: Unit price shall include all excavation and backfill, installation of the vault, dewatering, hatches, ladder rungs, sump pit and grate, grout, waterstops, concrete collar around the box and all necessary incidentals to complete the work.

N. Item 14 − Chain Link Fence (6−foot High)

1. Measurement: Contractor to install 6−foot−tall chain link fence with metal posts as directed by the Owner to comply with easement stipulations. Fence shall be measured per linear foot of fencing installed. No payment shall be made for reinstallation of fencing due to Contractor error.

2. Payment: The unit price shall include all tools, labor, equipment, materials and all required incidentals necessary for complete installation of the fencing. No fencing shall be installed prior to coordination with the Owner.

O. Item 15 − 14’ Wide Chain Link Swing Gate

1. Measurement: Contractor to install 6−foot−tall, 14−feet wide chain link swing gate with metal posts as directed by the Owner. Gate shall be measured per each installed. No payment shall be made for reinstallation of fencing due to Contractor error.

2. Payment: The unit price shall include all tools, labor, equipment, materials and all required incidentals necessary for complete installation of the gate. Gate shall not be installed prior to coordination with the Owner.

P. Item 16 − 10’ Wide Double Swing Wooden Gate

1. Measurement: Contractor to install 6−foot−tall, 10−feet wide double swing wooden gate with wooden posts as directed by the Owner. Gate shall be measured per each installed. No payment shall be made for reinstallation of fencing due to Contractor error.

2. Payment: The unit price shall include all tools, labor, equipment, gate latch, materials and all required incidentals necessary for complete installation of the gate. Gate shall not be installed prior to coordination with the Owner.

Q. Item 17 − Bollards

1. Measurement: Bollards shall be measured and paid for on a per each basis.

2. Payment: The unit price shall include all tools, labor, equipment, materials, concrete, expansion joint material, excavation, installation, and all required incidentals necessary to complete the installation of the bollards per the design drawings.

R. Item 18 − Site Grading (Lift Station Area)

1. Measurement: Site grading shall be measured and paid for on a lump sum basis.

2. Payment: The lump sum price shall include all tools, labor, equipment, materials and all required incidentals necessary for complete the site grading per the construction plans.

S. Item 19 − 6−inch Ductile Iron Plug Valve, Valve Box, Actuator, Floor Stand, and Stem Extension

1. Measurement: Ductile iron plug valves, corresponding valve box, actuator, floor stand, and stem extension will be counted in place and paid for at the unit price bid for each.

2. Payment: Unit price shall include plug valves, stem extension, valve box, actuators, excavation, backfill, installation, dewatering, concrete, and all necessary incidentals to complete the work.

T. Item 20 − 8−inch Ductile Iron Plug Valve, Valve Box, Actuator, Floor Stand, and Stem Extension

1. Measurement: Ductile iron plug valves, corresponding valve box, actuator, floor stand, and stem extension will be counted in place and paid for at the unit price bid for each.

2. Payment: Unit price shall include plug valves, stem extension, valve box, actuators, excavation, backfill, installation, dewatering, concrete, and all necessary incidentals to complete the work.

U. Item 21 − 6−inch Bypass Port Assembly w/ 6−inch Ductile Iron Plug Valve and Valve Box

1. Measurement: 6−inch Bypass Port Assembly w/ 6−inch Ductile Iron Plug Valve shall be measured on a lump sum basis.

2. Payment: Unit price shall include plug valves, fittings, gaskets, valve box, restrained joints, ceramic epoxy lined and specified coating ductile iron pipe, excavation, backfill, installation, dewatering, concrete, and all necessary incidentals to complete the work.

V. Item 22 − Ductile Iron Pipe and Fittings (Ceramic Epoxy Lined DIP) − Lift Station Area

1. Measurement: Ductile iron pipe and fittings shall be measured and paid for on a lump sum basis.

2. Payment: The lump sum price shall include all tools, labor, equipment, materials and all required incidentals necessary for complete the installation of ductile iron pipe and

2. fittings per the construction plans. The LS price should include all restraints, dewatering, dismantling joints (flow meter vaults), fittings, connections, bypass pumping (if required), excavation and backfill, specified coatings and linings, and all other incidentals required for pipeline installation.

W. Item 23 − 6−inch Ceramic Epoxy Lined DIP and Fittings

1. Measurement: Ceramic Epoxy Lined Pipe and Fittings will be measured in place and paid for at the unit price bid per linear foot along the centerline of the pipe installed. Trench safety implementation will be measured and included at the unit price bid per linear foot of trench excavation.

2. Payment: The unit price will include all tools, labor, equipment, materials and all other incidentals necessary for complete installation of the pipeline as called for in the drawings and in the contract documents. The unit price bid for DIP installation will also

include and cover excavation (rock excavation covered separately); backfill; dewatering; sheeting; shoring; bedding material; complete furnishing, testing and placing of pipe; detection tape; hauling and disposal of unsuitable materials; all fittings; temporary stabilization; and the disposal of all debris in dressing and finishing after the line is laid. The unit price will include all labor, materials, and equipment necessary for trench safety per OSHA standards and the contract documents.

X. Item 24 − 8−Inch C900 Polyvinyl Chloride (PVC) Pipe

1. Measurement: 8" PVC (C900 DR18) Pipe shall be measured in place and paid for at the unit price bid per linear foot along the centerline of the pipe installed. No deduction in the length of pipe will be made for space occupied by manholes.

2. Payment: The unit price shall include all tools, labor, equipment, materials and all other incidentals necessary for complete installation of the pipeline as called for in the drawings and in the contract documents; including all any incidentals necessary for the testing of sewer mains as required. The unit price bid for PVC pipe shall also include and cover excavation (Rock Excavation Covered Separately), bedding material, dewatering, excavation and backfill, complete furnishing and installing of PVC pipe, temporary stabilization, and the disposal of all debris after the pipe installed. Trench safety implementation shall be measured and included in the unit price.

Y. Item 25 − Witness Markers

1. Measurement: Witness markers shall be counted in place and paid for at the unit price bid for each.

2. Payment: The unit price shall include all tools, labor, equipment, materials and all required incidentals necessary for complete installation of the witness markers.

Z. Item 26 − Concrete Slope Anchors

1. Measurement: Concrete encasement and slope anchors shall be counted in place and paid for at the unit price bid for each.

2. Payment: The unit price shall include all tools, labor, equipment, materials and all required incidentals necessary for complete the installation of concrete encasement and slope anchors per the drawings.

AA. Item 27 − 12−Inch Steel Casing, 0.375−Inch Thickness, Open Cut

1. Measurement: Steel casing crossings shall be measured in place and paid for at the unit price bid per linear foot along the centerline of the pipe installed. Crossing shall utilize the installation method as directed on the plans (trenchless or open cut). Steel casing shall be of the wall thickness designated on the plans.

2. Payment: The unit price shall include all tools, labor, equipment, materials and all other incidentals necessary for excavation, open cutting, dewatering, furnishing and installation of steel casing, and all expenses incidental to completing the work for each crossing. Steel casing, casing spacers, installation method, and any repairs of damages to the area (in like or better condition) for the crossing shall be included in the unit price. The sewer carrier pipeline shall be paid for under the DIP bid item.

BB. Item 28 − Polymer Manhole Base (5−foot depth) − Force Main Connection Manhole

1. Measurement: Force main connection manholes will be measured from the lowest point of the invert to up to 5 feet in depth for each polymer manhole. Manhole bases

shall be counted in place and paid for at the unit price bid for each.

2. Payment: The unit price will include all tools, labor, equipment, materials excavation, dewatering, backfill, hauling and disposal of unsuitable material and all other incidentals necessary for complete installation of the polymer manhole as called for in the drawings and in the contract documents. Manhole ring and cover will be included in the unit price.

CC. Item 29 − Polymer Manhole Base (5−foot depth)

1. Measurement: Manholes will be measured from the lowest point of the invert to up to 5 feet in depth for each polymer manhole. Manhole bases shall be counted in place and paid for at the unit price bid for each.

2. Payment: The unit price will include all tools, labor, equipment, materials excavation, dewatering, backfill, hauling and disposal of unsuitable material and all other incidentals necessary for complete installation of the polymer manhole as called for in the drawings and in the contract documents. Manhole ring and cover will be included in the unit price.

DD. Item 30 − Polymer Manhole Additional Vertical Foot Depth

1. Measurement: Additional vertical footage will be measured from 5−ft from the lowest point at the invert to the top of the concrete casting. Unit price for each vertical foot in excess of five vertical feet will be measured and paid per vertical foot installed of the polymer manhole riser section installed. Any polymer manhole equal to or less than 5−feet in total height will have no additional vertical footage paid for.

2. Payment: The unit price will include all tools, labor, equipment, materials excavation, dewatering, backfill, hauling and disposal of unsuitable material and all other incidentals necessary for complete installation of the manhole as called for in the drawings and in the contract documents. Manhole ring and cover will be included in the unit price.

EE. Item 31 − 2” Air/Vacuum Release Valve Assembly w/ Manhole

1. Measurement: 2” Air/Vacuum Release Valve Assemblies with Manholes will be measured in place per each occurrence installed and will include and all other incidentals necessary for complete installation of the appurtenance and manholes as called for in the drawings and in the contract documents.

2. Payment: The unit price bid per each will include all materials, air/vacuum valves, manholes (base, risers, and tops), stone base, rebar, concrete, valve stems and guides, plug valves, frame and covers, and all other incidentals necessary for complete installation of the air/vacuum valves and manholes as called for in the drawings and in the contract documents.

FF. Item 32 − Manhole Vent Assembly

1. Measurement: Manhole vent assemblies will be measured in place per each occurrence installed and will include and all other incidentals necessary for complete installation of the appurtenances, vents, odor control and miscellaneous items as called for in the drawings and in the contract documents.

2. Payment: The unit price bid per each will include all materials, vent piping and coatings, coring, odor control, insect screens, concrete, and all other incidentals

necessary for complete installation of the manhole vent assembly as called for in the drawings and in the contract documents.

GG. Item 33 − Existing Gravity Sewer Connection

1. Measurement: Connections to existing manholes will be measured in place per each occurrent installed and will include and all other incidentals necessary for complete installation of the pipeline as called for in the drawings and in the contract documents.

2. Payment: The unit price bid per each will include coring to the manhole, installing a boot, field adjusting invert accordingly, installing the connection pipe and all other incidentals necessary for complete installation of the pipeline connection as called for in the drawings and in the contract documents.

HH. Item 34 − Longitudinal Roadway Cut Final Backfill Replacement (Trench Width Only)

1. Measurement: Roadway cut and backfill, as necessary for pipe installation, shall be measured in place and paid for at the unit price bid per square yard.

2. Payment: The unit price shall include the cost of saw cutting, removal, and disposal of the existing road. The unit price shall also include all tools, labor, equipment, materials and all other incidentals necessary for complete installation of the road as outlined in the drawings.

II. Item 35 − Pavement Restoration and Restriping (1.5−Inch Mill and Overlay)

1. Measurement: Pavement restoration and restriping, as necessary for pipe installation, shall be measured in place and paid for at the unit price bid per square yard.

2. Payment: Pavement restoration will span from curb to curb, consisting of 1.5−inch mill and overlay. The unit price shall include the cost of saw cutting, removal, and disposal of the existing pavement. The unit price shall also include all tools, labor, equipment, materials and all other incidentals necessary for complete installation of the pavement as outlined in the drawings.

JJ. Item 36 − Curb and Gutter Repairs

1. Measurement: Curb and Gutter Repairs shall be measured in place and paid for at the unit price bid per linear foot along the face of the curb.

2. Payment: The unit price shall include the removal of existing curb and gutter, furnishing of materials, preparing subgrade or pavement surface, installing, and maintaining curb and gutter. The unit price shall also include all tools, labor, equipment, materials, and all other incidentals necessary for complete installation of the curb and gutter. Curb and gutter to match existing type and size.

KK. Item 37 − Sidewalk Repairs

1. Measurement: Sidewalk Repairs as necessary for pipe installation shall be measured in place and paid for at the unit price bid per square yard. Concrete sidewalks shall be replaced with a minimum thickness of four (4) inches and of a matching width, unless directed otherwise by the Engineer. Replacement of sidewalk shall be from joint to joint, unless specified otherwise by the Owner.

2. Payment: The unit price shall include the cost of saw cutting, removal, and disposal of the existing sidewalk. The unit price shall also include all tools, labor, equipment, materials and all other incidentals necessary for complete installation of the sidewalk.

LL. Item 38 − Flowable Fill Backfill

1. Measurement: Flowable fill will be measured in place and paid for at the unit price bid per cubic yard.
2. Payment: The unit price shall include all costs associated with the material, installation, coordination with vendors/subcontractors, placement, shoring, formwork (if required), dewatering, trenching, etc.

MM. Item 39 – Sand Filter Diaphragm

1. Measurement: Sand filter diaphragms will be counted in place and paid for at the unit price bid for each.
2. Payment: The unit price shall include all tools, labor, equipment, materials and all required incidentals necessary for complete installation of sand filter diaphragms per the drawings.

NN. Item 40 – Traffic Control Plan and Implementation

1. Measurement: Traffic control shall be measured and paid for on a lump sum basis.
2. Payment: The lump sum price shall include all materials, labor and incidentals necessary for the Contractor to prepare a traffic control plan and obtain approval from Forsyth County DOT, as necessary, and provide personnel and equipment to implement the approved plan, including but not limited to traffic barriers, message boards, and all signs.

OO. Item 41 − Bypass Pumping

1. Measurement: Measurement for the Work specified herein will be by lump sum, as the Work progresses, and as required by the Contract Documents
2. Payment: The lump sum price shall include all materials, labor and incidentals necessary for the Contractor to prepare, install, operate, and maintain the bypass piping and pumping system. Partial payment of the lump sum bid item for temporary bypass pumping shall be in accordance with the following:
    a. When initial setup and operation of the temporary bypass pumping system begins, 40 percent of the line item will be paid.
    b. The remaining portion of the line item will be paid when the temporary bypass pumping system operations for the entire job are completed.

PP. Item 42 − Complete Electrical and Instrumentation and Control Work

1. Measurement: Completion of electrical and instrumentation and control work shall be measured and paid for on a lump sum basis.
2. Payment: This lump sum basis includes all mobilization/demobilization, work, labor, materials, dewatering, temporary shoring and bracing, installation, cable and conduits, electrical work, instrumentation and controls work, system integration, flow meters, construction, testing, startup, training, and any other elements included with this scope of work. The Contractor should include all items needed to construct this project in this Lump Sum price.

1.05 MEASUREMENT AND BASIS FOR PAYMENT FOR CONTINGENT WORK ITEMS

A. Item C1: Unsuitable Soil Disposal and Replacement with Suitable Soils

1. Measurement: If excavated native earth fill does not meet the materials specified for this project, Contractor is to remove the required volume of unsuitable soil and dispose of the soil offsite. Acceptable volume of backfill/hauling and determination of unsuitable/suitable materials will be determined and directed by the Owner and Engineer. Unsuitable Soil Disposal and Replacement with Suitable Soils will be measured on a cubic yard basis.

2. Payment: Payment will be made for each cubic yard of unsuitable soils removed and replacement with suitable soils using the unit price in the Bid Form. Such payment will be considered compensation for the excavation and removal of unsuitable soils, furnishing and placement of the suitable soils, all hauling and disposal costs, and all other miscellaneous items required to complete the work. The contractor is to include the cost of bringing in acceptable material as defined in the contract documents above to the job site.

B. Item C2: Rock Excavation, Hauling, and Disposal

1. Measurement: If the Contractor encounters rock during the excavation process, the Contractor is to notify the Owner and EOR immediately. Rock that qualifies for measurement and payment for this line item shall not be excavatable by normal pipeline installation equipment. The Contractor is to remove the required volume of rock and dispose of the soil offsite. Acceptable volume of removal, hauling, and determination of rock materials will be determined and directed by the Owner and Engineer. Rock excavation, hauling, and disposal will be measured on a cubic yard basis.

2. Payment: Payment will be made for each cubic yard of rock removed. Replacement with suitable soils will be paid under the unit price in the Bid Form (C1). Rock excavation, hauling, and disposal payment will be include compensation for the excavation and removal of rock, all hauling and disposal costs, any and all special equipment and labor costs, and all other miscellaneous items required to complete the work.

C. Item C3: Pavement Restoration − Lift Station Area (1.5−Inch Mill and Overlay)

1. Measurement: Pavement restoration and restriping at the lift station area shall be measured in place and paid for at the unit price bid per square yard. The work associated with this line item should be coordinated and approved by the Owner and EOR prior to the Contractor beginning work.

2. Payment: Pavement restoration will span from edge of pavement to edge of pavement, consisting of 1.5−inch mill and overlay. The unit price shall include the cost of saw cutting, removal, and disposal of the existing pavement. The unit price shall also include all tools, labor, equipment, materials and all other incidentals necessary for complete installation of the pavement as outlined in the drawings.

1.06 MEASUREMENT AND BASIS FOR PAYMENT FOR ALLOWANCES

A. Item A1: Owner Directed Allowance

1. Measurement: The purpose for this allowance is to reimburse the Contractor for work

as directed by the Owner. Payment under this allowance shall be full compensation for all tools, labor, equipment, materials, traffic control, and any incidentals necessary for the work directed. The Contractor shall coordinate such work with the lift station site and force main installation.

2. Payment: In order to be eligible for payment under this item, the Contractor must submit a written proposal to the Owner for approval before any work begins. Reimbursement to the Contractor will be paid at the actual cost.

1.07 MEASUREMENT AND BASIS FOR PAYMENT FOR ALTERNATES

A. Item I−1: Alternative Manufacturers

1. Measurement: The Owner's preferred equipment manufacturers are listed in the design specifications. Should the Contractor propose an alternative manufacturer in Specification Section 00 41 13 "Bid Form", the contractor is to include specification, the name of the proposed manufacturer/model, schedule impacts (if any) and the total base bid add/deduct. The Contractor is to populate the List of Key Suppliers in the Contract Documents and include as part of their bid. Measurement for the Alternative Manufacturers (Add/Deduct) will be a lump sum add/deduct to the TOTAL BASE BID.

2. Payment: The Contractor's bid proposal will be evaluated by the TOTAL BASE BID ONLY. It will be at the Owner's sole discretion to evaluate and include the Alternative Manufacturers add/deduct line item in the awarded bid.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

01 31 00 PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.01 SUMMARY

A. Furnish resources required to complete the Project in accordance with the Contract Documents and within the Contract Times.

B. Construct Project in accordance with current safety practices.

C. Manage Site to allow access to Site and control construction operations.

D. Construct temporary facilities to provide and maintain control over environmental conditions at the Site. Remove temporary facilities when no longer needed.

E. Provide temporary controls for pollution, management of water, and management of excess earth as required in Section 01 57 00 “Temporary Controls.”

1.02 STANDARDS

A. Perform Work to comply with:

1. Requirements of the Contract Documents;

2. Laws and Regulations; and

3. Specified industry standards.

1.03 DOCUMENTATION

A. Provide documents in accordance with Section 01 33 00 “Document Management.”

B. Provide copies of Supplier’s printed storage instructions prior to furnishing materials or products and installation instructions prior to beginning the installation.

C. Incorporate field notes, sketches, recordings, and computations made by the Contractor in Record Drawings per Section 01 31 13 “Project Administration.”

1.04 PERMITS

A. Obtain environmental permits required for construction at the Site.

B. Provide other permits required to conduct any part of the Work.

C. Arrange for inspections and certification by agencies having jurisdiction over the Work and include the cost for these inspections and certifications in the Contract Price.

D. Make arrangements with private utility companies and pay fees associated with obtaining services or inspections.

E. Retain copies of permits and licenses at the Site and comply with all regulations and conditions of the permit or license.

1.05 SAFETY REQUIREMENTS

A. Manage safety to protect the safety and welfare of persons at the Site.

B. Provide safe access to move through the Site. Provide protective devices to warn and protect from hazards at the Site.

C. Provide safe access for those performing tests and inspections.

D. Maintain a supply of personal protective equipment for visitors to the Site.

E. Comply with latest provisions of the Occupational Health and Safety Administration (OSHA) and other Laws and Regulations.

F. Provide notification of accidents, injuries, or deaths. Cooperate with accident investigations. Reports not required unless requested by owner. If requested, provide two copies of all reports, including insurance company reports, prepared concerning accidents, injuries, or deaths related to the Project to the Construction Manager as Record Data per Section 01 31 13 “Project Administration.”

1.06 ACCESS TO THE SITE

A. Maintain access to the facilities at all times. Do not obstruct roads, pedestrian walks, or access to the various buildings, structures, stairways, or entrances. Provide safe access for normal operations during construction.

B. Provide adequate and safe access for inspections. Leave ladders, bridges, scaffolding, and protective equipment in place until inspections have been completed. Construct additional safe access if required for inspections.

C. Use roadways for construction traffic only with written approval of the appropriate representatives of each entity. Roadways may not be approved for construction traffic. Obtain written approval to use roads to deliver heavy or oversized loads to the Site. Furnish copies of the written approvals to the Construction Manager as Record Data per Section 01 31 13 “Project Administration.”

1.07 CONTRACTOR’S USE OF THE SITE

A. Limit the use of Site for Work and storage to those areas designated on the Drawings or approved by the Construction Manager. Coordinate the use of the Site with the Construction Manager.

B. Provide security at the Site as necessary to protect against vandalism and loss by theft.

C. Park construction equipment in designated areas only and provide spill control measures as discussed in Section 01 57 00 “Temporary Controls.”

D. Park employees’ vehicles in designated areas only.

E. Obtain written permission of the property owner before entering privately-owned land outside of the Owner’s property, rights-of-way, or easements.

F. Cooperate with public and private agencies with facilities operating within the limits of the Project. Provide 48 hours’ notice to any applicable agency when Work is anticipated to proceed in the vicinity of any facility by using GA811.

G. Conduct of Contractor’s or Subcontractor’s Employees:

1. Do not permit alcoholic beverages or illegal substances on the Site. Do not allow persons under the influence of alcoholic beverages or illegal substances to enter or

remain on the Site at any time. Persons on Site under the influence of alcoholic beverages or illegal substances will be permanently prohibited from returning to the Site. Criminal or civil penalties may also apply.

2. Do not allow the use of offensive language or sexual harassment in any form. These actions will cause immediate and permanent removal of the offender from the premises. Criminal or civil penalties may apply.

3. Do not allow the use, possession, concealment, transportation, promotion, or sale of the following prohibited items anywhere on the Site:

    a. Firearms (including air rifles and pistols and BB or pellet guns) and ammunition;

    b. Bows, crossbows, arrows, bolts, or any other projectile weapons;

    c. Explosives of any kind, including fireworks;

    d. Per Forsyth County Department of Water and Sewer Policy, Knives (and other similar instruments) are not allowed other than those present in the workplace for approved work purposes or for the specific purpose of food preparation and service;

    e. Other weapons prohibited by state Laws and Regulations; and

    f. Any other item that has been designed or intended to be used as a weapon.

    No exceptions will be made for the possession of a firearm by a person that has a valid state-issued license to carry a firearm. Remove any of the prohibited items listed above from the Site immediately and permanently. Any person found to be in possession of any prohibited item must also be removed from the Site and may be reported to local law enforcement.

1.08 PROTECTION OF EXISTING STRUCTURES AND UTILITIES

A. Examine the Site and review the available information concerning the Site. Locate utilities, underground facilities, and existing structures. Verify the elevations of the structures adjacent to excavations. Report any discrepancies from information in the Contract Documents to the Construction Manager before beginning construction.

B. Determine if existing structures, poles, piping, or other utilities at excavations will require relocation or replacement. Prepare a Plan of Action per Section 01 31 13 “Project Administration.” Coordinate Work with local utility company and others for the relocation or replacement.

C. Protect utilities, underground facilities and existing structures unless they are shown to be replaced or relocated on the Drawings. Restore damaged items to the satisfaction of the Owner and utility or property owner.

D. Carefully support and protect all structures and/or utilities so that there will be no failure or settlement where excavation or demolition endangers adjacent structures and utilities. Do not take existing utilities out of service unless required by the Contract Documents or approved by the Construction Manager. Notify and cooperate with the utility owner if it is necessary to move services, poles, guy wires, pipelines, or other obstructions.

E. Protect existing trees and landscaping at the Site by utilizing tree save orange barrier fencing. Mark trees that may be removed during construction and review with the Construction Manager for approval before removing. Protect trees to remain from damage limiting activity, including stockpiling of materials within the drip line of the tree.

F. Protect buildings from damage when handling material or equipment. Protect finished surfaces, including floors, doors, and jambs. Remove doors and install temporary wood protective coverings over jambs, if needed.

1.09 DISRUPTION TO SERVICES/CONTINUED OPERATIONS

A. Owner's facilities are to continue in service as usual during the construction unless noted otherwise. Owner or utilities must be able to operate and maintain the facilities. Keep disruptions to existing utilities, piping, process piping, or electrical services to a minimum.

1. Do not restrict access to critical valves, operators, or electrical panels.

2. Do not store material or products inside structures unless authorized by the Construction Manager.

3. Limit operations to the minimum amount of space needed to complete the specified Work.

4. Maintain storm sewers and sanitary sewers in service at all times. Provide temporary service around the construction or otherwise construct the Work in a manner that flow is not restricted.

B. Provide a Plan of Action in accordance with Section 01 35 00 "Special Procedures" if facilities must be taken out of operation.

1.10 FIELD VERIFICATION

A. Perform complete field measurements prior to purchasing products or beginning construction for products required to fit existing conditions.

B. Verify property lines, control lines, grades, and levels indicated on the Drawings.

C. Verify pipe class, equipment capacities, existing electrical systems, and power sources for existing conditions.

D. Check Shop Drawings and indicate the actual dimensions available where products are to be installed.

E. Include field measurements in Record Documents as required in Section 01 31 13 "Project Administration."

1.11 REFERENCE DATA AND CONTROL POINTS

A. The Design Drawings contain Benchmarks for horizontal control and vertical control.

B. Locate and protect control points prior to starting the Work and preserve permanent reference points during construction. Designated control points may be on an existing structure or monument. Do not change or relocate points without prior approval of the Construction Manager. Notify Construction Manager when a reference point is lost, destroyed, or requires relocation. Replace Project control points on the basis of the original

survey. Control points or benchmarks damaged, disturbed or destroyed as a result of the Contractor's negligence will be restored by the Construction Manager. Owner will impose a set-off as compensation for the effort required.

C. Provide complete engineering layout of the Work needed for construction.

1. Provide competent personnel. Provide equipment including accurate surveying instruments, stakes, platforms, tools, and materials.

2. Provide surveying with accuracy meeting the requirements established for the Georgia Professional Engineers and Land Surveyors Board.

3. Provide Record Data per Section 01 31 13 "Project Administration" and measurements per standards.

1.12 DELIVERY AND STORAGE

A. Deliver products and materials to the Site in time to prevent delays in construction.

B. Deliver packaged products to Site in original undamaged containers with identifying labels attached. Open cartons as necessary to check for damage and to verify invoices. Reseal cartons and store properly until used. Leave products in original packages or other containers until installed. If original packages or containers are damaged, repackage in containers and include packing slips, labels and other information from the original packaging.

C. Deliver products that are too large to fit through openings to the Site in advance of the time enclosing walls and roofs are erected. Set in place, raised above floor on cribs or pallets.

D. Assume full responsibility for the protection and safekeeping of products stored at the Site.

E. Store products at locations acceptable to the Construction Manager and to allow Owner access to maintain and operate existing facilities.

F. Store products in accordance with the Supplier's storage instructions immediately upon delivery. Leave seals and labels intact. Arrange storage to allow access for maintenance of stored items and for inspection. Store unpacked and loose products on shelves, in bins, or in neat groups of like items.

G. Provide additional storage areas as needed for construction. Store products subject to damage by elements in substantial weather-tight enclosures or storage sheds. Provide and maintain storage sheds as required for the protection of products. Provide temperature, humidity control, and ventilation within the ranges stated in the Supplier's instructions. Remove storage facilities at the completion of the Project.

H. Protect the pipe interior. Keep all foreign materials such as dirt, debris, animals, or other objects out of the pipe during the Work.

I. Provide adequate exterior storage for products that may be stored out-of-doors.

1. Provide substantial platforms, blocking, or skids to support materials and products above ground which has been sloped to provide drainage. Protect products from soiling or staining.

2. Cover products subject to discoloration or deterioration from exposure to the elements, with impervious sheet materials. Provide ventilation to prevent condensation below covering.

3. Store loose, granular materials on clean, solid surfaces, or on rigid sheet materials, to prevent mixing with foreign matter.

4. Provide surface drainage to prevent erosion and ponding of water.

5. Prevent mixing of refuse or chemically injurious materials or liquids with stored materials.

6. Pipes and conduits stored outdoors are to have open ends sealed to prevent the entrance of dirt, moisture, and other injurious materials. Protect PVC pipe from ultraviolet light exposure.

7. Store products to prevent wind damage.

J. Protect and maintain mechanical and electrical equipment in storage.

1. Provide Supplier's service instructions on the exterior of the package.

2. Service equipment on a regular basis as recommended by the Supplier. Maintain a log of maintenance services. Submit the log as Record Data per Section 01 31 13 "Project Administration" when Owner assumes responsibility for maintenance and operation.

3. Provide power to and energize space heaters for all equipment for which these devices are provided.

4. Provide temporary enclosures for all electrical equipment, including electrical systems on mechanical devices. Provide and maintain heat in the enclosures until equipment is energized.

K. Maintain storage facilities. Inspect stored products on a weekly basis and after periods of severe weather to verify that:

1. Storage facilities continue to meet specified requirements;

2. Supplier's required environmental conditions are continually maintained; and

3. Products that can be damaged by exposure to the elements are not adversely affected.

L. Replace any stored item damaged by inadequate protection or environmental controls.

M. Payment may be withheld for any products not properly stored.

1.13 CLEANING DURING CONSTRUCTION

A. Provide positive methods to minimize raising dust from construction operations and provide positive means to prevent air-borne dust from disbursing into the atmosphere. Control dust and dirt from demolition, cutting, and patching operations.

B. Clean the Site as Work progresses and dispose of waste materials, keeping the Site free from accumulations of waste or rubbish. Provide containers at the Site for waste collection. Do not allow waste materials or debris to blow around or off of the Site. Control dust from waste materials. Transport waste materials with as few handlings as possible.

C. Comply with Laws and Regulations. Do not burn or bury waste materials. Remove waste materials, rubbish, and debris from the Site and legally dispose of these at public or private disposal facilities.

1.14 MAINTENANCE OF ROADS, DRIVEWAYS, AND ACCESS

A. Maintain roads and streets in a manner that is suitable for safe operations of public vehicle during all phases of construction unless the Owner approves a street closing. Do not close public roads overnight. Coordinate and arrange for emergency vehicle access when streets are to be closed.

B. Submit a Notification by Contractor for Owner's approval of a street closing. The request must state:

1. The reason for closing the street.

2. How long the street will remain closed.

3. Procedures to be taken to maintain the flow of traffic.

a. Steel plates should be utilized to cover trenches to allow homeowners in and out of their driveways during construction.

C. Obtain permits and permissions of the entity that owns the road prior to any Work and provide a copy of the permit or permission Record Data per Section 01 31 13 "Project Administration."

D. Construct temporary detours, including by-pass roads around construction, with adequately clear width to maintain the free flow of traffic at all times. Maintain barricades, signs, and safety features around the detour and excavations. Maintain barricades, signs, and safety features around the Work in accordance with all provisions of the latest edition of the Manual on Uniform Traffic Control Devices (MUTCD).

E. Assume responsibility for any damage resulting from construction along roads or drives.

1.15 BLASTING

A. Blasting is not allowed for any purpose.

1.16 ARCHAEOLOGICAL REQUIREMENTS

A. Cease operations immediately and contact the Owner for instructions if historical or archaeological artifacts are found during construction.

B. Conduct all construction activities to avoid adverse impact of the sites where significant historical or archaeological artifacts are found or identified as an area where other artifacts could be found.

1. Obtain details for working in these areas from regulatory agencies.

2. Maintain confidentiality regarding the site(s) of artifacts.

3. Adhere to the requirements of applicable local, state, and federal Laws and Regulations.

4. Notify the Construction Manager and any local, state, or federal agency as required by applicable Laws and Regulations.

C. Do not disturb archaeological sites.

1. Obtain the services of a qualified archaeological specialist to instruct construction personnel on how to identify and protect archaeological finds on an emergency basis.

2. Coordinate activities to permit archaeological work to take place within the area.

a. Attempt to archaeologically clear areas needed for construction as soon as possible.

b. Provide a determination of priority for such areas.

D. Assume responsibility for any unauthorized destruction that might result to such sites by construction personnel, and pay all penalties assessed by state or federal agencies for non-compliance with these requirements.

E. Contract Times will be modified to compensate for delays caused by such archaeological finds. No additional compensation will be paid for delays.

1.17 ENDANGERED SPECIES RESOURCES

A. Do not perform any activity that is likely to destroy or adversely modify the habitat or jeopardize the continued existence of a threatened or endangered species as listed or proposed for listing under the Federal Endangered Species Act (ESA) or applicable state Laws and Regulations.

B. Cease Work immediately in the area of the encounter and notify the Construction Manager if a threatened or endangered species is encountered during construction. Construction Manager will implement actions in accordance with the ESA and applicable state statutes. Resume construction in the area of the encounter when authorized to do so by the Construction Manager.

1.18 OCCUPANCY

A. Owner has the right to occupy or operate any portion of the Project that is ready for use after notifying the Contractor of its intent to do so.

B. Testing of equipment and appurtenances including specified test periods, training, and startup does not constitute acceptance for operation.

C. Owner may accept the facility for continued use after startup and testing at the option of the Owner. If acceptance is delayed at the option of the Owner, shut down facilities per approved operation and maintenance procedures.

D. The execution of bonds is understood to indicate the consent of the surety to these provisions for occupancy of the structures and use of equipment.

E. Provide an endorsement from the insurance carrier permitting occupancy of the structures and use of equipment during the remaining period of construction.

F. Conduct operations to ensure the least inconvenience to the Owner and general public.

END OF SECTION

01 31 13 PROJECT ADMINISTRATION

PART 1 - GENERAL

1.01 WORK INCLUDED

A. Administer contract requirements to construct the Project. Provide documentation per the requirements of this Section. Provide information as requested by the OPT.

1.02 DOCUMENTATION

A. Provide documents in accordance with Section 01 33 00 “Document Management.”

1.03 COMMUNICATION DURING THE PROJECT

A. Construction Manager is to be the first point of contact for all parties on matters concerning this Project.

B. Construction Manager will coordinate correspondence concerning:

1. Contract administration;
2. Clarification and interpretation of the Contract Documents;
3. Contract modifications;
4. Observation of Work and testing; and
5. Claims.

C. Construction Manager will normally communicate only with the Contractor. Any required communication with Subcontractors or Suppliers will only be with the direct involvement of the Contractor.

D. Direct written communications to the Construction Manager at the address indicated at the pre-construction conference. Include the following with communications as a minimum:

1. Name of the Owner;
2. Project name;
3. Contract title;
4. Project number;
5. Date; and
6. A reference statement.

E. Submit communications on the forms referenced in this Section or in Section 01 33 00 “Document Management.”

1.04 PROJECT MEETINGS

A. Pre-Construction Conference:

1. Attend a pre-construction conference;
2. The location of the conference will be determined by the Construction Manager;

3. The time of the conference will be determined by the Construction Manager, but will be after the Notice of Award is issued and not later than 15 days after the Notice to Proceed is issued;
4. OPT, Contractor's project manager and superintendent, representatives of utility companies, and representatives from major Subcontractors and Suppliers may attend the conference; and
5. Provide and be prepared to discuss:
    a. Preliminary construction schedule per Section 01 33 05 "Construction Progress Schedule";
    b. Preliminary Schedule of Documents per Section 01 33 00 "Document Management";
    c. Schedule of Values and anticipated schedule of payments per the Contract Documents.
    d. List of Subcontractors and Suppliers;
    e. Contractor's organizational chart as it relates to this Project; and
    f. Letter indicating the agents of authority for the Contractor and the limit of that authority with respect to the execution of legal documents, contract modifications, and payment requests.

B. Progress Meetings:
1. Attend meetings with the Construction Manager, Design Professional, and Owner.
    a. Meet monthly or as requested by the Construction Manager to discuss the Project.
    b. Meet at the Site or other location as designated by the Construction Manager.
    c. Contractor's superintendent and other key personnel are to attend the meeting. Other individuals may be requested to attend to discuss specific matters.
    d. Notify the Construction Manager of any specific items to be discussed a minimum of 1 week prior to the meeting.
2. Provide information as requested by the Construction Manager, Design Professional or Owner concerning this Project. Prepare to discuss:
    a. Status of overall project schedule;
    b. Contractor's detailed schedule for the next month;
    c. Anticipated delivery dates for equipment;
    d. Coordination with the Owner;
    e. Status of documents;
    f. Information or clarification of the Contract Documents;
    g. Claims and proposed modifications to the Contract;
    h. Field observations, problems, or conflicts; and

i. Maintenance of quality standards.

3. Construction Manager will prepare a record of meeting proceedings. Review the record of the meeting and notify the Construction Manager of any discrepancies within 10 days of the date the record of the meeting is provided. The record will not be corrected after the 10 days have expired. Corrections will be reflected in the record of the following meeting.

C. Pre-Documentation and Pre-Installation Meetings:

1. Conduct pre-documentation and pre-installation meetings as required in the individual technical Specifications or as determined necessary by the Construction Manager (for example, instrumentation, roofing, concrete mix design, etc.).

2. Set the time and location of the meetings when ready to proceed with the associated Work. Submit a Notification by Contractor in accordance with Paragraph 1.07 for the meeting 2 weeks before the meeting. OPT must approve of the proposed time and location.

3. Attend the meeting and require the participation of appropriate Subcontractors and Suppliers in the meeting.

4. Construction Manager will prepare a record of meeting proceedings. Review the record of the meeting and notify the Construction Manager of any discrepancies within 10 days of the date the record of the meeting is provided. The record will not be corrected after the 10 days have expired. Corrections will be reflected in the record of the following meeting.

D. Weekly Coordination Meetings: Meet on a weekly basis with the Construction Manager or designated on-site representative of the OPT to discuss Work planned for the following week, review coordination issues, testing required, or other issues. Records of these meetings are not required.

E. High Performance Coating Meeting as outlined in Specification Section 09 96 00.01 “High Performance Coatings”.

1.05 REQUESTS FOR INFORMATION

A. Submit a Request for Information to the Construction Manager to obtain additional information or clarification of the Contract Documents.

1. Submit a separate Request for Information for each item on the form provided by the Construction Manager.

2. Attach adequate information to permit a response without further clarification. Construction Manager will return requests that do not have adequate information to the Contractor for additional information. Contractor is responsible for all delays resulting from multiple reviews due to inadequate information.

3. A response will be made when adequate information is provided. The response will be made on the Request for Information form provided by the Construction Manager.

B. Response to a Request for Information is given to provide additional information, interpretation, or clarification of the requirements of the Contract Documents, and does not modify the Contract Documents.

1. Submit a Change Proposal per Section 01 26 00 “Change Management” if a contract modification is suggested or required.

C. Use the Decision Register to document decisions made at meetings and actions to be taken in accordance with Paragraph 1.06.

D. Use the Action Item Register to document assignments for actions to be taken in accordance with Paragraph 1.06.

1.06 DECISION AND ACTION ITEM REGISTER

A. Construction Manager will maintain a Decision Register to document key decisions made during meetings, telephone conversations, or visits to the Site using the format provided by the Construction Manager:

1. Review the Decision Register prior to each regular meeting.

2. Report any discrepancies to the Construction Manager for correction or discussion at the next monthly meeting.

B. Construction Manager will maintain an Action Item Register in conjunction with the Decision Register to track assignments made during meetings, telephone conversations or visits to the Site using the format provided by the Construction Manager:

1. Review the Action Item Register prior to each regular meeting.

2. Report actions taken after the previous progress meeting on items in the register assigned to the Contractor or through the Contractor to a Subcontractor or Supplier to the Construction Manager. Report on status of progress 1 week prior to each progress meeting established in Paragraph 1.04 to allow Construction Manager to update the register prior to the Progress Meetings.

3. Be prepared to discuss the status at each meeting.

C. Decisions or action items in the register that require a change in the Contract Documents will have the preparation of a Modification as an action items if appropriate. The Contract Documents can only be changed by a Modification.

1.07 NOTIFICATION BY CONTRACTOR

A. Notify the Construction Manager of:

1. Need for testing;

2. Intent to work outside regular working hours;

3. Request to shut down facilities or utilities;

4. Proposed utility connections;

5. Required observation by Construction Manager, Engineer, or inspection agencies prior to covering Work; and

6. Training.

B. Provide notification a minimum of 2 weeks in advance to allow OPT time to respond appropriately to the notification.

C. Use the Notification by Contractor form provided by the Construction Manager.

1.08 REQUESTS FOR MODIFICATIONS

A. Submit requests for Modifications per Section 01 26 00 “Change Management.”.

1.09 PLAN OF ACTION

A. Submit a written Plan of Action for approval for shutting down essential services. These include:
   1. Electrical power;
   2. Control power;
   3. Process piping;
   4. Process equipment;
   5. Communications equipment; and
   6. Other designated functions.

B. Describe the following in the Plan of Action:
   1. Scheduled dates for construction;
   2. Work to be performed;
   3. Utilities, piping, or services affected;
   4. Length of time the service or utility will be disturbed;
   5. Procedures to be used to carry out the Work;
   6. Plan of Action to handle emergencies;
   7. List of manpower, equipment, and ancillary supplies;
   8. Backups for key pieces of equipment and key personnel; and
   9. Contingency plan that will be used if the original schedule cannot be met.

C. Submit plan 2 weeks prior to beginning the Work.

1.10 RECORD DATA

A. Submit information required by the Contract Documents that is not related to a product as Record Data using the form provided by the Construction Manager.

1.11 RECORD DOCUMENTS

A. Maintain one complete set of printed Record Documents at the Site including:
   1. Drawings;
   2. Specifications;
   3. Addenda;
   4. Modifications;

5. Product Data and approved Shop Drawings;
6. Construction photographs;
7. Test Reports;
8. Clarifications and other information provided in Request for Information responses; and
9. Reference standards.

B. Store printed Record Documents and Samples in the Contractor's field office.
   1. Record Documents are to remain separate from documents used for construction.
   2. Provide files and racks for the storage of Record Documents.
   3. Provide a secure storage space for the storage of Samples.
   4. Maintain Record Documents in clean, dry, legible conditions, and in good order.
   5. Make Record Documents and Samples available at all times for inspection by the OPT.

C. Maintain an electronic record of Specifications and Addenda to identify products provided in PDF format.
   1. Reference the Product Data number, Shop Drawing number, and O&M manual number for each product and item of equipment furnished or installed.
   2. Reference Modifications by type and number for all changes.

D. Maintain an electronic record of Drawings in PDF format.
   1. Reference the Product Data number, Shop Drawing number, and O&M manual number for each product and item of equipment furnished or installed.
   2. Reference Modifications by type and number for all changes.
   3. Record information as construction is being performed. Do not conceal any Work until the required information is recorded.
   4. Mark drawings to record actual construction.
      a. Depths of various elements of the foundation in relation to finished first floor datum or the top of walls.
      b. Horizontal and vertical locations of underground utilities and appurtenances constructed, and existing utilities encountered during construction.
      c. Location of utilities and appurtenances concealed in the Work. Refer measurements to permanent structures on the surface. Include the following equipment:
         1) Piping;
         2) Ductwork;
         3) Equipment and control devices requiring periodic maintenance or repair;
         4) Valves, unions, traps, and tanks;
         5) Services entrance;

6) Feeders; and

7) Outlets.

d. Changes of dimension and detail.

e. Changes by Modifications.

f. Information in Requests for Information or included in the Decision Register.

g. Details not on the original Drawings. Include field verified dimensions and clarifications, interpretations, and additional information issued in response to Requests for Information.

5. Mark Drawings with the following colors:

a. Highlight references to other documents, including Modifications in blue.

b. Highlight mark ups for new or revised Work (lines added) in red.

c. Highlight items deleted or not installed (lines to be removed) in purple.

d. Highlight items constructed per the Contract Documents in green.

6. Submit Record Documents to Construction Manager for review and acceptance 30 days prior to Final Completion of the Project.

E. Applications for Payment will not be recommended for payment if Record Documents are found to be incomplete or not in order. Final payment will not be recommended without complete Record Documents.

END OF SECTION

01 33 00 DOCUMENT MANAGEMENT

PART 1 - GENERAL

1.01 SUMMARY

A. Submit documentation as required by the Contract Documents and as requested by the Construction Manager.

B. Use the Project Management Information System (PMIS) provided by the OPT. Software for the PMIS is FNiManager which has the following system requirements:

1. Operating Systems: Windows 7 or later and OS X v10.8 or later.

2. Supported Internet Browsers: Internet Explorer 11.0 or later, Google Chrome 70.0 or later, Firefox 63.0 or later, Safari 11.0 or later, and Microsoft Edge 17.0 or later.

3. Screen Resolution: The recommended screen resolution is 1280 x 1024 or higher. The minimum screen resolution required to support all features is 1024 x 768.

1.02 QUALITY ASSURANCE

A. Submit legible, accurate, complete documents presented in a clear, easily understood manner. Documents not meeting these criteria will be returned without review as “Not Approved.”

1.03 CONTRACTOR’S RESPONSIBILITIES

A. Review documents prior to submission. Make certifications as required by the Contract Documents and as indicated on Construction Manager provided forms.

B. Provide a Schedule of Documents to list the documents that are to be submitted and the dates on which documents are to be sent to the Construction Manager for review. Use the form provided by the Construction Manager for this list.

C. Incorporate the dates for processing documents into the Progress Schedule required by Section 01 33 05 “Construction Progress Schedule.”

1. Provide documents in accordance with the schedule so construction of the Project is not delayed.

2. Allow a reasonable time for the review of documents when preparing the Progress Schedule. Assume a 14-day review cycle for each document unless a longer period of time is indicated in the Contract Documents or agreed to by Construction Manager and Contractor.

3. Schedule delivery of review documents to provide all information for interrelated Work at one time.

4. Allow adequate time for processing documents so construction of the Project is not delayed.

1.04 FORMS AND WORKFLOWS

A. Use the forms or workflow process provided by the Construction Manager for project documentation.

1.05 DOCUMENT PREPARATION AND DELIVERY PROCEDURES

A. Deliver documents in electronic format as directed by the Construction Manager.

1. Do not leave any blanks incomplete. If information is not applicable, enter NA in the space provided.

2. Deliver all documents in Portable Document Format (PDF).

a. Create PDF document using Bluebeam Revu software.

b. Create PDF documents from native format files unless files are only available from scanned documents.

c. Rotate pages so that the top of each document appears at the top of the monitor screen when opened in PDF viewing software.

d. Provide PDF document with adequate resolution to allow documents to be printed in a format equivalent to the document original. Documents are to be scalable to allow printing on standard 8-1/2 x 11 or 11 x 17 paper.

e. Submit color PDF documents where color is required to interpret the document.

f. Create or convert documents to allow text to be selected for comments or searched using text search features. Run scanned documents through Optical Character Recognition (OCR) software if necessary.

g. Flatten markups in documents to prevent markups made by Contractor from being moved or deleted. Flatten documents to allow markup recovery.

h. Use Bluebeam Revu software to reduce file size using default settings except the option for “Drop Metadata”. Uncheck the “Drop Metadata” box when reducing file size.

i. Add footers to each document with the name of the Project.

1.06 DOCUMENTATION

A. Furnish documents as indicated in the individual Specification Sections. Submit documents per the procedures described in the Contract Documents.

B. Submit documents per the Specification Sections shown in the following table:

Document Type	Specification Section
Application for Payment	General Conditions
Certified Test Report	01 33 02 for approval of product 01 40 00 to demonstrate compliance
Change Management	01 26 00
Graphic Documentation	01 33 06
Notification by Contractor	01 31 13

Document Type	Specification Section
Operation & Maintenance Manuals	01 33 04
Product Data	01 33 03
Progress Schedules	01 33 05
Record Data	01 31 13
Request for Information	01 31 13
Schedule of Values	Contract Documents
Shop Drawing	01 33 02
Substitutions	01 26 00
Suppliers and Subcontractors	01 31 13 01 33 03

C. Submittals shall be numbered in the format of XXXXXX-YY-ZZ, where:

1. X is the specification number
2. Y is the sequential number of the submittal for that specification
3. Z is the revision number

1.07 Electronic Documents Protocol

A. The parties shall follow the provisions in this Section, referred to as the Electronic Documents Protocol ("EDP"), for exchange of electronic transmittals.

B. Basic Requirements:

1. Except as otherwise stated elsewhere in the Contract Documents, the OPT and Contractor will send and accept Electronic Documents sent by Electronic Means using the protocols provided in this Section.
2. The contents of the information in any Electronic Document will be the responsibility of the transmitting party. Electronic Documents may be used in the same manner as the printed versions of the same documents that are exchanged using non-electronic format and methods, and are subject to the same governing requirements, limitations, and restrictions, set forth in the Contract Documents.
3. Provisions of this Contract regarding Electronic Documents must be incorporated into other agreements or subcontracts on the Project. Nothing in this paragraph reduces or eliminates requirements:
    a. to create, provide, or maintain an original printed record version of Drawings and Specifications, signed and sealed according to applicable Laws and Regulations;
    b. to comply with any applicable Law or Regulation governing the signing and sealing of design documents and related Modifications or the signing and electronic transmission of any other documents; or
    c. to comply with the notice requirements.
4. When sending Electronic Documents by Electronic Means the sending party makes no representations as to long-term compatibility, usability, or readability of the Electronic Documents resulting from the recipient's use of software application packages,

operating systems, or computer hardware differing from those used in the drafting or sending Electronic Documents.

C. System Infrastructure for Electronic Document Exchange:

1. Contractor will provide hardware, operating system(s) software, internet, e-mail, and large file transfer functions ("System Infrastructure") at its own cost. System Infrastructure must comply with these requirements.

2. The maximum size of an email attachment for exchange of Electronic Documents under this EDP is 100 MB. Attachments larger than that may be exchanged in parts or by using large file transfer functions or physical media.

3. Contractor assumes full and complete responsibility for its own costs, delays, deficiencies, and errors associated with converting, translating, updating, verifying, licensing, or otherwise enabling its System Infrastructure, including operating systems and software.

4. Contractor is responsible for its own system operations, security, back-up, archiving, audits, printing resources, and other Information Technology ("IT") for maintaining operations of its System Infrastructure during the Project, including coordination with individual(s) or entity responsible for managing its System Infrastructure and capable of addressing routine communications and other IT issues affecting the exchange of Electronic Documents.

5. Contractor will operate and maintain industry-standard, industry-accepted, ISO standard, commercial-grade security software and systems that are intended to protect others from: software viruses and other malicious software like worms, trojans, adware; data breaches; loss of confidentiality; and other threats in the transmission to or storage of information from the other parties, including transmission of Electronic Documents by physical media such as CD/DVD/flash drive/hard drive. Contractor will not be liable to others for any breach of system security to the extent that Contractor maintains and operates required security software and systems.

6. In the case of disputes, conflicts, or modifications to the use of Electronic Documents required to address issues affecting System Infrastructure, Contractor and OPT will cooperatively resolve the issues; but, failing resolution, OPT is authorized to make and require reasonable and necessary changes meet its original intent. Contractor may submit a Change Proposal if the changes cause additional cost or time to Contractor that could not have reasonably been anticipated.

7. Contractor and OPT are both responsible for their own back-up and archive of documents sent and received during the term of the contract. Contractor and OPT remain solely responsible for its own post-Project back-up and archive of Project documents after the term of the Contract as each party deems necessary for its own purposes.

8. If a Contractor or OPT receives an obviously corrupted, damaged, or unreadable Electronic Document, the receiving party will advise the sending party of the incomplete transmission. The parties will attempt to complete a successful transmission of the Electronic Document or use an alternative delivery method to complete the communication.

9. OPT will operate a project information management system (Project Website) for use of OPT and Contractor during the Project for exchange and storage of Project-related communications and information. Except as otherwise provided in this Contract, use of the Project Website will be mandatory for exchange of Project documents, communications, submittals, and other Project-related information.

D. Software Requirements:

1. OPT and Contractor will each acquire the software and software licenses necessary to create and transmit Electronic Documents and to read and to use any Electronic Documents received from the other party (and if relevant from third parties), using the following software formats:

Document	Document Format
Email	.htm, .rtf, or .txt without formatting that impair legibility of content on screen or in printed copies
Submittals	Bluebeam PDF
Applications for Payment	Bluebeam PDF and Microsoft® Excel
Progress Schedules	PDF and Schedule in Schedule in Native Format (Microsoft Project)
Layouts and drawings to be submitted to Owner for future use and modification	Autodesk® AutoCAD .dwg format
Document submitted to OPT for future word processing use and modification	Microsoft® Word
Spreadsheets and data submitted to OPT for future data processing use and modification	Microsoft® Excel
Photographs	.jpg or .jpeg
Videos	.mp4, .mpeg, or .avi

2. Software will be the version currently published at the time Contract is signed, unless a specific software version is listed in the Supplementary Conditions. Prior to using any updated version of the software required in this section for sending Electronic Documents to the other party, the originating party will first notify and receive concurrence from the other party for use of the updated version or convert to comply with this Section.

3. The parties agree not to intentionally edit, reverse engineer, decrypt, remove security or encryption features, or convert to another format for modification purposes any Electronic Document or information contained therein that was transmitted in a software data format, including Portable Document Format (PDF), intended by sender not to be modified, unless the receiving party obtains the permission of the sending party or is citing or quoting excerpts of the Electronic Document for Project purposes.

E. Requests by Contractor for Electronic Documents in Other Formats:

1. Release of any Electronic Documents developed during the design process (including Contract Documents, Technical Data, Drawings, and computer models) in formats other than those identified in this Section will be at the discretion of the OPT.

2. To the extent determined by OPT, release of Electronic Documents and other project information requested by Contractor ("Request") in formats other than those identified in this Section will be subject to the provisions of Owner's response to the Request, and to the following conditions:

    a. The content included in the Electronic Documents covered by the Request was prepared by Design Professional as an internal working document or electronic computer model solely for Design Professional's purposes and not for any construction processes and is being provided to Contractor on an "AS IS" basis without any warranties of any kind, including, any implied warranties of fitness for any purpose. Contractor is advised and acknowledges that the content may not be suitable for Contractor's application or may require substantial modification and independent verification by Contractor. The content may include limited resolution of models, not-to-scale schematic representations and symbols, use of notes to convey design concepts in lieu of accurate graphics, approximations, graphical simplifications, undocumented intermediate revisions, and other devices that may affect subsequent reuse.

    b. Electronic Documents containing text, graphics, metadata, or other types of data that are provided by Design Professional to Contractor under the Request are only for convenience of Contractor. Any conclusion or information obtained or derived from such data will be at the Contractor's sole risk and Contractor waives any claims against the Design Professional or Owner arising from use of data in Electronic Documents covered by the Request.

    c. **CONTRACTOR SHALL INDEMNIFY AND HOLD HARMLESS THE OWNER AND DESIGN PROFESSIONAL AND THEIR SUBCONSULTANTS FROM ALL CLAIMS, DAMAGES, LOSSES, AND EXPENSES, INCLUDING ATTORNEYS' FEES AND DEFENSE COSTS ARISING OUT OF OR RESULTING FROM THE CONTRACTOR'S USE, ADAPTATION, OR DISTRIBUTION OF ANY ELECTRONIC DOCUMENTS PROVIDED UNDER THE REQUEST.**

    d. Contractor agrees not to sell, copy, transfer, forward, give away or otherwise distribute this information (in source or modified file format) to any third party without the direct written authorization of Design Professional, unless such distribution is specifically identified in the Request and is limited to the Contractor's subcontractors. Contractor warrants that subsequent use by the Contractor's subcontractors complies with all terms of the Contract Documents and the Owner's response to Request.

3. In the event that Owner elects to provide or directs Design Professional to provide to Contractor any Contractor-requested Electronic Document versions of project information that is not explicitly identified in the Contract Documents as being available to Contractor, Owner shall be reimbursed by Contractor on an hourly basis for any costs necessary to create or otherwise prepare the data in a manner deemed appropriate by Design Professional in accordance with the General Conditions.

END OF SECTION

01 33 02 SHOP DRAWINGS

PART 1 - GENERAL

1.01 SUMMARY

A. Shop Drawings are required for those products that cannot adequately be described in the Contract Documents to allow fabrication, erection, or installation of the product without additional detailed information from the Supplier.

B. Submit Shop Drawings as required by the Contract Documents and as reasonably requested by the Construction Manager to:

1. Record the products incorporated into the Project;

2. Provide detailed information for the products proposed for the Project regarding their fabrication, installation, commissioning, and testing; and

3. Allow the Design Professional to advise the Owner if products proposed for the Project by the Contractor conform, in general, to the design concepts of the Contract Documents.

C. Contractor's responsibility for full compliance with the Contract Documents is not relieved by the review of Shop Drawings, Samples, or mockups.

D. Submit a Change Proposal per Section 01 26 00 "Change Management" to request modifications to the Contract Documents, including those for approval of "or equal" products when specifically allowed by the Contract Documents or as a substitution for specified products or procedures. Deviations from the Contract Documents can only be approved by Change Order or Field Order.

1.02 QUALITY ASSURANCE

A. Submit legible, accurate, and complete documents presented in a clear, easily understood manner. Shop Drawings not meeting these criteria will not be approved.

B. Demonstrate that the proposed products are in full compliance with the design criteria and requirements of the Contract Documents, or will be if deviations requested per Paragraph 1.10 are approved.

C. Furnish and install products that fully comply with the information included in the Shop Drawings.

1.03 CONTRACTOR'S RESPONSIBILITIES

A. Shop Drawings are required for the following items:

Specification Section	Shop Drawing Description
02 96 00	Temporary Bypass Pumping and/or Piping System
03 41 19	Precast Reinforced Concrete Valve Vault
26 05 19	Low Voltage Wire

Specification Section	Shop Drawing Description
25 05 23	Backboards, Category 5e Balanced Twisted Pair Cable, Category 6 Balanced Twisted Pair Cable, Category 6a Balanced Twisted Pair Cable, Balanced Twisted Pair Cable Hardware, Twin-axial Data Highway Cable, RS-232 Cable, RS-485 Cable, Low-voltage Control Cable, Control-Circuit Conductors, Fire-alarm Wire and Cable, Optical-fiber Cable, Optical-fiber Cable Hardware, UTP Cable, UTP Cable Hardware, Triad Shielded Cable (RTD Cable)
26 27 26	List of Legends and Description of Materials and Process Used for Premarking Wall plates
26 28 16	Enclosed Switches, Circuit Breakers
26 29 13.19	Control Panel Layout, Wiring Diagrams, Heat Rise Calculations, UPS Battery Calculations
26 29 16	Motor Operators for Valves, Complete Sizing Calculations
32 31 13	Fences, Gates, Posts, Rails, Tension Wires, Details of Extended Posts, Extension Arms, Gate Swing, or Other Operation, Hardware, and Accessories, Gate Operator, Wiring Diagrams
32 31 29	Fences, Gates, Posts, Rails, Tension Wires, Details of Extended Posts, Extension Arms, Gate Swing, or Other Operation, Hardware, and Accessories
33 05 01.02	DI Pipe, Mechanical Joint Connections, Connections to Differing Pipe Materials
33 05 01.13	Sanitary Sewer Pipe (PVC)
33 39 13	Manhole Sections, Concrete Batch Mix for Cast-in-Place Sections
40 05 62	Eccentric Plug Valves
40 61 21	Process Control System Testing
40 66 33	Wiring Diagrams and Installation Details of Telecommunications Equipment
40 67 00	Load Calculations
40 71 13	Cover Sheet Listing Each Instrument Being Provided, Component Manufacturing Data Sheet, Product Cut Sheets, Component Drawing, Full Description of Operation, Complete Schematic Diagram, Special Equipment Warranty
40 72 76	Cover Sheet Listing Each Instrument Being Provided, Product Cut Sheets, Component Drawing, Wiring Schematic, Full Description of Operation, Complete Schematic Diagram

B. Include Shop Drawings in the Document Register required by Section 01 33 00 “Document Management” to indicate the Shop Drawings to be submitted, the dates on which Shop Drawings are to be sent to the Construction Manager for review, and proposed dates that the product will be incorporated into the Project.

C. Incorporate the dates for processing Shop Drawings into the Progress Schedule required by Section 01 33 05 “Construction Progress Schedule.”

1. Submit Shop Drawings in accordance with the schedule so construction of the Project is not delayed.

2. Submit Shop Drawings for interrelated Work at one time.

3. Allow adequate time for ordering, fabricating, delivering, and installing products so construction of the Project is not delayed.

D. Complete the following before submitting a Shop Drawing or Sample:

1. Prepare and review the Shop Drawing or Sample. Coordinate the Shop Drawing or Sample with other Shop Drawings and Samples, with the requirements of the Work, and the Contract Documents;

2. Determine and verify specified performance and design criteria, installation requirements, materials, catalog numbers, and similar information with respect to Shop Drawings and Samples;

3. Determine and verify the suitability of materials and equipment offered with respect to the indicated application, fabrication, shipping, handling, storage, assembly, and installation pertaining to the performance of the Work; and

4. Determine and verify information relative to Contractor's responsibilities for means, methods, techniques, sequences, and procedures of construction, and safety precautions and programs incident thereto.

E. Determine and verify:

1. Field measurements, quantities, and dimensions are shown on the Shop Drawing and are accurate;

2. Location of existing structures, utilities, and equipment related to the Shop Drawing have been shown and conflicts between the products, existing structures, utilities, and equipment have been identified;

3. Conflicts that impact the installation of the products have been brought to the attention of the Construction Manager;

4. Shop Drawing is complete for its intended purpose; and

5. Conflicts between the Shop Drawing related to the various Subcontractors and Suppliers have been resolved.

F. Review Shop Drawings prior to submitting to the Construction Manager. Certify that all Shop Drawings have been reviewed by the Contractor and are in strict conformance with the Contract Documents as modified by Addenda, Change Order, Field Order, or Contract Amendment when submitting Shop Drawings except for deviations specifically brought to the Construction Manager's attention on an attached Shop Drawing Deviation Request form in accordance with Paragraph 1.10.

G. Fabrication or installation of any products prior to the approval of Shop Drawings is done at the Contractor's risk. Defective products may be rejected at the Owner's option.

H. Payment will not be made for products for which Shop Drawings or Samples are required until these are approved by the Construction Manager and Design Professional.

1.04 DOCUMENTATION

A. Provide adequate information in Shop Drawings and with Samples so the Design Professional can:

1. Assist the Owner in selecting colors, textures, or other aesthetic features.

2. Compare the proposed features of the product with the specified features and advise Owner that the product does, in general, conform to the Contract Documents.

3. Compare the performance features of the proposed product with those specified and advise the Owner that the product does, in general, conform to the performance criteria specified in the Contract Documents.

4. Review required certifications, guarantees, warranties, and service agreements for compliance with the Contract Documents.

B. Include a complete description of the material or equipment to be furnished, including:

1. Type, dimensions, size, arrangement, model number, and operational parameters of the components;

2. Weights, gauges, materials of construction, external connections, anchors, and supports required;

3. Performance characteristics, capacities, engineering data, motor curves, and other information necessary to allow a complete evaluation of mechanical components;

4. All applicable standards;

5. Fabrication and installation drawings, setting diagrams, manufacturing instructions, templates, patterns, and coordination drawings;

6. Wiring and piping diagrams and related controls;

7. Mix designs for concrete, asphalt, or other materials proportioned for the Project; and

8. Complete and accurate field measurements for products which must fit existing conditions. Indicate on the document that the measurements represent actual dimensions obtained at the Site.

C. Submit Shop Drawings that require coordination with other Shop Drawings for fabrication at the same time. Shop Drawings requiring coordination with other Shop Drawings will not be approved until a complete package is submitted, unless approved by the Construction Manager.

D. Submit information for all of the components and related equipment required for a complete and operational system in one Submittal.

1. Include electrical, mechanical, and other information required to indicate how the various components of the system function together as a system.

2. Provide certifications, warranties, and written guarantees and service contracts with the document package for review when these are required.

1.05 SPECIAL CERTIFICATIONS AND REPORTS

A. Provide all required special certifications, reports, and other documentation with the Shop Drawings as specified in the individual Specification Sections which may include:

1. Certified Test Reports (CTR): A report prepared by an approved testing agency giving results of tests performed on products to indicate their compliance with the Specifications. This report is to demonstrate that the product, when installed, will meet the requirements of the Contract Documents and is part of the Shop Drawing. Field tests may be performed by the Owner to determine that in place materials or products meet the same quality as indicated in the CTR submitted as part of the Shop Drawing.

2. Certification of Local Field Service (CLS): A certified letter stating that field service is available from a factory or supplier approved service organization located within a 300-mile radius of the Site. Include the names, addresses, and telephone numbers of approved service organizations with the certificate.

3. Certification of Adequacy of Design (CAD): A certified letter from the manufacturer of the equipment stating that the equipment has been designed to be structurally stable and to withstand all imposed loads without deformation, failure, or adverse effects to the performance and operational requirements of the unit. The letter must state that mechanical and electrical components have been adequately sized to be fully operational for the conditions specified or normally encountered by the product's intended use.

4. Certification of Applicator/Subcontractor (CSQ): A certified letter stating that the applicator or subcontractor proposed to perform a specified function is duly designated as factory authorized and trained for the application of the specified product.

1.06 WARRANTIES AND GUARANTEES

A. Provide all required warranties, guarantees, and related documents with the Shop Drawing. The effective date of warranties and guarantees will be the date of Substantial Completion.

B. Identify all extended warranties which are defined as any guarantee of performance for the product or system beyond the one-year correction period described in the General Conditions. Issue the warranty certificate in the name of the Owner. Provide a warranty bond for extended warranties if required by the individual Specification Sections.

C. Include an additional copy of equipment warranties in operation and maintenance manuals.

D. Provide a copy of all warranties in a separate document in accordance with Section 01 70 00 "Execution and Closeout Requirements."

1.07 EXTENDED SERVICE AGREEMENTS

A. Provide Extended Service Agreements and related documents with the Product Data. An Extended Service Agreement is a contract between the Owner and an approved Subcontractor or Supplier to provide service and or maintenance beyond that required to

fulfill requirements for warranty repairs, or to perform routine maintenance for a definite period beyond the one-year correction period specified in the General Conditions.

B. An Extended Service Agreement does not relieve the Contractor from obligations under the one-year correction period or warranty provisions specified in the General Conditions.

C. An Extended Service Agreement does not relieve the Contractor from obligations under the maintenance bond, if a maintenance bond is required by the Contract.

D. Requirements for the Extended Service Agreement are described in the Specification Sections for each piece of equipment or system requiring an Extended Service Agreement.

E. Enter into a contract with the service provider and assign the service contract to the Owner on the date Substantial Completion. Once assigned to the Owner, Contract requirements for the Extended Service Agreement will be complete and will not extend the Contract between the Owner and Contractor.

F. Owner may require that a performance bond be provided for the Extended Service Agreement. Provide a separate bond meeting the same requirements as those for the Contractor's performance bond if required. The bond will be in the amount of the Extended Service Agreement.

G. Include an additional copy of Extended Service Agreements in operation and maintenance manuals.

H. Provide a copy of Extended Service Agreements in a separate document in accordance with Section 01 70 00 "Execution and Closeout Requirements."

1.08 SHOP DRAWING SUBMITTAL PROCEDURES

A. Submit Shop Drawings to the Construction Manager. Send all documents in digital format for processing.

1. Provide all information requested. Do not leave any blanks incomplete. If information is not applicable, enter NA in the space provided.

2. Submit all documents in Portable Document Format (PDF) as required by Section 01 33 00 "Document Management." Provide color PDF documents where color is required to interpret the Shop Drawing. Provide Samples and color charts per Paragraph 1.09.

3. Submit each specific product, class of material, or equipment system separately so these can be tracked and processed independently. Do not submit Shop Drawings for more than one independent system in the same Submittal.

4. Submit items specified in different Specification Sections separately unless they are part of an integrated system.

5. Define abbreviations and symbols used in Shop Drawings.

a. Use terms and symbols in Shop Drawings consistent with the Contract Drawings.

b. Provide a list of abbreviations and their meaning as used in the Shop Drawings.

c. Provide a legend for symbols used on Shop Drawings.

6. Mark Shop Drawings to reference:
    a. Related Specification Sections;
    b. Drawing number and detail designation;
    c. Equipment designation or name;
    d. Schedule references;
    e. System into which the product is incorporated; and
    f. Location where the product is incorporated into the Project.

B. Use the following conventions to markup Shop Drawings for review:
    1. Make comments and corrections in the color blue. Add explanatory comments to the markup.
    2. Highlight items in black (redact) that are not being furnished when the Supplier's standard drawings or information sheets are provided so that only the products to be provided are in their original color.
    3. Make comments in yellow where selections or decisions by the Design Professional are required, but such selections do not constitute a deviation from the Contract Documents. Add explanatory comments to the markup to indicate the action requested of the Design Professional.
    4. Make comments in orange that are deviation requests. Include the deviation request number on the Shop Drawing that corresponds to the deviation request on the Shop Drawing Deviation Request form. Include explanatory comments in the Shop Drawing Deviation Request form.
    5. Mark dimensions with the prefix "FD" to indicate field verified dimensions on the Shop Drawings.

C. Designate a document as requiring priority treatment to place the review of the Shop Drawing ahead of other Shop Drawings previously delivered. Shop Drawings are typically reviewed in the order received, unless Contractor requests that a different priority be assigned. Priority Shop Drawings will be reviewed before other Shop Drawings already received but not yet reviewed. Use of this priority designation for Shop Drawings may delay the review of Shop Drawings previously submitted. Contractor is responsible for delays resulting from the use of the priority designation status on Shop Drawings.

1.09 SAMPLE AND MOCKUP SUBMITTAL PROCEDURES

A. Submit color charts and Samples for every product requiring color, texture, or finish selection.
    1. Submit color charts and Samples only after Shop Drawings for the products have been approved.
    2. Deliver all color charts and Samples at one time.
    3. Provide Samples of adequate size to clearly illustrate the functional characteristics of the product, with integrally related parts and attachment devices.
    4. Indicate the full range of color, texture, and patterns.

5. Deliver color charts and Samples to the field office and store for the duration of the Project.
6. Notify the Construction Manager that color charts and Samples have been delivered for approval using the Notification by Contractor form.
7. Submit color charts and Samples not less than 30 days prior to when these products are to be ordered or released for fabrication to comply with the Project schedule.
8. Remove Samples that have not been approved. Submit new Samples following the same process as for the initial Sample until Samples are approved.
9. Dispose of Samples when related Work has been completed and approved and disposal is approved by the Construction Manager. At Owner's option, Samples will become the property of the Owner.

B. Construct mockups for comparison with the Work being performed.

1. Construct mockups from the actual products to be used in construction per the detailed specifications.
2. Construct mockups of the size and in the area indicated in the Contract Documents.
3. Construct mockups complete with texture and finish to represent the finished product.
4. Notify the Construction Manager that mockups have been constructed and are ready for approval using the Notification by Contractor form. Allow 2 weeks for Construction Manager to approve of the mockup before beginning the Work represented by the mockup.
5. Remove mockups that have not been approved. Construct new mockups following the same process as for the initial mockup until mockup is approved.
6. Protect mockups until Work has been completed and accepted by the Construction Manager.
7. Dispose of mockups when related Work has been completed and disposal is approved by the Construction Manager.

1.10 REQUESTS FOR DEVIATION

A. Submit a Change Proposal per Section 01 26 00 "Change Management" to request modifications to the Contract Documents, including those for approval of "or equal" products when specifically allowed by the Contract Documents or as a substitution for specified products or procedures.

B. Provide a Shop Drawing with the Change Proposal that clearly identifies deviations for any product or component of the product that does not fully comply with the Contract Documents using the Shop Drawing Deviation Request form provided by the Construction Manager. Mark deviations on the Shop Drawing per Paragraph 1.08.B.

C. Include a description of why the deviation is required and the impact on Contract Price or Contract Times. Include the amount of any cost savings to the Owner for deviations that result in a reduction in cost.

D. Identify each deviation request as a separate item. Include all requested deviations that must be approved as a group together and identify them as a single item.

E. Construction Manager will issue a Field Order or Change Order to approve acceptable deviations. Approval of a requested Shop Drawing deviation by the Design Professional on the Shop Drawings Deviation Request form indicates approval of the requested deviation only on its technical merits as generally conforming to the Contract Documents. Deviations from the Contract Documents can only be approved by a Modification issued by the Construction Manager.

1.11 CONSTRUCTION MANAGER AND DESIGN PROFESSIONAL RESPONSIBILITIES

A. Shop Drawings will be received by the Construction Manager. Construction Manager will log the documents and forward to the Design Professional for review per this Section for general conformance with the Contract Documents.

1. Design Professional's review and approval will be only to determine if the products described in the Shop Drawing or Sample 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. Design Professional's review and approval will not extend to means, methods, techniques, sequences, or procedures of construction or to safety precautions or programs incident thereto.

3. Design Professional's review and approval of a separate item as such will not indicate approval of the assembly in which the item functions.

B. Comments will be made on items called to the attention of the Design Professional for review and comment. Any marks made by the Design Professional do not constitute a blanket review of the document or relieve the Contractor from responsibility for errors or deviations from the Contract requirements.

1. Design Professional will respond to Contractor's markups by either making markups directly in the Shop Drawing file using the color red or by attaching a Document Review Comments form with review comments keyed to the Drawings or Shop Drawing Deviation Request.

2. Shop Drawings that are reviewed will be returned with one or more of the following status designations:

a. Approved: Shop Drawing is found to be acceptable as submitted.

b. Approved as Noted: Shop Drawing is approved so long as corrections or notations made by Design Professional are incorporated into the Shop Drawing.

c. Not Approved: Shop Drawing or products described are not acceptable.

d. Cancelled: This action indicates that for some reason, the Shop Drawing is to be removed from consideration and all efforts regarding the processing of that document are to cease.

3. Shop Drawings will also be designated for one of the following actions:

a. Documents Filed: Shop Drawing is acceptable without further action and has been filed as a record document.

b. Shop Drawing Not Required: A Shop Drawing was not required by the Contract Documents. Resubmit the document per Section 01 33 03 “Product Data.”

c. Cancelled: This action indicates that for some reason, the Shop Drawing is to be removed from consideration and all efforts regarding the processing of that document are to cease.

d. Revise and Resubmit: Shop Drawing has deviations from the Contract Documents, significant errors, or is inadequate and must be revised and resubmitted for subsequent review.

Actions “a” through “c” will close out the Shop Drawing review process and no further action is required as a Shop Drawing. Action “d” requires follow up action to close out the review process.

4. Drawings with a significant or substantial number of markings by the Contractor may be marked “Approved as Noted.” These drawings are to be revised to provide a clean record of the document. Proceed with ordering products as the documents are revised.

5. Dimensions or other data that do not appear to conform to the Contract Documents will be marked as “At Variance With” (AVW) the Contract Documents or other information provided. The Contractor is to make revisions as appropriate to comply with the Contract Documents.

C. Bring deviations to the Shop Drawings to the attention of the Design Professional for approval by using the Shop Drawing Deviation Request form. Use a single line for each requested deviation so the Status and Action for each deviation can be determined for that requested deviation. If approval or rejection of a requested deviation will impact other requested deviation, then all related deviations should be included in that requested deviation line so the status and action can be determined on the requested deviation as a whole.

D. Requested deviations will be reviewed as a possible Modification to the Contract Documents.

1. A requested deviation will be marked as “Not Approved” if the requested deviation is unacceptable. Contractor is to revise and resubmit the Shop Drawing with corrections for approval.

2. A Field Order will be issued by the Construction Manager for deviations approved by the Design Professional if the requested deviation is acceptable and if the requested deviation will not result in a change in Contract Price or Contract Times. Requested deviations from the Contract Documents may only be approved by Field Order.

3. A requested deviation will not be approved if the requested deviation is acceptable but the requested deviation will or should result in a change in Contract Price or Contract Times. Submit any requested deviation that requires a change in Contract Price or Contract Times as a Change Proposal for approval prior to resubmitting the Shop Drawing.

E. Contractor is to resubmit a complete Shop Drawing incorporating revisions until it is acceptable and marked “Approved” or “Approved as Noted” and is assigned an action per Paragraph 1.11.B.3 that indicates that the Shop Drawing process is closed.

F. Information that is submitted as a Shop Drawing that should be submitted as Product Data or other type of document, or is not required may be returned without review, or may be deleted. No further action is required and the Shop Drawing process for this document will be closed.

1.12 RESUBMISSION REQUIREMENTS

A. Make all corrections or changes required by the Design Professional in the document and resubmit to the Construction Manager until approved.

B. Resubmit a complete Shop Drawing for each resubmittal. The last approved Shop Drawing must not rely on previous submissions. The final Shop Drawing is to provide a complete record for the Owner's records.

C. Revise initial drawings or data and resubmit as specified for the reviewed document.

1. Highlight or cloud in green those revisions which have been made in response to the previous reviews by the Design Professional. This will include changes previously highlighted or clouded in yellow to direct attention to Design Professional to items requiring selections, decisions by the Design Professional or highlighted or clouded in orange for a requested deviation from the Contract Documents, or comments in red made by the Construction Manager.

2. Highlight and cloud new items in yellow where selections or decisions by the Design Professional are required, but such selections do not constitute a deviation from the Contract Documents. Add explanatory comments to the markup to indicate the action to be taken by the Design Professional.

3. Highlight and cloud new items in orange that are deviation requests. Include the deviation request number on the Shop Drawing that corresponds to the deviation request on the Shop Drawing Deviation Request form. Numbering for these new items is to start with the next number following the last Shop Drawing deviation requested. Include explanatory comments in the Shop Drawing Deviation Request form.

D. Pay for excessive review of Shop Drawings.

1. Excessive review of Shop Drawings is defined as any review required after the original review has been made and the first resubmittal has been checked to see that corrections have been made.

2. Review of Shop Drawings or Samples will be an additional service requiring payment by the Contractor if the Contractor submits a substitution for a product for which a Shop Drawing or Sample has previously been approved, unless the need for such change is beyond the control of Contractor.

3. Cost for additional review time will be billed to the Owner by the Design Professional for the actual hours required for the review of Shop Drawings by Design Professional and in accordance with the rates listed in Section 00 73 00 "Supplementary Conditions."

4. A set-off will be included in each Application for Payment to pay the cost for the additional review. The set-off will be based on invoices submitted to the Owner for these services.

5. Need for more than one resubmission or any other delay in obtaining Design Professional's approval of Shop Drawings will not entitle the Contractor to an adjustment in Contract Price or an extension of Contract Times.

END OF SECTION

01 33 03 PRODUCT DATA

PART 1 - GENERAL

1.01 SUMMARY

A. Submit Product Data as required by the Contract Documents and as reasonably requested by the Construction Manager. Provide Product Data for all products unless a Shop Drawing is required for the same item.

B. Submit Product Data to provide documents that allow the Owner to:

1. Record the products incorporated into the Project;

2. Record detailed information about products regarding their fabrication, installation, commissioning, and testing; and

3. Provide replacement or repair of products at some future date.

C. Contractor's responsibility for full compliance with the Contract Documents is not relieved by the receipt or cursory review of Product Data.

D. Submit a Change Proposal per Section 01 26 00 "Change Management" to request modifications to the Contract Documents, including those for approval of "or equal" products when specifically allowed by the Contract Documents or as a substitution for specified products or procedures. Deviations from the Contract Documents can only be made by an approved Change Order or Field Order.

1.02 QUALITY ASSURANCE

A. Submit legible, accurate, and complete documents presented in a clear, easily understood manner. Product Data not meeting these criteria will not be accepted and must be resubmitted.

1.03 CONTRACTOR'S RESPONSIBILITIES

A. Furnish Product Data for products as indicated in the individual Specification Sections.

B. Product Data is required for the following items:

Specification Section	Product Data Description
02 96 00	Temporary Bypass Pumping and/or Piping System
03 30 53	Formwork, Steel Reinforcement, Concrete Materials, Admixtures, Related Materials, Curing Materials, Concrete Mixtures, Concrete Mixing
03 41 19	Precast Reinforced Concrete Valve Vault

Specification Section	Product Data Description
09 96 00.01	Coating Manufacturer's Color Selection Literature, Sample Warranty Documents, Certification from Manufacturer Regarding Lead Weight, Product Information and Safety Data Sheets, Coating Plan, Documentation on Proposed Containment System Methods for Blasting and Coating Operations, Evidence of Notification of Georgia Environmental Protection Division on Abrasive Blasting and Copies of Permits, Coating Manifest
09 96 01	Product Data Sheets
26 05 19	Copper Building Wire, Metal-clad Cable (Type MC), Tray Cable (Type TC), Connectors and Splicers
26 05 23	Backboards, Category 5e Balanced Twisted Pair Cable, Category 6 Balanced Twisted Pair Cable, Category 6a Balanced Twisted Pair Cable, Balanced Twisted Pair Cable Hardware, Twin-axial Data Highway Cable, RS-232 Cable, RS-485 Cable, Low-voltage Control Cable, Control-Circuit Conductors, Fire-alarm Wire and Cable, Optical-fiber Cable, Optical-fiber Cable Hardware, UTP Cable, UTP Cable Hardware, Triad Shielded Cable (RTD Cable)
26 05 26	Conductors, Connectors, Grounding Electrodes, Conduit Ground Fittings, Ground Rod Boxes, Exothermic Welding Process
26 27 26	Straight-blade Receptacles, USB Charger Devices, GFCI Receptacles, SPD Receptacles, Hazardous (Classifed) Location Recptacles, Twist-locking Receptacles, Pendant Cord-connector Devices, Cord and Plug Sets, Toggle Switches, Decorator-style Devices, Wall Switch Sensor Light Switch (Dual Technology), Wall Switch Sensor Light Switch (Passive Infrared), Wall Switch Sensor Light Switch (Ultrasonic), Digital Timer Light Switch, Wall-box Dimmers, Wall Plates, Floor Service Fittings, Prefabricated Multioutlet Assemblies, Service Poles, Finishes
26 28 16	Fusible Switches, Nonfusible Switches, Receptacle Switches, Shunt Trip Switches, Molded-case Circuit Breakers, Molded-case Switches, Enclosures
26 29 13.19	Enclosures, Power Distribution and Power Devices, Control Devices, Indication and Control Station Devices, Panel Ancillaries, Panel Wiring and Wire Management
26 29 16	Size, Dimensions, Capacity, Settings, Motor and Actuator, and Operating Characteristics of Selected Models
31 05 13	Material Source, Gradation, Testing Data
31 05 16	Product Data for Aaggregates
31 23 23.34	Product Data and Mix Design for Flowable Fill
31 32 19.15	Product Data for Geotextile Material

Specification Section	Product Data Description
32 12 16	Mix Design, Gradation of Materials, and Certificate of Materials
32 15 00	Sieve Analysis for Aggregate Fills
32 16 13	Concrete, Reinforcing Steel, Expansion Joint Material
32 31 13	Fence and Gate Posts, Rails, and Fittings, Chain-link Fabric, Reinforcements, and Attachments, Gates and Hardware, Gate Operators (Including Operating Instructions), Motors
32 31 29	Fence and Gate Posts, Rails, and Fittings, Wooden Pickets, Bracing, and Attachments, Gates and Hardware
33 05 01.02	Ductile Iron Pipe, fittings, linings, coatings, mill certificates, and mechanical joints.
33 05 01.13	Sanitary Sewer Pipe (PVC), gaskets, joints, and warning tape
33 39 13	Manhole Cover and Ring, Polymer Concrete Manholes
40 05 00	Pipe and Fittings, Joining Materials, Insulating Flanges, Couplings, Unions, Vent and Drain Valves, Escutcheons
40 05 62	Eccentric Plug Valves, operators and actuators, valve boxes, floor stands, painting schedule
40 67 00	Control Panel Enclosures, Enclosure Accessories, Control Panel Backplates, Nameplates, Adhesive Labels, Legend Plates, Wire Labels, Panel Wiring and Termination, Terminal Blocks, Fused Terminal Blocks, Circuit Breakers (Telemetry Systems), Circuit Breakers (Non-Telemetry Systems), Relays, Surge Protection Device (TVSS), DC Power Supply, Uninterruptible Power Supply, Uninterruptible Power Supply Batteries, Wiring Duct, DIN Rails, Process Indicator Display
40 71 13	Flow Meters, enclosures and panels,
40 72 76	Float switches

C. Include Product Data in the Document Register required by Section 01 33 00 “Document Management” to indicate the Product Data to be submitted, the dates on which documents are to be sent to the Construction Manager for review, and proposed dates that the product will be incorporated into the Project.

D. Complete the following before submitting Product Data:

1. Prepare Product Data and coordinate with Shop Drawings, Samples, Product Data for related products, and with the requirements of the Contract Documents;

2. Determine and verify specified performance and design criteria, installation requirements, materials, catalog numbers, and similar information;

3. Determine and verify the suitability of materials and equipment offered with respect to the indicated application, fabrication, shipping, handling, storage, assembly, and installation pertaining to the performance of the Work; and

4. Determine and verify information relative to Contractor's responsibilities for means, methods, techniques, sequences, and procedures of construction, and safety precautions and programs incident thereto.

E. Determine and verify:

1. Field measurements, quantities, and dimensions are shown on the Product Data and are accurate;

2. Location of existing structures, utilities, and equipment related to the Product Data have been shown and conflicts between the products, existing structures, utilities, and equipment have been brought to the attention of the Construction Manager;

3. Conflicts that impact the installation of the products have been brought to the attention of the Construction Manager;

4. Product Data is complete for its intended purpose; and

5. Conflicts between the Product Data related to the various Subcontractors and Suppliers have been resolved.

F. Review Product Data prior to submitting to the Construction Manager. Certify that all Product Data has been reviewed by the Contractor and is in strict conformance with the Contract Documents as modified by Addenda, Change Order, Field Order, or Contract Amendment when submitting Product Data.

1.04 DOCUMENTATION

A. Include a complete description of the material or equipment to be furnished, including:

1. Type, dimensions, size, arrangement, model number, and operational parameters of the components;

2. Weights, gauges, materials of construction, external connections, anchors, and supports required;

3. Performance characteristics, capacities, engineering data, motor curves, and other information necessary to allow a complete evaluation of mechanical components;

4. All applicable standards;

5. Fabrication and installation drawings, setting diagrams, manufacturing instructions, templates, patterns, and coordination drawings;

6. Wiring and piping diagrams and related controls;

7. Mix designs for concrete, asphalt, or other materials proportioned for the Project; and

8. Complete and accurate field measurements for products which must fit existing conditions. Indicate on the document that the measurements represent actual dimensions obtained at the Site.

B. Submit information for all components and related equipment required for a complete and operational system in one submittal.

1. Include electrical, mechanical, and other information required to indicate how the various components of the system function together as a system.

2. Provide certifications, warranties, and written guarantees and service contracts with the document package for review when these are required.

1.05 SPECIAL CERTIFICATIONS AND REPORTS

A. Provide all required certifications with the Product Data as specified in the individual Specification Sections:

1. Certified Test Reports (CTR): A report prepared by an approved testing agency giving results of tests performed on products to indicate their compliance with the Specifications. This report is to demonstrate that the product when installed will meet the requirements of the Contract Documents and is part of the Product Data. Field tests may be performed by the Owner to determine that in place materials or products meet the same quality as indicated in the CTR submitted as part of the Product Data.

2. Certification of Local Field Service (CLS): A certified letter stating that field service is available from a factory or supplier approved service organization located within a 300-mile radius of the Site. Include the names, addresses, and telephone numbers of approved service organizations with the certificate.

3. Certification of Adequacy of Design (CAD): A certified letter from the manufacturer of the equipment stating that the equipment has been designed to be structurally stable and to withstand all imposed loads without deformation, failure, or adverse effects to the performance and operational requirements of the unit. The letter must state that mechanical and electrical components have been adequately sized to be fully operational for the conditions specified or normally encountered by the product's intended use.

4. Certification of Applicator/Subcontractor (CSQ): A certified letter stating that the applicator or subcontractor proposed to perform a specified function is duly designated as factory authorized and trained for the application of the specified product.

1.06 WARRANTIES AND GUARANTEES

A. Provide all required warranties, guarantees, and related documents with the Product Data. The effective date of warranties and guarantees will be the date of Substantial Completion.

B. Identify all Extended Warranties which are defined as any guarantee of performance for the product or system beyond the one-year correction period described in the General Conditions. Issue the warranty certificate in the name of the Owner. Provide a warranty bond for extended warranties if required by Specification Sections.

C. Include an additional copy of equipment warranties in operation and maintenance manuals.

D. Provide a copy of all warranties in a separate document in accordance with Section 01 70 00 "Execution and Closeout Requirements."

1.07 EXTENDED SERVICE AGREEMENTS

A. Provide Extended Service Agreements and related documents with the Product Data. An Extended Service Agreement is a contract between the Owner and an approved

Subcontractor or Supplier to provide service and or maintenance beyond that required to fulfill requirements for warranty repairs, or to perform routine maintenance for a definite period beyond the one-year correction period specified in the General Conditions.

B. An Extended Service Agreement does not relieve the Contractor from obligations under the one-year correction period or Warranty provisions specified in the General Conditions.

C. An Extended Service Agreement does not relieve the Contractor from obligations under the maintenance bond, if a maintenance bond is required by the Contract.

D. Requirements for the Extended Service Agreement are described in the Specification Sections for each piece of equipment or system requiring an Extended Service Agreement.

E. Enter into a contract with the service provider and assign the service contract to the Owner on the date of Substantial Completion. Once assigned to the Owner, Contract requirements for the Extended Service Agreement will be complete and will not extend the Contract between the Owner and Contractor.

F. Owner may require that a performance bond be provided for the Extended Service Agreement. Provide a separate bond meeting the same requirements as those for the Contractor's performance bond if required. The bond will be in the amount of the Extended Service Agreement.

G. Include an additional copy of Extended Service Agreements in operation and maintenance manuals.

H. Provide a copy of Extended Service Agreements in a separate document in accordance with Section 01 70 00 "Execution and Closeout Requirements."

1.08 PRODUCT DATA SUBMITTAL PROCEDURES

A. Submit Product Data to the Construction Manager. Send all documents in digital format for processing.

1. Provide all information requested. Do not leave any blanks incomplete. If information is not applicable, enter NA in the space provided.

2. Submit all documents in Portable Document Format (PDF) as required by Section 01 33 00 "Document Management." Provide color PDF documents where color is required to interpret the Product Data.

3. Submit each specific product, class of material, or equipment system separately so these can be tracked and processed independently. Do not submit Product Data for more than one system in the same Submittal.

4. Submit items specified in different Specification Sections separately unless they are part of an integrated system.

5. Define abbreviations and symbols used in Product Data.

a. Use terms and symbols in Product Data consistent with the Contract Drawings.

b. Provide a list of abbreviations and their meaning as used in the Product Data.

c. Provide a legend for symbols used on Product Data.

6. Mark Product Data to reference:
    a. Related Specification Sections;
    b. Drawing number and detail designation;
    c. Equipment designation or name;
    d. Schedule references;
    e. System into which the product is incorporated; and
    f. Location where the product is incorporated into the Project.

B. Complete the certification required by Paragraph 1.03.F.

1.09 CONSTRUCTION MANAGER AND DESIGN PROFESSIONAL RESPONSIBILITIES

A. Product Data will be received by the Construction Manager, logged, and provided to Owner as the Project record.
    1. Product Data may be reviewed to see that the information provided is adequate for the purpose intended. Product Data not meeting the requirements of Paragraph 1.02 may not be approved.
    2. Product Data is not reviewed for compliance with the Contract Documents. Comments may be returned if deviations from the Contract Documents are noted during the cursory review performed to see that the information is adequate.
    3. Contractor's responsibility for full compliance with the Contract Documents is not relieved by the review of Product Data. Contract modifications can only be approved by a Change Order or Field Order.

B. Construction Manager may take the following action in processing Product Data:
    1. File Product Data as received if the cursory review indicates that the document meets the requirements of Paragraph 1.02. Document will be marked "Filed as Received" and "Documents Filed." No further action is required on that Product Data.
    2. Not approve the Product Data for one of the following reasons:
        a. The documentation requirements of the Contract Documents indicate that the document submitted as Product Data should have been submitted as a Shop Drawing. The Product Data will be marked "Not Approved" and "Submit as Shop Drawing." No further action is required on this document as Product Data and the Product Data process will be closed. Resubmit the document as a Shop Drawing per Section 01 33 02 "Shop Drawings."
        b. The cursory review indicates that the document does not meet the requirements of Paragraph 1.02. The Product Data will be marked "Not Approved" and "Revise and Resubmit." Contractor is to resubmit the Product Data until it is acceptable and marked "Filed as Received." When Product Data is filed, no further action is required and the Product Data process will be closed.
        c. The Product Data is not required by the Contract Documents nor is applicable to the Project. The Product Data will be marked "Not Approved" and "Cancelled." No further action is required and the Product Data process will be closed.

C. Contractor is to resubmit the Product Data until it is acceptable and marked “Filed as Received.”

END OF SECTION

01 33 04 OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.01 SUMMARY

A. Prepare a complete and detailed operation and maintenance manual (manual) for each type and model of equipment or product furnished and installed under this Contract.

B. Prepare manuals in the form of an instruction manual for the Owner. The manuals are to be suitable for use in providing the operation and maintenance instructions for the equipment specified and provided.

C. Provide complete and detailed information specifically for the products or systems provided for this Project. Include the information required to operate and maintain the product or system.

D. Manuals are to be provided in addition to any information packed with or attached to the product when delivered. Remove information packed with or attached to the product and include this information as an attachment to the manual.

E. Include cost for manuals provided by Suppliers and Subcontractors as described in this Section in the Cost of Work for that equipment item.

1.02 DOCUMENTATION

A. Submit manuals in accordance with Section 01 33 00 “Document Management.” Attach a copy of the Operation and Maintenance Manual Review Report form provided by the Construction Manager to each manual with pertinent information completed.

B. Provide one preliminary electronic copy of the manual to the Construction Manager for review within 15 days after review of any equipment submittal by the OPT.

C. Provide one electronic copy and three printed copies of the final manual after:

1. Preliminary manuals have been approved;

2. Field test records have been incorporated into the manual; and

3. Record Documents per Section 01 31 13 “Project Administration” have been approved and have been incorporated in the final manual.

D. Provide copies of the manufacturer’s warranties, guarantees, or service agreements in accordance with Section 01 70 00 “Execution and Closeout Requirements.”

PART 2 - PRODUCTS

2.01 MATERIALS

A. Provide digital files for each manual as specified in Paragraph 2.02.

1. Use filenames that correspond to the equipment designation shown in the Contract Documents or other equipment designations provided by the OPT.

2. Submit a preliminary version of the electronic manual for review. Provide a final version of the manual incorporating OPT’s comments.

B. Provide printed copies of each manual as specified in Paragraph 2.03.

2.02 ELECTRONIC MANUAL FORMAT

A. Manual contents are to be submitted in electronic format to the Construction Manager.

B. Provide individual electronic files for each manual.

1. Maximum file size is 75 MB. If manual is greater than maximum allowable file size, provide individual files for each major section of manual.

2. Acceptable file types for written documents are Portable Document File (PDF) or provide manual text in Microsoft Word. Provide drawings in native format and PDF format. All files must be compatible with the latest software version available.

3. Filename must identify the equipment location, equipment manufacturer, and date equipment placed in service, e.g. JCC1-Pump Room-Manufacturer-200503.pdf.

4. Each electronic file must contain a table of contents at the beginning of the file which includes hypertext links or bookmarks to navigate the file contents per section/chapter.

5. Scanned images of written documents are not acceptable. Document must allow character selection (I.e., searchable documents). Text within a file must be transferable to other documents.

6. Drawing files must have the ability to turn on/off drawing layers within the file.

2.03 PRINTED MANUAL FORMAT

A. Printed copies of each manual are to be submitted as follows:

1. Print manuals on heavy, first quality 8-1/2 x 11 paper.

a. Reduce drawings and diagrams to 8-1/2 x 11 paper size.

b. When reduction is not practical, fold drawings and place each separately in a clear, super heavy weight, top loading polypropylene sheet protector designed for three-ring binder use. Provide a typed identification label on each sheet protector.

c. Punch paper for standard three-ring binders.

2. Place manuals in heavy duty presentation, d-ring binders with clear front, back, and spine covers.

3. Identify each manual by placing a printed cover sheet in the front cover of the binder and as the first page in the manual. The first page is to be placed in a clear polypropylene sheet protector. The information on first page and the cover page are to include:

a. Name of Owner;

b. Project name;

c. Volume number; and

d. Table of contents.

4. Insert the name of the Project and volume number into the spine covers.
5. Sheet lifters are to be provided.
6. Minimum size is 2-inch capacity. Maximum size is 3-inch capacity. Fill binders to only three-fourths of its indicated capacity to allow for addition of materials to each binder by the Owner.
7. Provide index tabs for each section of the manual. Indexes are to be constructed of heavy-duty paper with a reinforced binding edge. The designation on each index tab is to correspond to the number and letter assigned in the Table of Contents.
8. Manuals for several products or systems may be provided in the same binder. Correlate the data into related groups when multiple products or systems are included in the same binder.
    a. Sections for each product or system must be included in the same binder.
    b. Sections must be in numerical order from volume to volume.

PART 3 - EXECUTION

3.01 MANUAL ORGANIZATION AND CONTENTS

A. Provide a table of contents listing each section of the manual for each product or system.
    1. Assign a number and letter to each section in the manual.
        a. The number is to correspond to the Owner's equipment numbering system or other system designated in the Contract Documents.
        b. The letter assigned will represent the part of the manual, consistent with the manual contents as required by this Section.
    2. Identify each product or system using the nomenclature shown in the Contract Documents. Provide a cross reference to the Owner's numbering system and designations for equipment indicated in the Contract Documents if these are different.
B. Include only the information that pertains to the product described. Annotate each sheet to:
    1. Clearly identify the specific product or component installed;
    2. Clearly identify the data applicable to the installation; and
    3. Delete or strike through references to inapplicable information.
C. Supplement manual information with drawings as necessary to clearly illustrate relations of component parts of equipment and systems, and control and flow diagrams.
D. Manuals for several products or systems may be provided in the same binder.
E. Fill binders to only three-fourths of its indicated capacity to allow for addition of information by the Owner.

3.02 EQUIPMENT AND SYSTEMS MANUAL CONTENT

A. Provide the following information in the first tabbed section of each manual:

1. A description of the unit and component parts and how it functions.

2. Operating instructions for pre-startup, startup, normal operations, regulation, control, shutdown, emergency conditions, and limiting operating conditions.

3. The sequence of operation by the controls manufacturer. Provide control diagrams by the manufacturer, modified to reflect the as-built, as-installed condition.

4. Include general assembly contract drawings, sections, and photographic views as necessary to completely depict and properly identify the equipment. Indicate the dimensions, weight, capacity, and design conditions for the equipment.

B. Include detailed information to allow for the proper installation, calibration, testing, preventative, and corrective maintenance procedures in the second section of the manual or of each section of the manual information if the manual covers a multi-component equipment system. This information should include the following:

1. Maintenance instructions including assembly, installation, alignment, clearances, tolerances, and interfacing equipment requirements, adjustment, and checking instructions. Include any special rigging required to place the equipment into place, and any special test equipment required to place the equipment in service.

2. A safety subsection which addresses all safety and tag-out procedures necessary to safely operate and maintain the equipment.

3. Lubrication schedule and lubrication procedures. Include a cross reference for recommended lubrication products.

4. Troubleshooting guide.

5. A table showing the schedule of routine maintenance requirements and seasonal work which is not performed at a set frequency. Preventative maintenance tasking must address:

a. Daily/weekly inspections performed by operations personnel;

b. Routine preventative maintenance scheduled weekly, monthly, quarterly, semi-annually, or annually through major overhauls by maintenance personnel; and

c. Predictive maintenance work such as alignment, analysis of the equipment, vibration, flow, oil sampling, etc.

6. Description of sequence of operation by the control manufacturer.

7. Warnings for detrimental maintenance practices.

8. Detailed corrective maintenance procedures including:

a. Detail equipment for complete disassembly and assembly;

b. Cross-sectional drawings or exploded views with all parts numbered to correspond with the numbers in the parts list to permit identification of the various parts;

c. A table of normal clearances, diameters, thickness of new parts, and limits permissible for wearing parts; and

d. List torque settings for nuts, bolts, and fasteners when critical to the equipment's performance.

C. Include all necessary diagrammatic piping and wiring diagrams and miscellaneous contract drawings and equipment in the third section of the manual or of each section of the manual if the manual covers a multi-component equipment system.

D. Provide an exploded view of all equipment, when possible.

E. Provide spare parts information in the fourth section of the manual including:

1. Part numbers for ordering new parts;

2. Assembly illustrations showing an exploded view of the complex parts of the product;

3. Predicted life of parts subject to wear;

4. List of the manufacturer's recommended spare parts, current prices with effective date, and number of parts recommended for storage;

5. Directory of a local source of supply for parts with company name, address, and telephone number;

6. Complete nomenclature and list of commercial replacement parts; and

7. Complete list of spare parts, spare equipment, tools, and materials that are turned over to the Owner.

F. Provide statistical information from the original equipment manufacturer as to performance such as pump curves, flow charts insulation resistance, calibration, or test data sheets in the fifth section of the manual, including all field testing records used to verify actual performance.

G. Provide equipment name plate data installed on equipment and valves and equipment data sheets as required and furnished by the Owner in the sixth section of the manual.

H. Provide a copy of warranties and the date the warranty expires for equipment in the seventh section of the manual.

3.03 ELECTRICAL AND ELECTRONICS SYSTEMS MANUAL

A. Provide all of the information listed in Paragraph 3.02 as appropriate and include the following information:

1. Control schematics and point to point wiring diagrams prepared for field installation;

2. Circuit directories of panel boards and terminal strips and as installed color coded wiring diagrams; and

3. Other information as may be required by the individual Specification Sections.

3.04 LIST OF SERVICE ORGANIZATIONS

A. Provide a directory of authorized service organizations with company name, address, telephone number, email address, and the contact person for warranty repair.

END OF SECTION

01 33 05 CONSTRUCTION PROGRESS SCHEDULE

PART 1 - GENERAL

1.01 SUMMARY

A. Prepare and submit a Progress Schedule for the Work and update the schedule on a monthly basis for the duration of the Project.

B. Provide Progress Schedule in adequate detail to allow Owner to monitor progress and to relate submittal processing to sequential activities of the Work.

C. Incorporate Contract Milestones into the schedule and show activities leading to achievement of these milestones.

D. Assume complete responsibility for maintaining the progress of the Work per the Progress Schedule submitted.

1.02 DOCUMENTATION

A. Submit the schedules to the Construction Manager. Send all documents in digital format for processing.

B. Do not leave any blanks incomplete. If information is not applicable, enter NA in the space provided.

C. Provide schedules, schedule updates and revisions to the Construction Manager in electronic format in its originating software and in Portable Document Format (PDF) as required by Section 01 33 00 “Document Management.”

D. Submit a preliminary Progress Schedule at the pre-construction conference.

E. Submit a detailed Progress Schedule at least 10 days prior to the first payment request.

F. Submit Progress Schedule updates monthly within 10 days after submitting Applications for Payment to indicate the progress made on the Project to the closing date for the Application for Payment. Failure to submit Progress Schedules will cause delay in the review and approval of subsequent Applications for Payment.

1.03 PROGRESS SCHEDULE REQUIREMENTS

A. Progress Schedule is to be in adequate detail to:

1. Ensure adequate planning, scheduling, and reporting during the execution of the Work;

2. Ensure the coordination of the Work of the Contractor and the various Subcontractors and Suppliers;

3. Monitor the progress of the Work; and

4. Evaluate the impact of proposed changes to the Contract Times and Project Schedule.

B. Provide personnel with 5 years’ minimum experience in scheduling construction work comparable to this Project. Prepare the Progress Schedule using acceptable scheduling software.

C. Provide the Progress Schedule in the form of a computer-generated critical path schedule which includes Work to be performed on the Project. It is intended that the Progress Schedule accomplish the following:

1. Give early warning of delays in time for correction.
2. Provide detailed plans for the execution of the Work in the form of future activities and events in sequential relationships.
3. Establish relationships of significant planned Work activities and provide a logical sequence for planned Work activities.
4. Provide continuous current status information.
5. Allow analysis of the Contractor's program for the completion of the Project.
6. Permit schedules to be revised when the existing schedule is not achievable.
7. Log the progress of the Work as it actually occurs.

D. Provide a time-scaled horizontal bar chart which indicates graphically the Work scheduled at any time during the Project. The chart is to indicate:

1. Complete sequence of construction by activity;
2. Identification of the activity by structure, location, and type of Work;
3. Chronological order of the start of each item of Work;
4. The activity start and stop dates;
5. The activity duration; and production rates used to determine the duration;
6. Successor and predecessor relationships for each activity;
7. A clearly indicated single critical path; and
8. Projected percentage of completion, based on dollar value of the Work included in each activity as of the first day of each month.
9. Baseline schedule and any deviations;

E. Provide a Progress Schedule for Submittals:

1. Indicate the specific dates each document is to be delivered to the Construction Manager.
2. Allow a reasonable time to review each document, taking into consideration the size and complexity of the document, other documents being processed, and other factors that may affect review time.
3. Include time for making revisions to the Shop Drawings and resubmitting the Shop Drawing for at least a second review.
4. Assume a 14-day review cycle for each time a Shop Drawing is submitted for review unless a longer period is indicated in the Contract Documents or provided by the Construction Manager.

5. Contractor is responsible for delays associated with additional time required to review incomplete or erroneous documents and for time lost when documents are submitted for products that do not meet specification requirements.

1.04 PROGRESS SCHEDULE REVISIONS

A. Revise the Progress Schedule if it appears that the schedule no longer represents the actual progress of the Work.

1. Submit a Plan of Action for schedule recovery if the Progress Schedule or earned value analysis indicates that the Project is more than 30 days behind schedule. The report is to include:

a. Number of days behind schedule;

b. Narrative description of the steps to be taken to bring the Project back on schedule; and

c. Anticipated time required to bring the Project back on schedule.

2. Submit a revised Progress Schedule indicating the action that the Contractor proposes to take to bring the Project back on schedule.

B. Revise the Progress Schedule to indicate any adjustments in Contract Times approved by a Modification.

1. Include a revised Progress Schedule with Change Proposals if a change in Contract Times is requested.

2. Construction Manager will deem any Change Proposal that does not have a revised Progress Schedule and request for a change in Contract Times as having no impact on the ability of the Contractor to complete the Project within the Contract Times.

C. Updating the Progress Schedule to reflect actual progress is not considered a revision to the schedule.

D. Applications for Payment will not be recommended for payment without a revised Progress Schedule and if required, the report indicating the Contractor's plan for bringing the Project back on schedule.

1.05 FLOAT TIME

A. Define float time as the amount of time between the earliest start date and the latest start date of a chain of activities on the construction schedule.

B. Float time is not for the exclusive use or benefit of either the Contractor or Owner.

C. Where several subsystems each have a critical path, the subsystem with the longest time of completion is the critical path and float time is to be assigned to other subsystems.

D. Schedule completion date must be the same as the Contract completion date. Time between the end of construction and the Contract completion date is float time.

1.06 MODIFICATION OF CONTRACT TIMES

A. Contract Times cannot be changed by the submission of a Progress Schedule. Contract Times can only be modified by a Change Order or Contract Amendment.

B. Submit a Change Proposal for any proposed change in Contract Times, and include justification for the change in accordance with the provisions of the Contract Documents.

1.07 NEAR-TERM LOOK AHEAD SCHEDULES

A. Provide a near-term look ahead schedule (NTLA Schedule) every 30 days, typically at periodic coordination meetings, using the form provided by the Construction Manager which shows the days of planned activity for the following:

1. Submittals to be provided and day of anticipated return;

2. Equipment and material deliveries;

3. Arrival and departure of key construction equipment; and

4. Activities for the Contractor and each Subcontractor.

B. Coordinate NTLA Schedule with Project Schedule. Submit a report with each NTLA Schedule identifying deviations from the Project Schedule.

C. Submit a report of near-term work planned in the previous NTLA Schedule that was delayed or not executed by marking actual activity on the previous near term look ahead schedule. Provide explanation of why planned work was not executed and plan to execute in the future and regain time lost.

1.08 WEATHER DELAYS

A. The Engineer will obtain weather data during construction from National Oceanic and Atmospheric Administration (NOAA) and will maintain weather records.

B. Engineer will determine Contractor's entitlement to an extension of the Contract Times as a result of weather delays, based on the data included in Tables 1 and 2. Extensions of time will be granted at the discretion of Engineer for circumstances not covered by the flow chart.

C. Any weather-related extension of Contract Times shall be non-compensable. Efficiencies gained as a result of favorable weather within a calendar month, where the number of days of normally anticipated weather days is less than expected, shall contribute to the project Float and shall not affect the Contract Times.

D. Application for a weather-related extension of time shall be submitted to Engineer and shall state the extension requested and be supported by the relevant weather data.

Table 1
Average Monthly Precipitation
(inches)
20 year average 2004 – 2023
NOAA National Data Center, Annual Climatological Summaries

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
4.74	5.10	4.73	4.67	4.46	4.76	5.17	5.01	4.06	3.95	4.01	5.99

Table 2 Average Number of Calendar Days With Precipitation of >=0.5 Inches 20 year average 2004 – 2023 NOAA National Data Center, Annual Climatological Summaries											
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
3	3	3	3	3	3	3	3	2	3	3	4

END OF SECTION

01 33 06 GRAPHIC DOCUMENTATION

PART 1 - GENERAL

1.01 SUMMARY

A. Furnish an adequate number of photographs of the Site to clearly depict the completed Project.

1. Provide aerial photographs of the completed Project from an angle and height to include the entire Site.

2. Provide a minimum of four different views.

3. Photograph a panoramic view of the entire Site.

4. Photograph all significant areas of completed construction.

5. Do not take completion photographs until all construction trailers, excess materials, trash, and debris have been removed.

6. Employ a professional photographer approved by the Construction Manager to photograph the Project.

B. Provide video recordings of the Site.

1. Record the condition of all existing facilities in or abutting the construction area (right-of-way) including streets, curb and gutter, utilities, driveways, fencing, landscaping, etc., prior the beginning of construction. Provide one copy of the dated and labeled recording to the Construction Manager before the start of construction. Provide additional recording as directed by the Construction Manager if the recording provided is not considered suitable for the purpose of recording pre-existing conditions.

2. Provide a video recording of the Site after the Project is complete and all construction trailers, excess materials, trash, and debris have been removed. Provide a 360-degree view of the Project from a consistent height and angle.

3. Format must allow photographic still shots to be extracted from the video recording.

C. All photographs and video recordings are to become the property of the Owner. Photographs or recordings may not be used for public or private publication or display without the written consent of the Owner.

D. Unmanned Aerial Vehicles used for aerial photography must be registered and piloted by licensed individuals in accordance with Laws and Regulations.

1.02 DOCUMENTATION

A. Submit photographic documentation in accordance with Section 01 33 00 “Document Management.”

1.03 QUALITY ASSURANCE

A. Provide clear photographs and video recordings taken with proper exposure. View photographs and video recordings in the field and take new photographs or video

recordings immediately if photos of an adequate print quality cannot be produced or video quality is not adequate. Provide photographs with adequate quality and resolution to permit enlargements.

PART 2 - PRODUCTS

2.01 PHOTOGRAPHS

A. Provide photographs in digital format with a minimum resolution of 1280x960, accomplished without a digital zoom.

B. Take photographs at locations acceptable to the Construction Manager.

C. Provide a digital copy of each photograph taken.

D. Identify each photograph with:

1. Name of the Project.

2. Date, time, location, and orientation of the exposure.

3. Description of the subject of photograph.

2.02 VIDEO RECORDING

A. Provide video recordings in digital format that can be played with Windows Media Player in full screen mode without loss of resolution.

B. Identify Project on video by audio or visual means.

C. Provide video with file size that does not exceed 1 GB.

D. Provide video resolution of at least 1080p.

E. The quality of the video must be adequate to determine the existing conditions of the construction area. Camera panning must be performed while at rest; do not pan the camera while walking or driving. Camera pans should be performed at intervals to clearly view the entire construction area.

F. Construction stationing is to be annotated in the video.

G. The entire construction area recording must be submitted at once. Sections submitted separately will not be accepted.

H. Site components must be video recorded in an organized sequential order with major components identified.

END OF SECTION

01 35 00 SPECIAL PROCEDURES

PART 1 - GENERAL

1.01 CONSTRUCTION SEQUENCE

A. Perform the Work as required to complete the entire Project within the Contract Times and in the sequence stipulated below:

Sequence No.	Description	Predecessor Condition
1	Install, backfill, and pressure and leak test all pipe, valves, fittings, connections, etc. from approximately STA 0+25 to STA 23+88 (Project End). Complete electrical, instrumentation, and control work as necessary (existing station to remain active during this time).	N/A
2	The Contractor is to set-up the required bypass pumping and piping from the existing wetwell to the newly installed 6-inch bypass connection port. Once the bypass pumping and piping has been installed per the design specifications, the Contractor is to remove the existing 8-inch force main from service (See note below regarding Owner's Assistance). The Contractor is to demolish the existing piping, valves, and bypass connection ports as indicated on sheet C-1.	Sequence No. 1
3	The Contractor is to install the remaining 6-inch pipe and fittings, 8-inch pipe and fittings, 8-inch plug valve, 8" flow meter vault, and remaining electrical, instrumentation, and control work that is required to be completed with the station offline.	Sequence No. 2
4	Once all new pipe, fittings, valves, and meters have been pressure tested and accepted per the specifications, the station can be returned to service. Contractor to complete all remaining work.	Sequence No. 3

B. Consider the sequences, duration limitations, and governing factors outlined in this Section to prepare the schedule for the Work.

C. Perform the Work not specifically described in this Section as required to complete the entire Project within the Contract Times.

1.02 OWNER ASSISTANCE

A. Owner will assist the Contractor in removing the sewage from the existing force main and wetwell area for the work associated with Sequence Item No. 2 above.

END OF SECTION

01 40 00 QUALITY MANAGEMENT

PART 1 - GENERAL

1.01 OVERVIEW

A. Quality management refers to the overall process of delivering a completed Project to the Owner that complies with the requirements of the Contract Documents. Quality management applies to documentation, products, services, and the Work.

B. Contractor is responsible for the quality of documentation, products, services, and the Work provided.

1. Contractor is to integrate quality control procedures into the execution of the Work that are adequate to produce a Project that meets the requirements of the Contract Documents, while minimizing loss of time and increased costs. Contractor is solely responsible for time and cost impacts of correcting Defective Work.

2. Contractor is to provide all testing and inspection required to control the quality of the Work in progress to determine that completed Work will comply with the requirements of the Contract Documents.

3. Contractor is to provide verification or acceptance testing as required by the Contract Documents to demonstrate that the completed Work complies with the requirements of the Contract Documents, except for those test that the Owner has determined are to be conducted independent of the Contractor and identified as Owner testing in the Owner's Quality Management Plan.

1.02 STANDARDS

A. Provide testing laboratories that comply with the American Council of Independent Laboratories (ACIL) "Recommended Requirements for Independent Laboratory Qualifications."

B. Perform testing in accordance with the published standards and procedures for testing listed in the Specifications and applicable Laws and Regulations.

1.03 DOCUMENTATION

A. Provide documentation which includes:

1. Contractor's Quality Management Plan that establishes the methods of ensuring compliance with the Contract Documents. Submit this plan as Product Data per Section 01 31 13 "Project Administration."

2. A statement of qualifications for any proposed testing laboratory that includes a list of the engineers and technical staff that will provide testing services on the Project, descriptions of the qualifications of these individuals, list of tests that can be performed, equipment used with date of last certification, and a list of recent projects for which testing has been performed with references for those projects.

3. Certified Test Reports for products to be incorporated into the Project. Provide reports to indicate that the proposed products comply with the Contract Documents or indicate that the proposed products do not comply with the Contract Documents and

why those products do not comply. Submit Certified Test Reports as part of a Shop Drawing submitted per Section 01 33 02 “Shop Drawings.”

4. Certified Test Reports for inspections and testing required in this Section and in other Sections of the Specifications. Provide reports to indicate that the Work complies with the Contract Documents or indicate that the Work does not comply with the Contract Documents and why the Work does not comply. Submit these test reports on forms provided by the Construction Manager per Section 01 33 00 “Document Management.”

5. Certified Test Reports of Defective Work and Certified Test Reports documenting that successful corrective action has produced Work that complies with the Contract Documents. Construction Manager will maintain a Defective Work register. Progress on correction of Defective Work will be discussed at progress meetings as described in Paragraph 1.05.E. The final Defective Work register will be incorporated into closeout documentation required per Section 01 70 00 “Execution and Closeout Requirements” as a record that all Defective Work has been corrected.

1.04 OWNER’S QUALITY MANAGEMENT ACTIVITIES

A. Owner may perform its own verification testing independent of the Contractor. The Owner’s Quality Management Plan describes the Owner’s anticipated verification testing program for this Project. The preliminary testing plan is shown in Paragraph 3.04. This plan outlines the anticipated testing in general terms and may not reflect the actual testing performed by the Owner. Actual testing will depend on the Contractor’s means, methods, and procedures of construction which will not be known until the Contractor submits the Contractor’s Quality Control Plan (CQCP) to the Construction Manager. There is no guarantee that all testing in the preliminary OQMP included in the Bidding/Proposal Documents will be performed by the Owner. Contractor will arrange and pay for all production control testing deemed necessary by the Contractor to produce quality results.

B. Quality management activities of the Owner are for verifying the results of the Contractor’s Work complies with the requirements of the Contract Documents. Performance or non-performance of verification activities by the Owner:

1. Does not relieve the Contractor of its responsibility to provide Work and furnish products that comply with the requirements of the Contract Documents;

2. Does not relieve the Contractor of its responsibility to provide adequate quality control measures to produce quality documents, products, services, or Work;

3. Does not relieve the Contractor of its responsibility for damage to or loss of Work or products before Owner’s acceptance; and

4. Does not affect the continuing rights of the Owner after acceptance of the completed Work.

C. The Work is subject to observations or testing at any time by the OPT. Products which have been tested or inspected and accepted by the Owner at a supply source or staging area may be inspected or tested again by the OPT before, during, or after incorporation into the Work and rejected if products do not comply with the Contract Documents.

D. Verification testing performed by the OPT will be paid for by the Owner, except for testing related to Defective Work as discussed in Paragraph 3.03.

1.05 CONTRACTOR'S RESPONSIBILITIES

A. Review the OQMP and provide a Contractor's Quality Control Plan (CQCP) outlining testing to be provided by the Contractor per Paragraph 1.07.

B. Implement the CQCP to provide Work that complies with the requirements of the Contract Documents.

1. Provide quality documents meeting the requirements of the Contract Documents.

2. Provide services meeting the requirements of the Contract Documents.

3. Provide the services of a Construction Materials Inspection and Testing (CMIT) provider meeting the requirements of this Section to provide testing required by the Contract Documents to demonstrate that products proposed for the Project in Shop Drawings and Product Data fully comply with the Contract Documents.

4. Inspect and test products to be incorporated into the Project to identify defects before installing them. Do not install Defective products. Conspicuously mark Defective products and remove from the Site. If products are installed before the defect is recognized, remove the Defective products, mark them as Defective and remove them from the Site when the defect is recognized.

5. Integrate production quality control measures into construction activities to produce Work meeting the requirements of the Contract Documents. Inspect self-performed Work and the Work of Subcontractors and Suppliers to identify defects. Correct or replace Defective Work.

6. Provide facilities, equipment, and Samples required for inspections and tests.

a. Give the Construction Manager adequate notice before proceeding with Work that would interfere with inspections or testing.

b. Notify the Construction Manager and CMIT provider prior to the time that testing is required, providing adequate lead time to allow arrangements for inspections or testing to be performed.

c. Do not proceed with Work that would impact the ability to correct defects, or with Work that would require that it be removed to correct defects, until testing is complete, and test results indicate that the corrected Work is acceptable.

d. Provide safe access for all CMIT activities, including those to be conducted as part of the Owner's Quality Management Program.

e. Cooperate fully with the performance of sampling, inspection, and testing. Provide personnel to assist with sampling or to assist in making inspections and field tests.

f. Provide Samples and products in adequate quantities for testing at the Site or at the production source of the product for testing.

g. Provide facilities required to store and cure test Samples.

h. Provide calibrated scales and measuring devices for OPT's use in performing inspections and testing.

i. Provide adequate lighting to allow OPT observations.

j. Make Contract Documents available to testing agencies when requested.

C. Perform tests as indicated in Contract Documents. All verification testing is to be observed by the Construction Manager or its designated representative.

D. Submit test reports to the Construction Manager.

E. Provide an update on quality control activities performed the previous month and planned for the coming month at monthly progress meetings required by Section 01 31 13 "Project Administration."

F. Determine testing or inspections required to implement the CQCP. Include costs for additional testing and inspections required to meet the Contractor's quality control obligations in the Contract Price.

1.06 CONTRACTOR'S QUALITY CONTROL MANAGER

A. Provide a Quality Control Manager for the Project. Quality Control Manager must have authority to reject Defective Work, redirect the efforts of the Contractor, Subcontractor and Suppliers to correct Defective Work, and implement steps to prevent future Defective Work.

B. The resident superintendent or an approved assistant can serve as Quality Control Manager, provided other duties will allow adequate time to serve in this capacity.

1.07 CONTRACTOR'S QUALITY CONTROL PLAN

A. Provide a CQCP that describes testing and inspections for Work performed at the Site and at remote locations. Include Work by Subcontractors and Suppliers. The CQCP is to include:

1. A description of the quality control organization, including an organization chart showing lines of authority to control the quality of Work.

2. Documentation describing name, qualifications (in resume format), duties, responsibilities, and level of authority of the Quality Control Manager.

3. The name, qualifications (in resume format), duties, responsibilities, and authorities of other persons assigned a quality control function.

4. Procedures for scheduling, reviewing, certifying, and managing documentation including documentation provided by Subcontractors and Suppliers.

5. Control, verification, and acceptance testing procedures for each specific test. Include:

a. Name of tests to be performed;

b. Specification paragraph requiring test;

c. Parameters of Work to be tested;

d. Test frequency;

e. Persons responsible for each test; and

f. Applicable industry testing standards and laboratory facilities to be used for the test.

6. Incorporate the testing specified in the OQMP into the CQCP, specifically identifying the tests or inspections that will be provided by the OQMP;

7. Procedures for tracking and documenting quality management efforts per Paragraph 1.03.

8. Reporting procedures which incorporate the use of forms provided by the Construction Manager.

9. The name of the proposed testing laboratories along with documentation of qualifications per Paragraph 1.03.

B. Use the Contractor's Quality Control Plan Checklist provided by the Construction Manager to review the CQCP before submitting and include a copy of the completed checklist with the CQCP. Do not begin Work until the CQCP is accepted. Submit an interim plan covering only the portion of Work to be performed if the Contractor plans to begin Work prior to submitting the complete CQCP for the Project. Do not begin Work on other parts of the Project until the complete CQCP is accepted.

C. Meet with the OPT 7 days after CQCP is submitted and before start of construction to discuss the CQCP.

D. Notify the Construction Manager of any changes to the CQCP or quality control personnel.

1.08 CONTRACTOR'S USE OF OWNER'S TEST REPORTS

A. Contractor will receive copies of all test reports documenting the Owner's verification tests. Contractor is entitled to rely on the accuracy of these tests results and use these as part of its quality control efforts.

B. Contractor may submit a Change Proposal if the Owner's testing program deviates significantly from the OQMP. Contractor must demonstrate that actual testing and inspection costs were incurred implementing the CQCP as a result of Owner's decision to not provide testing described in the OQMP.

1.09 LIMITATION OF AUTHORITY OF THE TESTING LABORATORY

A. The testing laboratory representatives are limited to providing testing services and interpreting the results of the test performed.

B. The testing laboratory is not authorized to:

1. Alter the requirements of the Contract Documents;

2. Accept or reject any portion of the Work;

3. Perform any of the duties of the Contractor; or

4. Direct or stop the Work.

1.10 TEST REPORTS

A. Certified Test Reports are to be prepared for all tests.

1. Tests performed by testing laboratories may be submitted on their standard test report forms if acceptable to the Owner using the process directed by the Construction Manager. These reports must include the following:
    a. Name of the Owner, Project title and number, and name of the Contractor;
    b. Name, address, and telephone number of the laboratory;
    c. Name and signature of the laboratory personnel performing the test;
    d. Description of the product being sampled or tested;
    e. Date and time of sampling, inspection, and testing;
    f. Date the report was issued;
    g. Description of the test performed;
    h. Weather conditions and temperature at time of test or sampling;
    i. Location at the Site or structure where the test was taken;
    j. Standard or test procedure used in making the test;
    k. A description of the results of the test;
    l. Statement of compliance or non-compliance with the Contract Documents; and
    m. Interpretations of test results, if appropriate.
2. Submit reports on tests performed by the Contractor, Subcontractors, or Suppliers as directed by the Construction Manager.
3. OPT will prepare test reports on tests performed by the OPT.

B. Submit test reports as directed by the Construction Manager within 24 hours of completing the test. Flag tests reports with results that do not comply with Contract Documents for immediate attention. Notify the Construction Manager, using acceptable means other than the test report, immediately of any test that fails to comply with the Contract Documents.

1.11 DELIVERY, STORAGE, AND HANDLING

A. Handle and protect test specimens of products and construction materials at the Site in accordance with recognized test procedures. Provide facilities for storing, curing, and processing test specimens as required by test standards to maintain the integrity of Samples. Transport test specimens in a manner to prevent damage to specimens while in transit.

PART 2 - PRODUCTS

2.01 TESTING APPARATUS

A. Furnish testing apparatus and related accessories necessary to perform the tests.

2.02 SAMPLE PRODUCTS

A. Provide Samples of products in adequate quantity for testing.

PART 3 - EXECUTION

3.01 IMPLEMENTING CONTRACTOR'S QUALITY CONTROL PLAN

A. Perform quality control observations and testing as required in each Section of the Specifications and where indicated on the Drawings.

B. Include the phases listed below for each definable work task. A definable work task is one which is separate and distinct from other tasks, has separate control requirements, may be provided by different trades or disciplines, or may be work by the same trade in a different environment.

1. Planning Phase: Perform the following before beginning each definable work task:

a. Review the Contract Documents.

b. Review documents the Contractor will submit and determine that they are complete in accordance with the Contract Documents.

c. Check to ensure that all materials and/or equipment have been tested, submitted, and approved.

d. Examine the work area to ensure that all required preliminary Work has been completed and complies with the Contract Documents.

e. Examine required materials, equipment, and sample Work to ensure that they are on hand, conform to Contract Documents, Shop Drawings and Product Data, and are properly stored.

f. Review requirements for quality control inspection and testing.

g. Discuss procedures for controlling quality of the Work. Document construction tolerances and workmanship standards for the work task.

h. Check that the portion of the plan for the Work to be performed incorporates document review comments.

i. Discuss results of planning phase with the Construction Manager. Conduct a meeting attended by the Construction Manager, Quality Control Manager, superintendent, other quality control personnel as applicable, and the foreman responsible for the work task. Instruct applicable workers as to the acceptable level of workmanship required to meet the requirements of the Contract Documents. Document the results of the planning phase actions by separate meeting minutes prepared by the Quality Control Manager and attached to the quality control report.

j. Do not move to the next phase unless results of investigations required for the planning phase indicate that requirements have been met.

2. Work Phase: Complete this phase after the planning phase.

a. Notify the Construction Manager at least 1 week in advance of beginning the Work and discuss the review of the planning phase effort to indicate that requirements have been met.

b. Check the Work to ensure that it is in full compliance with the Contract Documents.

c. Verify adequacy of controls to ensure full compliance with the Contract Documents. Verify required control inspection and testing is performed.

d. Verify that established levels of workmanship meet acceptable workmanship standards. Compare with required Sample panels as appropriate.

e. Repeat the work phase for each new crew to work on-site, or any time acceptable specified quality standards are not being met.

3. Follow-Up Phase: Perform daily checks to ensure control activities, including control testing, are providing continued compliance with contract requirements.

a. Make checks daily and record observations in the quality control documentation.

b. Conduct follow-up checks and correct all defects prior to the start of additional work tasks that may be affected by the Defective Work. Do not build upon nor conceal Defective Work.

c. Conduct a review of the Work at least 1 month prior to the expiration of the correction period prescribed in the General Conditions with the OPT. Correct defects as noted during the review.

C. Conduct additional planning and work phases if:

1. The quality of on-going Work is unacceptable;

2. Changes are made in applicable quality control staff, on-site production supervision, or crews;

3. Work on a task is resumed after a substantial period of inactivity; or

4. Other quality problems develop.

3.02 DEFECTIVE WORK

A. Immediately correct any Defective Work or notify the Construction Manager why the Work is not to be corrected immediately and when corrective action will be completed.

B. Work performed that is connected or adjacent to Defective Work or Work that would have to be removed to correct Defective Work is also considered to be Defective. Contractor is responsible for all costs associated with replacing any acceptable Work that must be removed, or might be damaged by corrective actions.

C. Document Defective Work, corrective actions taken to correct defects, and that corrected Work complies with the Contract Documents.

D. Implement countermeasures to prevent future Defective Work.

E. No payment will be made for Defective Work. Remove Work from the Application for Payment if Work paid for on a previous Application for Payment is found to be Defective.

F. Owner will withhold payment for Defective Work or Work that has not been tested or inspected in accordance with the CQCP, OQCP, or the Contract Documents.

G. Although OPT will be responsible for certain testing outlined below, the Contractor is responsible for maintaining quality. If the OPT must repeat testing more than twice due to Contractor quality issues, the cost of the retesting may be charged to the Contractor.

3.03 VERIFICATION TESTING FOR CORRECTED DEFECTS

A. Provide verification testing on corrected Work when corrective action is complete to demonstrate that the corrected Work complies with the Contract Documents. Conduct the same tests or inspections used to determine that the original Work was Defective. Different tests or methods may be used if approved by the Owner. Document that Defective Work has been corrected with the Construction Manager.

B. Pay for verification testing until Work meets quality requirement set forth in the Contract Documents. OPT may perform verification testing as part of the Owner's Quality Management Program and impose a set-off to recover the cost for this testing.

3.04 OWNER'S PRELIMINARY QUALITY CONTROL PLAN

Spec. Section	Test / Frequency	OPT or Contractor
02 96 00	Test Run for Period of 24 Hours of Temporary Bypass Piping System	Contractor
03 30 53	Test According to ACI 301. One composite Sample shall be obtained for each day's pour of each concrete mix exceeding 5 cubic yards but less than 25 cubic yards, plus one set for each additional 50 cubic yards or fraction thereof and as directed by the Owner and Engineer.	OPT
09 96 00.01	Field Tests, Holiday Testing	OPT
09 96 01	Destructive Testing, Field Tests, Holiday Testing	OPT
26 01 26	Power System Testing	Contractor
26 05 19	Tests and Inspections of Conductors and Cables After Installation and Before Electrical Circuitry Has Been Energized	Contractor
26 05 23	Tests and Inspections with Manufacturer's Field Service, Optical-fiber Cable Tests, Link End-to-End Attenuation Tests	Contractor
26 05 26	Tests and Inspections with Manufacturer's Field Service	Contractor
26 27 26	Tests and Inspections with Manufacturer's Field Service, Tests for Convenience Receptacles	Contractor
26 28 16	Tests and Inspections for Switches, Tests and Inspections for Molded Case Circuit Breakers	Contractor
26 29 13.19	Functional Checkout, Acceptance Test, Tests and Inspections	Contractor
26 29 16	Performance Test of Each Actuator, Acceptance Test	Contractor
31 05 13	Soils Classification Testing	OPT
31 05 16	Aggregates Classification Testing	OPT

Spec. Section or Drawing	Test / Frequency	OPT or Contractor
31 23 23.34	Strength tests for excavatable and non-excavatable flowable fills. Quality Control Testing of Backfill Operations. At minimum perform one test per day per work location, but not less than one per 10 cubic yards.	OPT
31 23 23.34	Fluidity test – slump flow test and visual stability index (VSI) test	OPT
31 23 33	Compaction Testing. Compact backfill and appropriate embedment material to the specified maximum density at the specified moisture content. Compaction and density tests should be made at least once per 100 linear feet.	OPT
32 12 16	Surface Tests, Pavement Thickness Test	OPT
32 15 00	Thickness Verifications, Gradations, Density	OPT
32 16 13	Ponding or Irregularities of Curbs and Gutters	OPT
32 16 13	Concrete Strength Tests outlined in 03 30 53	OPT
32 31 13	Grounding Resistance Tests	Contractor
32 31 29	Post Alignment	Contractor
33 05 01.02	Hydrostatic Test	Contractor
33 05 01.13	Pressure Testing, Hydrostatic Leak Test, Low Pressure Air Test, Air Test for Individual Joints	Contractor
33 39 13	Manhole Testing – Leakage, Vacuum Testing	Contractor
40 05 62	Leakage Test	Contractor
40 61 21	Factory Acceptance Test, Operational Readiness Test, Functional Demonstration Test, Site Acceptance Test	Contractor
40 66 33	Tests and Inspections of Metallic and Fiber-optic Communication Cabling and Connectors	Contractor
ES-1 and ES-2	Primary Permittee, Erosion, Sedimentation, and Pollution Control Inspections	Contractor

END OF SECTION

01 50 00 TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.01 SUMMARY

A. Provide temporary facilities, storage sheds, workshops, and other facilities needed to complete the Work.

B. Provide temporary utilities needed to support the operation of the facilities and construction activities.

C. Provide and maintain temporary project identification signs for Owner.

D. Provide temporary informational signs to identify key elements of construction and direct the flow of traffic.

E. Provide a weatherproof kiosk for display of permits and other notices required by Laws and Regulations.

1.02 DOCUMENTATION

A. Submit Shop Drawings in accordance with Section 01 33 02 “Shop Drawings” for the following:

1. Project identification sign.

1.03 QUALITY ASSURANCE

A. Inspect and test each utility before using facilities. Arrange for all required inspections and tests by regulatory agencies, and obtain required certifications and permits for use of facilities.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Transport, unload, and set up all temporary buildings and utilities.

1.05 JOB CONDITIONS

A. Locate equipment and storage facilities at the Site as indicated or as approved by the OPT.

B. Prepare the Site by removing trees, brush, or debris and performing demolition or grubbing needed to clear a space adequate for the structures.

C. Provide Contractor’s temporary facilities and utilities in time to avoid delays in the performance of the Work.

D. Provide and maintain temporary facilities and utilities.

E. Operate temporary facilities in a safe and efficient manner.

1. Restrict loads on utilities to operate within their designed or designated capacities.

2. Provide sanitary conditions. Prevent public nuisance or hazardous conditions from developing or existing at the Site.

3. Prevent freezing of pipes, flooding, or the contamination of water.

4. Maintain site security and protection of the facilities.

F. Remove temporary facilities and utilities when construction is complete and removal is approved by the Construction Manager.

PART 2 - PRODUCTS

2.01 SIGN MATERIALS

A. Provide wood or metal signs in sound condition, structurally adequate to withstand wind and weather.

B. Provide 3/4-inch exterior grade A/D face veneer plywood with medium density overlay for sign surface.

C. Provide galvanized or stainless steel bolts, brackets, fasteners, and other hardware.

D. Provide exterior quality coatings.

2.02 TEMPORARY STORAGE BUILDINGS

A. Furnish storage buildings of adequate size to store any materials or equipment delivered to the Site that might be affected by weather.

2.03 TEMPORARY SANITARY FACILITIES

A. Provide sanitary facilities at the Site for the entire duration of the Project. Maintain these facilities in a clean and sanitary condition at all times, and comply with the requirements of the local health authority.

2.04 TEMPORARY UTILITIES

A. Provide the temporary utilities for administration, construction, testing, disinfection, and startup of the Work, including electrical power, water, and telephone. Pay all costs associated with furnishing temporary utilities.

1. Provide a source of temporary electrical power of adequate size for construction procedures.

a. Use existing power systems where spare capacity is available. Provide temporary power connections that do not adversely affect the existing power supply. Submit connections to the Construction Manager for approval prior to installation.

b. Provide electrical pole and service connections that comply with Laws and Regulations and the requirements of the power company.

2. Provide temporary water.

B. Provide power for construction and storage.

2.05 WATER FOR CONSTRUCTION

A. Provide temporary water. Potable water may be purchased from the Owner by obtaining a water meter from the Owner and transporting water from a water hydrant. Non-potable

water may be used for hydraulic testing of non-potable basins or pipelines. Include the cost of water in the Contract Price.

PART 3 - EXECUTION

3.01 LOCATION OF TEMPORARY FACILITIES

A. Locate temporary facilities in areas approved by the Construction Manager. Construct and install signs at locations approved by the Construction Manager. Install informational signs so they are clearly visible.

3.02 PROJECT IDENTIFICATION SIGNS

A. Arrange for a professional sign painter to paint and erect a sign for the Site in accordance with the sign information provided in the Contract Documents or provided by the Owner**.** Sign will include identification of the OPT and Contractor (including appropriate logos, as required) and other Project information as determined by the Construction Manager. Paint sign on a 4-foot by 8-foot by 3/4-inch exterior grade plywood board. Frame plywood with 2 x 4 wood frame and mount on not less than two 4 x 4 posts. House plywood board in a channel routed 1/2 inch deep in the 2 x 4 frame. Shoulder, glue, and screw corners.

3.03 TEMPORARY LIGHTING

A. Provide lighting that is adequate to perform Work within any space.

B. Provide portable flood lights at any time that Work will be performed at night. Provide adequate lighting at any location Work is being performed.

3.04 REMOVAL OF TEMPORARY FACILITIES

A. Remove temporary buildings, sheds, and utilities at the conclusion of the Project and restore the Site to original condition or finished condition in accordance with the Drawings.

B. Remove informational signs upon completion of construction.

C. Remove project identification signs, framing, supports, and foundations upon completion of the Project.

3.05 MAINTENANCE AND JANITORIAL SERVICE

A. Maintain signs and supports in a neat, clean condition. Repair damage to structures, framings, or signs.

B. Repair any damage to Work caused by placement or removal of temporary signage.

END OF SECTION

01 57 00 TEMPORARY CONTROLS

PART 1 - GENERAL

1.01 SUMMARY

A. Provide labor, materials, equipment, and incidentals necessary to construct temporary facilities to provide and maintain control over environmental conditions at the Site. Remove temporary facilities when no longer needed.

B. Construct temporary impounding works, channels, diversions, furnishing, and operation of pumps, installing piping and fittings, and other construction for control of conditions at the Site. Remove temporary controls at the end of the Project.

1.02 DOCUMENTATION

A. Provide Shop Drawings in accordance with Section 01 33 02 “Shop Drawings.”

B. Provide copies of notices, records, and reports required by the Contract Documents or Laws and Regulations as Product Data in accordance with Section 01 31 13 “Project Administration.”

1.03 QUALITY ASSURANCE

A. Construct and maintain temporary controls with adequate workmanship using durable materials to provide effective environmental management systems meeting the requirements of the Contract Documents and Laws and Regulations. Use materials that require minimal maintenance to prevent disruption of construction activities while providing adequate protection of the environment.

B. Periodically inspect systems to determine that they are meeting the requirements of the Contract Documents.

1.04 POLLUTION CONTROL

A. Prevent the contamination of soil, water, or atmosphere by the discharge of noxious substances from construction operations. Provide adequate measures to prevent the creation of noxious air-borne pollutants. Prevent dispersal of pollutants into the atmosphere. Do not dump or otherwise discharge noxious or harmful fluids into drains or sewers, nor allow noxious liquids to contaminate public waterways in any manner.

B. Provide equipment and personnel and perform emergency measures necessary to contain any spillage.

1. Contain chemicals in protective areas and do not dump on soil. Dispose of such materials at off-site locations in an acceptable manner.

2. Excavate contaminated soil and dispose at an off-site location if contamination of the soil does occur. Fill resulting excavations with suitable backfill and compact to the density of the surrounding undisturbed soil.

3. Provide documentation to the Owner which states the nature and strength of the contaminant, method of disposal, and the location of the disposal site.

4. Comply with Laws and Regulations regarding the disposal of pollutants.

C. Groundwater or run-off water which has come into contact with noxious chemicals, sludge, or contaminated soil is considered contaminated. Do not allow contaminated water to enter streams or water courses, leave the Site in a non-contained form, or enter non-contaminated areas of the Site.

1. Construct temporary holding ponds or take other precautions and measures as required to contain the contaminated water and pump to a designated storage area.

2. Wash any equipment used for handling contaminated water or soil within contaminated areas three times with uncontaminated water prior to using such equipment in an uncontaminated area. Dispose of wash water used to wash such equipment as contaminated water.

1.05 EARTH CONTROL

A. Remove excess soil, spoil materials, and other earth not required for backfill. Control stockpiled materials to eliminate interference with Contractor and Owner's operations.

B. Dispose of excess earth off the Site. The Contractor is responsible for disposal.

1.06 AIR POLLUTION CONTROL

A. Air Pollution Watch Days:

1. Air Pollution Watch Days (APWD) may occur in the following times:

a. Typical Ozone Season: May 1 through October 31.

b. Critical Emission Time: 6:00 a.m. to 10:00 a.m.

2. Watch Days:

a. State or local environmental regulatory agencies, in coordination with the National Weather Service, may designate the following day as an APWD by 3:00 p.m. on the prior afternoon.

b. Begin work after 10:00 a.m. on designated APWD if work requires the use of heavy construction equipment for run times in excess of 1 hour prior to 10:00 a.m. Heavy construction equipment may be used prior to 10:00 a.m. if equipment is certified by EPA as "Low Emitting" or equipment burns Ultra Low Sulfur Diesel (ULSD), diesel emulsions, or alternative fuels such as CNG.

B. Obtain air permit for construction activities per requirements of Laws and Regulations.

1.07 MANAGEMENT OF WATER

A. Manage water resulting from rains or ground water at the Site. Maintain trenches and excavations free of water at all times.

B. Lower the water table in the construction area by acceptable means if necessary to maintain a dry and workable condition at all times. Provide drains, sumps, casings, well points, and other water control devices as necessary to remove excess water.

C. Provide continuous operation of water management actions. Maintain standby equipment to provide proper and continuous operation for water management.

D. Ensure that water drainage does not damage adjacent property. Divert water into the same natural watercourse in which its headwaters are located, or other natural stream or waterway as approved by the Owner. Assume responsibility for the discharge of water from the Site.

E. Remove the temporary construction and restore the Site in a manner acceptable to the Construction Manager and to match surrounding material at the conclusion of the Work.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Provide materials that comply with Laws and Regulations.

PART 3 - EXECUTION

3.01 CONSTRUCTING, MAINTAINING, AND REMOVING TEMPORARY CONTROLS

A. Construct temporary controls in accordance with Laws and Regulations.

B. Maintain controls in accordance with regulatory requirements where applicable or in accordance with the requirements of the Contract Documents.

C. Remove temporary control when no longer required, but before the Project is complete. Correct any damage or pollution that occurs as the result of removing controls while they are still required.

END OF SECTION

01 70 00 EXECUTION AND CLOSEOUT REQUIREMENTS

PART 1 - GENERAL

1.01 SUMMARY

A. Comply with requirements of the General Conditions and specified administrative procedures in closing out the Contract.

1.02 DOCUMENTATION

A. Submit affidavits and releases on forms provided by the Construction Manager through the PMIS.

1.03 SUBSTANTIAL COMPLETION

A. The following requirements must be met for the Project or a designated portion of the Work to be Substantially Complete per the General Conditions:

1. Work must be fully functional and able to operate in accordance with the Contract Documents without special or extraordinary efforts on the part of the Owner.

B. Conduct inspections with superintendent, Subcontractors, and Suppliers for the Work or a designated portion of the Work prior to calling for a Substantial Completion inspection by the OPT. Create a list of deficiencies in the Work that must be completed for the Project to qualify for Substantial Completion. Review the list with the Construction Manager or the designated member of the OPT. The Construction Manager or the designated member of the OPT may assist the Contractor with this effort; however, it is the Contractor's responsibility to create and manage this list of deficiencies until corrections are made.

C. Correct the identified deficiencies prior to calling for a Substantial Completion inspection.

D. Notify the Construction Manager that the Work or a designated portion of the Work is Substantially Complete per the General Conditions. Include a list of the items remaining to be completed or corrected before the Project will be considered for Final Completion.

E. OPT will visit the Site to observe the Work within a reasonable time after notification is received to determine the status of the Project.

F. Construction Manager will notify the Contractor that the Work is either Substantially Complete or that additional Work must be performed before the Project will be considered Substantially Complete.

1. Construction Manager will notify the Contractor of items that must be completed before the Project will be considered Substantially Complete.

2. Correct the noted deficiencies in the Work.

3. Notify the Construction Manager when the items of Work in the Construction Manager's notice have been completed.

4. OPT will revisit the Site and repeat the process.

5. Construction Manager will issue a Certificate of Substantial Completion to the Contractor when the OPT considers the Project to be Substantially Complete. The

certificate will include a tentative list of items to be corrected before Final Payment will be recommended.

6. Review the list and notify the Construction Manager of any objections to items on the list within 10 days after receiving the Certificate of Substantial Completion.

1.04 TRANSFER OF UTILITIES

A. Transfer utilities to the Owner when the Certificate of Substantial Completion has been issued.

B. Submit final meter readings for utilities and similar data as of the date the Owner occupied the Work.

1.05 CLOSEOUT REQUIREMENTS

A. Provide the following before Final Completion:

1. Record Documents per Section 01 31 13 “Project Administration”;
2. Keys and keying schedule;
3. Warranties, bonds, and service agreements;
4. Equipment Installation Reports;
5. Shop Drawings, Product Data, operation and maintenance manuals, and other documentation required by the Contract Documents;
6. Specified spare parts and special tools;
7. Certificates of occupancy, operating certificates, or other similar releases required to allow the Owner unrestricted use of the Work and access to services and utilities;
8. Evidence of continuing insurance and bond coverage as required by the Contract Documents; and
9. Final videos and photographs per Section 01 33 06 “Graphic Documentation.”

1.06 WARRANTIES, BONDS, AND SERVICES AGREEMENTS

A. Provide warranties, bonds, and service agreements required by Section 01 33 00 “Document Management” or by the individual Sections of the Specifications.

B. The date for the start of warranties, bonds, and service agreements is established per the General Conditions.

C. Compile warranties, bonds, and service agreements and review these documents for compliance with the Contract Documents.

1. Each document is to be signed by the respective Supplier or Subcontractor.
2. Each document is to include:
    a. The product or Work item description;
    b. The firm name, with the name of the principal, address, and telephone number;
    c. Scope of warranty, bond, or services agreement;

d. Date, duration, and expiration date for each warranty bond and service agreement;

e. Procedures to be followed in the event of a failure; and

f. Specific instances that might invalidate the warranty or bond.

D. Submit digital copies of the documents to the Construction Manager for review.

E. Submit warranties, bonds, and services agreements within 10 days after equipment or components placed in service.

1.07 FINAL COMPLETION

A. Conduct inspections with Superintendent, Subcontractors, and Suppliers prior to calling for a Final Completion inspection by the OPT. Create a list of deficiencies in the Work that must be completed for the Project to qualify for the Final Completion inspection. Review the list with the Construction Manager or the designated member of the OPT. The Construction Manager or the designated member of the OPT may assist the Contractor with this effort; however, it is the Contractor's responsibility to create and manage this list of deficiencies until corrections are made.

B. Identify, list, and correct deficiencies prior to calling for a Final Completion inspection. The Project at the call for Final Completion represents the Contractor's interpretation of a project completed in conformance with the Contract Documents and reflects the Contractor's representation of a quality project meeting the Owner's expectations.

C. Notify the Construction Manager when:

1. Work has been completed and complies with the Contract Documents;

2. Equipment and systems have been tested per the Contract Documents and are fully operational;

3. Final operation and maintenance manuals have been provided to the Owner and all operator training has been completed;

4. Specified spare parts and special tools have been provided;

5. Work is complete and ready for final inspection;

6. Final documentation for all outstanding Modifications and Claims (other than those listed on the Certificate of Final Completion) have been processed and are ready for incorporation into the final Application for Payment; and

7. Closeout requirements in Paragraph 1.05 have been completed.

D. OPT will visit the Site to determine if the Project is complete and ready for final payment within a reasonable time after the notice is received.

E. Construction Manager will notify the Contractor that the Project is complete or will notify the Contractor that Work is Defective.

F. Take immediate steps to correct Defective Work. Notify the Construction Manager when Defective Work has corrected. OPT will visit the Site to determine if the Project is complete and the Work is acceptable. Construction Manager will issue a Certificate of Final

Completion to the Contractor when the Project is complete or will notify the Contractor that Work is Defective.

G. Submit the request for final payment with closeout documentation described in Paragraph 1.05 if notified that the Project is complete and the Work is acceptable.

1.08 REINSPECTION FEES

A. Owner may impose a set-off against the Application for Payment in accordance with the General Conditions to compensate the OPT for additional visits to the Project if additional Work is required.

END OF SECTION

01 74 23 FINAL CLEANING

PART 1 - GENERAL

1.01 SUMMARY

A. Perform a thorough cleaning of the Site, buildings, or other structures prior to Owner occupancy of the buildings, and prior to Final Completion. Leave the Project clean and ready for occupancy.

1.02 DOCUMENTATION

A. Provide data for maintenance per Section 01 33 04 “Operation and Maintenance Data.”

1.03 QUALITY CONTROL

A. Use experienced workmen or professional cleaners for final cleaning.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Furnish the labor and products needed for cleaning and finishing as recommended by the manufacturer of the surface material being cleaned.

B. Use cleaning products only on the surfaces recommended by the Supplier.

C. Use only those cleaning products which will not create hazards to health or property and which will not damage surfaces.

PART 3 - EXECUTION

3.01 FINAL CLEANING

A. Thoroughly clean the entire Site and make ready for occupancy.

1. Remove construction debris, boxes, and trash from the Site.
2. Remove construction storage sheds and field offices.
3. Restore grade to match surrounding condition and remove excess dirt.
4. Sweep all drives and parking lots clean of dirt and debris. Use water trucks or hose down paved site to like new appearance.

B. Clean floors and inspect for damage.

1. Remove oil, grease, paint drippings, and other contaminants from floors, then mop repeatedly until thoroughly clean. Replace damaged flooring.
2. Clean resilient flooring with an approved cleaner and provide one coat of liquid floor polish as recommended by the flooring manufacturer. Polish to a buffed appearance with powered floor buffer.
3. Vacuum all carpets with powered floor sweeper to remove dirt and dust. Remove glue or other substances from nap of carpet.

C. Clean and polish inside and outside glass surfaces. Wash with window cleaner and water, apply a coat of high quality glass polish, and wipe clean. Do not scratch or otherwise mar glass surfaces.

D. Clean wall surfaces to remove dirt or scuff marks. Remove excess adhesive along top edges of wall base. Remove adhesive from surfaces of vinyl wall coverings.

E. Align ceiling tile to fit properly in grid and replace cracked or damaged tile. Remove smear marks and other dirt from tile and clean surface of grid system.

F. Spot paint nicks and other damage. Repaint the wall from inside corner to inside corner if spot-painting does not blend into the existing color and texture of the surrounding surfaces. Touch up damaged surfaces on factory finished equipment using special paint furnished by the manufacturer.

G. Clean plumbing fixtures, valves, and trim. Clean toilet seats and covers. Remove labels and adhesive from fixtures. Remove floor drains and clean baskets or buckets. Polish strainers and exposed chrome or brass.

H. Remove dirt, oil, grease, dust, and other contaminants from floors, equipment, and apparatus in mechanical and electrical rooms.

I. Clean and polish ceramic tile floors and wall surfaces to remove mildew or other stains. Tuck point defective joints.

J. Inspect exterior painted surfaces. Spot paint any damaged surfaces.

K. Clean permanent filters and replace disposable filters on heating, ventilating, and air conditioning systems. Clean ducts, blowers, and coils if units were operated without filters during construction.

L. Clean roof areas of debris; flush roof drainage systems with water until clear.

M. Broom clean exterior paved surfaces and rake clean other surfaces of the grounds.

N. Clean and polish all electrical equipment and exposed conduits. Remove paint overspray. Provide a blemish free appearance on all exposed equipment and conduits.

END OF SECTION

DIVISION 02

EXISTING CONDITIONS

02 41 00 DEMOLITION

1.00 GENERAL

1.01 WORK INCLUDED

A. Furnish labor, materials, equipment and incidentals necessary for every type of required demolition.

B. Furnish equipment of every type required to demolish and transport construction debris away from the Site.

C. Coordinate all demolition work with Section 01 35 00 “Special Procedures” if required.

1.02 STANDARDS

A. Work shall be performed in accordance with the codes and ordinances of the agency having authority over the Place of Record.

B. Resilient Floor Covering Institute (RFCI) publication “Recommended Work Practices for the Removal of Resilient Floor Coverings”

C. Occupational Safety and Health Association (OSHA), 29 CFR Parts 1010 and 1926, “Occupational Exposure to Asbestos, Tremolite, Anthophyllite, and Actinolite”, 40 CPR Part 61 - “National Emission Standard for Hazardous Air Pollutants”

1.03 DELIVERY AND STORAGE

A. Stockpile construction debris at the Site only as long as necessary to haul to a disposal site. Stack materials neatly and handle in an orderly manner until removed from the Site.

1.04 JOB CONDITIONS

A. Contractor shall visit the Site and determine the extent of demolition required and the Site conditions that might affect its proposal. Include costs of covering all aspects of the demolition as part of the proposal.

B. The Drawings shall be carefully reviewed to determine the extent of necessary demolition and to identify elements of the existing construction which are to remain in place. Report any discrepancies to Owner and Engineer before disturbing existing conditions. Property lines and limits of demolition shall be accurately located prior to beginning site demolition. Start of demolition activities shall represent confirmation by Contractor that existing conditions are as presented in the Contract Documents. Demolition outside the limits indicated on the Drawings, or outside the property lines shall not be performed.

1. For electrical demolition, verify field measurements and circuiting arrangements are as shown on the Drawings. Verify that existing wiring and equipment designated to be abandoned or demolished serve only abandoned facilities.

2. For process piping demolition confirm with the Owner that current operations will not be impacted and provide temporary equipment with Owner to keep systems functional during demolition process if required.

C. Material removed during demolition, and any equipment not otherwise designated to remain the property of the Owner, shall become the property of the Contractor, and shall be promptly removed from the Site.

D. Equipment and material designated as remaining the property of the Owner shall be removed from the structure and transported to a designated location on the Site and stored for the Owner's use. Store on wood runners raised above the surrounding grade and cover with weather resistant covering that is tied securely in place.

E. Take necessary precautions in removing Owner designated property to prevent damage during the demolition process. Equipment shall be removed in one piece. Loose components may be removed separately. Controls and electrical equipment may be removed from the equipment and handled separately. Large units, such as motor driven pumps, may be dismantled and motors handled separately. Do not use a cutting torch to separate the Owner's equipment or material. Salvaged piping shall be taken apart at flanges or fittings and removed in sections.

F. Contractor to coordinate with the Owner regarding any demolished items that will be salvaged. Any items that need to be disposed is per Forsyth County requirements.

1.05 HAZARDOUS MATERIALS

A. Hazardous materials will be removed by Owner before start of the Work.

1. If materials suspected of containing hazardous materials are encountered, do not disturb; immediately notify Engineer and Owner. Hazardous materials will be removed by Owner under a separate contract.

2. Owner will provide material safety data sheets for materials that are known to be present near the demolition site of operations or processes performed onsite.

2.00 PRODUCTS

2.01 MATERIALS

A. New materials and equipment for patching and extending work shall meet the requirements of the individual Sections in these Contract Documents. For materials not addressed in these documents, materials used shall meet or exceed the dimensions and quality of the existing work.

3.00 EXECUTION

3.01 SITE CLEARING

A. Perform site clearing to the limits indicated on the Drawings. Scrape the Site, removing brush, trees, weeds and trash. Haul debris away from the Site to an approved site as it accumulates.

B. Grub out tree and brush roots within the limits of buildings, parking lots, driveways and other structures. Remove rock out-croppings and boulders from any area within the limits of grading or structures. Remove roots and backfill any excavation resulting from tree removal with suitable soil for final grading plan.

C. Trees not located within the construction limits, or otherwise indicated for removal, shall remain in place. Visit the Site with the Engineer or Owner and identify those trees that are to remain. Mark all other trees with yellow paint to indicate removal. Protect remaining trees during construction. Wrap the tree trunks with 2 x 4 timbers if construction equipment must operate in close proximity to them.

D. Only designated trees shall be removed. In the event that trees other than those designated are erroneously removed or damaged to the point of distress, install replacement trees of equal size and number to compensate for those destroyed, at no additional cost to the Owner.

E. Provide dust control as needed or requested by the Owner.

F. Regulatory requirements: Verify and comply with applicable regulations regarding those governing noise, dust, nuisance, drainage and runoff, fire protection, and disposal.

G. Pre-construction conference: Meet with Engineer to discuss order and method of work.

3.02 REMOVAL OF CONCRETE SLABS

A. Remove parts of the existing concrete floor slab as indicated on the Drawings. Saw-cut the existing slab with two parallel lines around the area to be removed to the depth of the reinforcing. Do not cut reinforcing. Break out the remainder of the slab using jackhammers or by manual means. Cut reinforcing at a distance of 24 inches from the cut edge of the slab and bend back out of the way. Perform the remainder of the demolition, removing underground piping, or installing new Work. Provide dust control as needed or as requested by the Owner.

B. After buried Work has been completed, bend the reinforcing bars back into proper place and add new reinforcing of the same size and number as the remaining dowels. Lap the joints a minimum of 18 inches and securely tie in place. Replace concrete as required to repair the slab. Concrete shall be Type A as specified in Section “03 30 53 Miscellaneous Cast-in-place Concrete.”

3.03 REMOVAL OF PIPE

A. Meet with Owner and identify any material to be salvaged. Remove pipe designated for salvage by carefully excavating surrounding backfill material. Remove pipe using protective measures which prevent damage. Piping shall be disconnected at joints, allowing removal in one piece. Salvaged pipe determined unsatisfactory for re-use by the Engineer may be removed in any manner. Suspended or supported pipe shall be disassembled at joints. Remove in sections without cutting. Welded pipe sections may be cut with a torch, but cuts shall be along a welded joint.

3.04 UNDERGROUND PIPING

A. Contractor shall be responsible for obtaining location of underground utilities at the Site. Arrange for all applicable utility companies to accurately locate underground piping and set color-coded flags along the pipe route. Investigate utility company’s records to ascertain depths and sizes of piping and other ancillary features.

B. In the event that exact location of piping cannot be obtained, dig test holes as necessary to establish location of piping. Contractor shall not use mechanical digging machines within 6 feet of any active buried piping. For a distance of 4 feet on either side of buried piping, all digging shall be by hand excavation. If the piping is not active, or is to be abandoned or removed, any form of excavation may be used. Any existing active piping that is damaged during demolition will be repaired, in coordination with the Owner, to new condition by the Contractor at no additional cost to the Owner.

3.05 BACKFILLING

A. Backfill cavities resulting from demolition. Fill cavities occurring within the limits of buildings, structures, or pavements in accordance with the requirements of other Sections of the Specifications. Backfill and compact cavities outside the construction limits to the same density as the surrounding earth. No testing is required for backfill outside the limits of new construction.

3.06 CLEANING AND REPAIR

A. Clean and repair existing materials and equipment which remain or are to be reused.

B. Lights: Use mild detergent to clean all exterior and interior surfaces. Rinse with clean water and wipe dry. Replace lamps and broken electrical parts impacted by the demolition processes.

3.07 GRUBBING:

A. From excavated areas: Grub stumps, roots, and other obstructions 1 inches or over in diameter to depth of not less than 18 inches below finish grade.

B. In embankment areas or other areas to be cleared outside construction area, do not leave stumps, roots, and other obstructions higher than 2 feet.

C. Backfill and compact cavities left below subgrade elevation by removal of stumps or roots to density of adjacent undisturbed soil.

3.08 TREES AND SHRUBBERY

A. A. Existing trees, shrubbery, and other vegetative material may not be shown in the drawings. Inspect the site as to the nature, location, size, and extend of vegetative material to be removed or preserved, as specified herein. Preserve in place trees that are specifically shown in the drawings and designated to be preserved.

B. Preservation of Trees, Shrubs, and Other Plant Material:

1. Save and protect plant materials (trees, shrubbery, and plants) beyond the limits of clearing and grubbing from damage resulting from the work. No filling, excavating, trenching, or stockpiling of materials will be permitted within the drip line of these plant materials. The drip line is defined as a circle drawn by extending a line vertically to the ground from the outermost branches of a plant or group of plants. To prevent soil compaction within the drip line area, no equipment will be permitted within this area.

2. When trees are close together, restrict entry to area within drip line by fencing. In areas where no fence is erected, protect the trunks of trees 2 inches or greater in diameter by encircling the trunk entirely with boards held securely by 12-gauge wire and staples. This protection shall extend from ground level to a height of 6 feet.
3. Cut and remove tree branches where necessary for construction. Remove branches other than those required for a balanced appearance of any tree. Treat cuts with a tree sealant.

END OF SECTION

02 96 00 TEMPORARY BYPASS PUMPING

1.00 GENERAL

1.01 WORK INCLUDED

A. Furnish labor, materials, equipment and incidentals necessary to implement a temporary bypass pumping system that will pump into the installed 6” bypass pumping line for the purpose of diverting existing sewer flows around the work area during the proposed 8” piping, 8” Valve Vault, and required instrumentation and controls (I&C) installation.

B. The Owner will provide vacuum trucks to haul sewage from the wetwell to allow breakage of the existing 8” force main.

C. The Contractor shall provide temporary bypass pumping and piping as necessary to prevent sewage overflows in the wetwell to perform all necessary work. The Contractor is to utilize the existing wetwell for the suction and the newly installed 6” bypass connection port for the discharge.

1.02 QUALITY ASSURANCE

A. Contractor shall demonstrate that the temporary bypass piping system is in good working order and is sufficiently sized to successfully handle all sanitary sewer flows by performing a test run for a period of 24 hours prior to beginning Work.

B. Contractor shall be required to have all materials, equipment and labor necessary to complete the repair and/or replacement on the Site prior to isolating the sewer manhole or line segment and beginning flow diversion or pumping operations.

C. Contractor shall provide both a strobe light type, high level alarm, as well as alarm notification to their cell phones, as well as other appointed personnel to be identified by the Owner and ensure adequate alarm notification is attained prior to actual startup of the test period.

D. During active operations, the Contractor shall have a call system set-up that will notify the Contractor and Owner (if desired) in the event of a failure or high-water alarm. The Contractor must have personnel capable of making it onsite within 30 minutes of this notification.

E. Contractor shall coordinate all activities through Engineer and Owner.

F. It is anticipated that bypass pumping shall be required at the following locations:

1. Near the existing Kentmere Lift Station and proposed Valve Vault Area

1.03 SUBMITTALS

A. Make submittals required by this Section under the provisions of Section 01 33 00 “Document Management.”

B. Manufacturer’s product data, instructions, recommendations, Shop Drawings, and necessary certifications in order for the proposed Temporary Bypass Pumping Plan to be reviewed. The plan shall include, but not be limited to, the following:

1. Staging areas for pumps.

2. Site Plan, with erosion control details, for the existing Kentmere Lift Station and the proposed Valve Vault Area.
3. Sewer plugging method and types of plugs.
4. Number, size, material, location and method of installation of suction piping.
5. Number, size, material, location and method of installation of discharge piping, valves, and fittings.
6. Bypass pump sizes, capacity, number of each size to be on site, including spare pump, and power requirements.
7. Calculations of static lift, friction losses, and flow velocity (pump curves showing pump operating range shall be submitted based on bypass pumping schedule at the end of this Section).
8. Standby power generator size and location.
9. Downstream discharge plan.
10. Calculations for selection of bypass pumping pump size.
11. Method of noise control for each pump and/or generator if required.
12. Method of protecting discharge manholes or structures from erosion and damage.
13. Schedule for installation and maintenance of bypass pumping lines.

2.00 PRODUCTS

2.01 MATERIALS

A. Contractor shall provide all necessary pumping equipment, piping and all other necessary appurtenances in order to maintain adequate and reliable sanitary sewer flow in the sewer system (excluding manholes) at all times during construction. All materials, equipment, etc., must be in good condition and should not have visible damage such as cracks, holes, foreign material, blisters, etc.

B. Polyvinyl Chloride (PVC) C-900 pressure pipe and fabricated fittings or High-Density Polyethylene (HDPE) is the preferred pipe material for all bypass piping. HDPE must be used when bypass discharge piping will be going through streams, storm water culverts, and/or environmentally sensitive areas.

1. PVC/HDPE pipe must be assembled and joined using couplings, flanges or fusion welding in order to avoid joint leakage.
2. HDPE fusion welding must be performed by personnel certifid as fusion technician(s) by the manufacturer of HDPE pipe and/or fusing equipment.
3. The bypass pumping plan shall indicate the proposed DR of the pipe to be used.

C. Pipe material other than PVC and HDPE shall be submitted to the Engineer for approval. Neither “irrigation type” pipe nor glued PVC pipe will be permitted.

D. Plugs must be selected and installed according to the size of the line to be plugged. An additional plug must be on-site and ready to be installed in the event a plug fails or becomes dislodged. Plug(s) will be reviewed by the inspector and/or Engineer for defects that might

lead to failure prior to being installed. It is also imperative that the Contractor notify the inspector at the completion of the Work in order to verify that all plugs have been removed from the system.

2.02 EQUIPMENT

A. Pumps must be fully automatic self-priming units that do not require the use of foot-valves or vacuum pumps to prime the system. Pumps may be electric or diesel powered. The primary pump must be a grinder or chopper pump, in order to reduce the potential for debris to complicate the safe operation of the pumps.

B. Contractor shall have one backup pump, equal in capacity to the largest pump in the system, connected to the temporary bypass pumping system and ready for operation in case any of the primary pumps fail. The backup pump shall not be used in Contractor's calculations for determining the pumping capacity requirements for the stated flow conditions.

C. Sound-attenuated pump enclosures shall be required on all projects where the bypass pumps are located within 100 feet of any residence, business, park, or other presence of people.

3.00 EXECUTION

3.01 PREPARATION

A. Obtain the Engineer's approval of location of bypass pipelines and Temporary Bypass Plan staging areas and pump locations prior to installation.

B. Obtain approvals for placement within public or private property.

3.02 CONSTRUCTION, INSTALLATION, AND REMOVAL

A. During construction, it will be the Contractor's responsibility to maintain a safe and secure environment at all times. All provisions and/or requirements of the temporary bypass pumping plan must be followed throughout the course of any bypass flow operations. Contractor must notify the Owner and Engineer 72 hours prior to commencing the bypass pumping operations.

B. Contractor shall provide continuous supply on-site fuel storage sufficient for 24-hour operation of the bypass pumping installation. Contractor shall protect all components of the bypass operations from vandalism and vehicular damage by making the site secure.

C. Contractor shall minimize sewer odors by using lids, shroud covers, or any method approved by the Inspector or Engineer.

D. Contractor shall be solely responsible for any and all damages to private and/or public property caused by or during the installation, operation, and/or removal of the bypass pumping system.

E. All piping, joints and accessories shall be designed to withstand at least twice the maximum system pressure, or a minimum of 50 psi, whichever is greater.

F. During flow diversion and/or pumping, no sewage shall be leaked, dumped, or spilled in or onto, any area outside of the existing sanitary sewer system.

G. When flow diversion and/or pumping operations are complete, all pumping shall be drained into the sanitary sewer prior to disassembly and all flow management components shall be removed.

3.03 BYPASS PUMPING SCHEDULE

A. Flows shown below are based on historical flows provided by FCDWS.

B. It is the Contractors responsibility to verify the flows with FCDWS prior to development of bypass pumping plan.

Sanitary Sewer Manhole / Location	Average Dry Weather Inflow (GPM)	Peak Wet Weather Inflow (GPM)
Kentmere Lift Station Wetwell	50	100

END OF SECTION

APPENDIX A

A1.00 MEASUREMENT AND PAYMENT

A1.01 MEASUREMENT

A. Measurement for the Work specified herein will be by lump sum, as the Work progresses, and as required by the Contract Documents, in accordance with Section 01 29 01 "Measurement and Basis for Payment."

B. Temporary bypass pumping not specifically required on the Drawings, but directed by the Engineer and/or the inspector, will not be measured separately for payment and will be considered incidental. Repair or replacement of manhole sections disturbed as a part of the temporary bypass piping operations is considered incidental to the line item and will not be measured separately for payment.

A1.02 PAYMENT

A. Partial payment of the lump sum bid item for temporary bypass pumping shall be in accordance with the following:

1. When initial setup and operation of the temporary bypass pumping system begins, 40 percent of the line item will be paid.

2. The remaining portion of the line item will be paid when the temporary bypass pumping system operations for the entire job are completed.

END OF APPENDIX A

DIVISION 03

CONCRETE

03 30 53 MISCELLANEOUS CAST-IN-PLACE CONCRETE

1.00 GENERAL

1.01 SUMMARY

A. This Section specifies cast-in-place concrete, including reinforcement, concrete materials, mixture design, placement procedures, and finishes.

1.02 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Design Mixtures: For each concrete mixture.

1. Submit mix design supporting documentation and calculations as required.

1.03 QUALITY ASSURANCE

A. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C94/C94M requirements for production facilities and equipment.

B. Source Limitations: Obtain each type of cement of the same brand from the same manufacturer's plant, obtain aggregate from one source, and obtain admixtures through one source from a single manufacturer.

C. Comply with ACI 301, "Specification for Structural Concrete," including the following sections, unless modified by requirements in the Contract Documents:

1. "General Requirements."
2. "Formwork and Formwork Accessories."
3. "Reinforcement and Reinforcement Supports."
4. "Concrete Mixtures."
5. "Handling, Placing, and Constructing."

D. Comply with ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."

2.00 PRODUCTS

2.01 FORMWORK

A. Furnish formwork and formwork accessories according to ACI 301.

2.02 STEEL REINFORCEMENT

A. Reinforcing Bars: ASTM A615/A615M, Grade 60, deformed.

B. Plain-Steel Welded Wire Reinforcement: ASTM A1064, fabricated from as-drawn steel wire into flat sheets.

2.03 CONCRETE MATERIALS

A. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source throughout the Project:

1. Portland Cement: ASTM C150, Type II.

2. Fly Ash: ASTM C618, Class A or Class F.

a. Class C may be used in concrete made with Type II Portland cement.

b. Class F required if used in concrete mixes containing aggregates classified as potentially reactive based on ASTM C1293 or ASTM C1260.

1). CaO content: Less than 18 percent.

c. Loss on ignition: Not exceeding 3 percent.

3. No more than 20 percent of the cement may be replaced with fly ash.

B. Coarse Aggregate: ASTM C33, graded, uniformly graded, of the size scheduled and as follows:

1. Class: Moderate weathering region, but not less than 3M.

C. Fine Aggregate:

1. Washed and screened natural sands or sands manufactured by crushing stones; conforming to ASTM C33. The gradation in ASTM C33 is:

Sieve Size	Percent Retained	Percent Passing
3/8”	0	100
#4	0-5	95-100
#8	0-20	80-100
#16	15-50	50-85
#30	40-75	25-60
#50	70-90	10-30
#100	90-98	2-10

2. Fine aggregate shall have not more than 45 percent retained between any two consecutive sieves. Its fineness modulus, as defined in ASTM C125, shall be not less than 2.3 nor more than 3.1.

D. Water: ASTM C94/C94M; potable.

2.04 ADMIXTURES

A. Air-Entraining Admixture: ASTM C260.

B. Chemical Admixtures: Provide admixtures certified by manufacturers to be compatible with other admixtures and that will not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.

Water-Reducing Admixture	ASTM C494/C494M, Type A
Retarding Admixture	ASTM C494/C494M, Type B
Water-Reducing and Retarding Admixture	ASTM C494/C494M, Type D

High-Range, Water-Reducing Admixture	ASTM C494/C494M, Type F
High-Range, Water-Reducing and Retarding Admixture	ASTM C494/C494M, Type G
Plasticizing and Retarding Admixture	ASTM C1017/C1017M, Type II

2.05 RELATED MATERIALS

A. Joint-Filler Strips: STM D1751, asphalt-saturated cellulosic fiber, or ASTM D1752, cork or self-expanding cork.

B. Zinc Rich Primer: Aluminum surfaces which contact or are embedded in concrete shall be coated with zinc rich primer. Primer shall be:

1. Tneme-Zinc; Tnemec Company, Inc.
2. MasterProtect P 8100AP; Master Builders Solutions US LLC.
3. Approved equal.

2.06 CURING MATERIALS

A. Evaporation Retarder: Waterborne, monomolecular film forming; manufactured for application to fresh concrete.

B. Absorptive Cover: AASHTO M182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. when dry.

C. Moisture-Retaining Cover: ASTM C171, polyethylene film or white burlap-polyethylene sheet.

D. Water: Potable.

E. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C309, Type 1, Class B.

2.07 CONCRETE MIXTURES

A. Comply with ACI 301 requirements for concrete mixtures.

B. Normal-Weight Concrete: Prepare design mixes, proportioned according to ACI 301, as follows:

Class	Min. 28-Day Compressive Strength (psi)	Maximum Size of Coarse Aggregate	Maximum Water/Cement Ratio	Maximum Slump (in.)	Minimum Sacks of Cement per cubic yard
A	4000	1-1/2”	0.45	3	5.75
B	3000	1.5 Size No. 467	0.47	3	5.75
E	1500	1.5 Size No. 467	0.70	4	4.00
* Slump shown is with HRWR ** Provide one additional sack of cement per cubic yard if concrete must be deposited in standing water.					

1. Air Content: Maintain within range permitted by ACI 301. Do not allow air content of floor slabs to receive troweled finishes to exceed 3 percent.

C. Concrete Usage

Class	Usage
Class A Use	Footings and slabs, and other unless noted otherwise
Class B Use	Pavement, gutters, sidewalks
Class E Use	Cradling, blocking, mud slab, lean concrete backfill

2.08 CONCRETE MIXING

A. Ready-Mixed Concrete:

1. Measure, batch, mix, and deliver concrete according to ASTM C94/C94M, and furnish batch ticket information.

2. When the air temperature is above 90 F, reduce mixing and delivery time to 60 minutes.

3.00 EXECUTION

3.01 FORMWORK

A. Design, construct, erect, brace, and maintain formwork according to ACI 301.

3.02 STEEL REINFORCEMENT AND EMBEDDED ITEMS

A. Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.

B. Where aluminum anchors, aluminum shapes, or aluminum electrical conduits are embedded in concrete, paint aluminum contact surfaces with zinc rich primer. Allow the paint to thoroughly dry before placing the aluminum in contact with the concrete.

3.03 JOINTS

A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.

B. Construction Joints: Locate and install so strength and appearance of concrete are not impaired.

C. Isolation Joints: Install joint-filler strips at junctions with slabs-on-grade and vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.

D. Extend joint fillers full width and depth of joint, terminating flush with finished concrete surface, unless otherwise indicated.

3.04 CONCRETE PLACEMENT

A. Comply with ACI 301 for measuring, batching, mixing, transporting, and placing concrete.

B. Do not add water to concrete during delivery, at the Site, or during placement.

C. Consolidate concrete with mechanical vibrating equipment.

3.05 BLOCKING OF PIPE FITTINGS

A. Concrete blocking shall be placed at bends, tees, wyes, crosses, plugs, etc. The concrete blocking shall be placed so as to rest against firm undisturbed trench walls. The supporting area for each block shall be sufficient to withstand the thrusts, shall rest on a firm, undisturbed earth.

B. The concrete blocking shall be placed against undisturbed trench walls, with a minimum of 18 inches between trench wall and pipe. Blocking shall extend a minimum of 0.75 x pipe diameter below and above the centerline of pipe and shall not extend beyond any joints.

C. If requested by the Owner's representative or where upward thrusts are present, the ends of the thrust blocks shall be contained in wood or metal forms.

3.06 FINISHING FORMED SURFACES

A. No Finish: After forms are removed, repair or patch tie holes and defects. Otherwise, no additional finish is required. Apply to surfaces which are not visible from the inside or outside of the completed structure or less than 12 inches below finish grade (i.e. back of retaining walls below embankment, etc.).

B. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defective areas. Remove fins and other projections exceeding 1/8 inch. Apply to concrete surfaces exposed to view.

C. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces, unless otherwise indicated.

3.07 FINISHING UNFORMED SURFACES

A. General: Comply with ACI 302.1R for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.

B. Screed surfaces with a straightedge and strike off. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane before excess moisture or bleedwater appears on surface. Do not further disturb surfaces before starting finishing operations.

C. Float Finish: Apply float finish to surfaces to receive trowel finish.

D. Trowel Finish: Apply a hard trowel finish to surfaces exposed to view except for exterior traffic surfaces.

E. Nonslip Broom Finish: Apply a nonslip broom finish to exterior concrete traffic surfaces. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route.

3.08 CONCRETE PROTECTING AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and with ACI 301 for hot-weather protection during curing.

B. Evaporation Retarder: Apply evaporation retarder to concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb./sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.

C. Begin curing after finishing concrete but not before free water has disappeared from concrete surface.

D. Curing Methods:

1. Cure formed and unformed concrete for at least 7 days by one or a combination of the following methods:

a. Moisture Curing:

1). Keep surfaces continuously moist for not less than 7 days with the following materials:

a). Water.

b). Continuous water-fog spray.

c). Absorptive cover, water saturated and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.

b. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Cure for not less than 7 days. Immediately repair any holes or tears during curing period using cover material and waterproof tape.

c. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within 3 hours after initial application. Maintain continuity of coating and repair damage during curing period.

3.09 FIELD QUALITY CONTROL

A. Testing Agency: Contractor is to engage a qualified independent testing and inspecting agency to sample materials, perform tests, and submit test reports during concrete placement according to requirements specified in this Article.

B. Tests: Perform according to ACI 301.

1. Testing Frequency: One composite Sample shall be obtained for each day's pour of each concrete mix exceeding 5 cubic yards but less than 25 cubic yards, plus one set for each additional 50 cubic yards or fraction thereof and as directed by the Owner and Engineer.

3.10 REPAIRS

A. Remove and replace concrete that does not comply with requirements in this Section.

END OF SECTION

03 41 19 PRECAST REINFORCED CONCRETE VALVE VAULT

1.00 GENERAL

1.01 WORK INCLUDED

A. Furnish all labor, materials, equipment, incidentals and transportation necessary for placing precast reinforced concrete vaults.

1.02 QUALITY ASSURANCE

A. Design Criteria:

1. Precast reinforced concrete valve vault shall conform:

a. To the requirements of ASTM C857 and C858 for underground precast concrete utility structures.

b. Be designed for the specific site conditions and construction document requirements.

c. Be designed to resist buoyant forces due saturated soil.

2. Wall and slab minimum thicknesses shall be as calculated to resist design forces, but shall not be less than that required for: manufacture and handling proper installation of pipe penetration seal.

B. Test Requirements: Refer to ASTM C858 for testing requirements.

C. Inspection:

1. After installation, the Contractor shall demonstrate that vaults have been properly installed, level, with tight joints, at the correct elevations and orientations, and that the backfilling has been carried out in accordance with the Contract Documents.

D. Permissible Variations:

1. Tolerances for precast sections shall conform to ASTM C858.

a. Deviations from the above tolerances will be acceptable if the sections can be fitted at the plant or job site and it is determined that an acceptable joint can be made.

b. An acceptable joint is when two sections are fitted together on a flat surface, in proper alignment and position they will be installed, such that the longitudinal opening shall not exceed 1 inch at any point . Sections fitted together at the plant and accepted in this manner shall be match-marked for installation.

E. Inspection: The quality of materials, the process of manufacture, and the finished valve vault shall be subject to inspection and approval by the Owner or an authorized representative at the manufacturing plant. In addition, the valve vault shall be subject to further inspection by the Owner at the Project Site prior to and during installation.

F. Cause for Rejection:

1. The valve vault shall be subject to rejection on account of failure to conform to any of the specification requirements. Individual sections of valve vault may be rejected because of the following:

a. Fractures or cracks in the vault.

b. Defects that indicate imperfect proportioning, mixing and molding.

c. Surface defects indicating honeycombed or open texture.

d. Damaged ends, where such damage would prevent making a structurally sound and water tight joint.

1.03 SUBMITTALS

A. Submittals shall be in accordance with Section 01 33 00 “Document Management” and shall include:

1. Manufacturer’s product data sheets.

2. Concrete mix and test results.

3. Shop drawings:

a. Show dimensions, locations, lifting inserts, reinforcement, and joints.

b. Structural design calculations for vaults, signed by a licensed registered Civil or Structural Engineer licensed in the State where project is located.

4. Manufacturer’s Certification for Vaults: Written certification that the vault complies with the requirements of this Section.

1.04 STANDARDS

A. The applicable provisions of the following standards shall apply as if written here in their entirety:

1. American Society of Testing and Materials (ASTM) Standards:

ASTM C857	Standard Practice for Minimum Structural Design Loading for Underground Precast Concrete Utility Structures
ASTM C858	Standard Specification for Underground Precast Concrete Utility Structures
ASTM C31	Standard Practice for Making and Curing Concrete Test Specimens in the Field
ASTM C150	Standard Specification for Portland Cement.
ASTM C857	Standard Practice for Minimum Structural Design Loading for Underground Precast Concrete Utility Structures.
ASTM C858	Standard Specification for Underground Precast Concrete Utility Structures.

2. American Association of State Highway and Transportation Officials (AASHTO) Standards:

AASHTO M198-08	Standard Specification for Joints for Concrete Pipe, Manholes, and Precast Box Sections using Preformed Flexible Joint Sealants

3. American Concrete Institute (ACI):
    a. 318 - Building Code Requirements for Structural Concrete and Commentary.
4. Occupational Safety and Health Administration (OSHA).
5. Forsyth County Department of Engineering, County, Georgia.

1.05 DELIVERY AND STORAGE

A. Coordinate delivery with installation where possible to avoid unnecessary handling and equipment movement. When stockpiling is required, storage shall be made as close as possible to the point of installation.

B. Store precast sections on level blocking in a manner acceptable to the Engineer. No load shall be placed upon them until design strength is reached and curing completed. Shipment of sections may be made when the design strength and curing requirements have been met.

C. Store flexible gasket materials not on the box section, and joint lubricating compounds in a cool dry place. Gaskets and preformed plastic materials for pipe joint construction shall be kept clean, away from oil, grease, excessive heat and out of the direct rays of the sun.

2.00 PRODUCTS

2.01 MIXES

A. Concrete: Mixed in a central batch plant or other approved batching facility from which the quality and uniformity of the concrete can be assured. Transit mixed concrete will not be acceptable. Concrete shall be 5000 psi minimum.

2.02 MANUFACTURED PRODUCTS

A. Valve Vault: Materials, manufacture and curing of precast reinforced concrete valve vault shall conform to ASTM C858. Vault shall be a precast concrete structure in accordance with the Drawings and Specifications.

B. Cold Applied Preformed Gaskets:

1. Cold applied preformed gaskets shall be suitable for sealing joints of tongue and groove concrete box sections. The gasket sealing the joint shall be produced from blends of refined hydrocarbon resins and plasticizing compounds reinforced with inert mineral filler and shall contain no solvents, irritating fumes or obnoxious odors. The gasket joint sealer shall not depend on oxidizing, evaporating, or chemical action for its adhesive or cohesive strength, and shall be supplied in extruded rope-form of suitable cross-section. The size of the gasket joint sealer shall be in accordance with the manufacturer's recommendations and sufficient to obtain the squeeze-out as described in Paragraph 3.02.

2. Gasket joint sealer shall be protected by a suitable removable two-piece wrapper. The two-piece wrapper shall be so designed that half may be removed longitudinally without disturbing the other half to facilitate application as noted below.

3. The chemical composition of the gasket joint sealing compound shall conform to the requirements of AASHTO M198-08 1, Type B, Flexible Plastic Gasket (Bitumen).

C. Workmanship and Finish: Valve Vault shall be substantially free from fractures, large or deep cracks and surface roughness. The ends of the valve vault shall be normal to the walls and centerline of the valve vault within the limits of Permissible Variations specified above. The vault exterior shall be coated with a bituminous coating for areas to be installed below grade.

D. Markings: The following information shall be clearly marked on each section. Markings shall be indented on the valve vault or painted thereon with waterproof paint.

1. The load rating and ASTM Designation No. of the valve vault.
2. The date of manufacture.
3. The name or trade name of the manufacturer.

3.00 EXECUTION

3.01 EXCAVATION AND EMBEDMENT

A. Excavation and embedment shall conform to the requirements in Section 31 23 10 “Structural Excavation and Backfill.”

3.02 INSTALLATION

A. Laying: Valve vault sections shall be installed such that the bottom section(s) shall be full sections. Partial sections, if necessary, shall be utilized for the top most section only. Valve vault cover shall be separate from the vault walls.

B. Jointing:

1. Joints using cold applied preformed plastic gaskets shall be made as follows:

a. A suitable primer of the type recommended by the manufacturer of the gasket joint sealer shall be brush- applied to the tongue and groove joint surfaces and the end surfaces and allowed to dry and harden. No primer shall be applied over mud, sand, dirt or sharp cement protrusions. Clean and dry the surface to the primed when primer is applied.

b. Before laying the valve vault in the trench, attach the plastic gasket sealer around the tapered tongue or tapered groove near the shoulder or hub of each joint. Remove the paper wrapper from one side only of the two-piece wrapper on the gasket and press firmly to the clean, dry valve vault joint surface. Do not remove the outside wrapper until immediately before pushing the valve vault into its final position.

c. When the tongue is correctly aligned with the flare of the groove, remove the outside wrapper on the gasket and pull or push home the valve vault with sufficient force and power (Back Hoe shovel, chain hoist, ratchet hoist or winch) to cause the evidence of squeeze-out of the gasket material on the side of outside around the complex valve vault joint perimeter.

d. When the atmospheric temperature is below 60 deg. F, plastic joint seal gaskets shall either be stored in an area warmed to above 70 deg. F, or artificially warmed to this temperature in a manner satisfactory to the Engineer. Apply gaskets to valve vault joints immediately prior to placing valve vault in trench, followed by connection to previously laid box section.

3.03 BACKFILL

A. After the valve vault has been placed, bedded and jointed as specified and approved by the Owner or his authorized representative, perform backfilling in accordance with Section 31 23 10 “Structural Excavation and Backfill.” Take special precautions in placing and compacting the backfill to avoid any movement of the valve vault or damage to the joints.

END OF SECTION

DIVISION 09

FINISHES

09 96 00.01 HIGH-PERFORMANCE COATINGS

1.00 GENERAL

1.01 WORK INCLUDED

A. Furnish labor, materials, equipment and incidentals necessary to apply protective coatings to material and equipment as specified herein, including the preparation of surfaces prior to application of coatings.

B. Protective coatings are special coatings to be used at specific locations or on specific surfaces as indicated her ein and are complementary to the coating surfaces specified in Section 09 96 01 “Concrete Protective Coatings” in that every surface of every description, except those which are specifically noted not to receive a coating finish, must be covered by a paint system as specified in this Section or in Section 09 96 01 “Concrete Protective Coatings.”

C. Protective coatings must be applied to the following surfaces:

1. Metal surfaces located outside of buildings and other structures anywhere on the Site.
2. New piping and valves, including:
    a. All new ductile iron piping and valves installed in the proposed valve vault.
    b. All above grade piping including force main bypass piping.
    c. Buried piping and valves shall be coated and lined per specification section 33 05 01.02 “Ductile Iron Pipe and Fittings” and 40 05 62 “Eccentric Plug Valves”.
3. Concrete surfaces at the following locations:
    a. The precast flowmeter vaults exterior shall be coated per specification 03 41 19 “Precast Reinforced Concrete Valve Vault” for areas to be installed below grade.

D. The following must not be coated and must be protected from drips, overspray, etc. unless indicated otherwise

1. Stainless steel piping, materials and equipment.
2. Galvanized steel piping, materials and equipment unless specifically indicated to be coated.
3. Aluminum materials and equipment.
4. Interior electrical items.

E. Special applications for painting include the following:

1. Buried pipe and valves must receive a shop applied protective coating as described in the appropriate Section of the Specifications.

F. Contain, treat, and dispose of any dust, spray, drainage, or spillage resulting from coating operations. It is the Contractor’s responsibility to determine if the materials to be disposed of are classified as Hazardous Waste. Disposed of waste, hazardous or otherwise, must be in accordance with applicable regulations. Contractor must be aware of and understand the regulations concerning disposal of waste generated by coating operations.

1.02 QUALITY ASSURANCE

A. Acceptable Manufacturers:

1. Products which comply with the Contract Documents and are manufactured by the following companies will be acceptable:

a. Tnemec Company, Inc.

b. Carboline.

c. PPG Protective & Marine Coatings.

d. The Sherwin-Williams Company.

e. Akzo Nobel / International Paint, LLC.

f. ICI Devoe High Performance Coatings.

g. Plasite Protective Coatings.

2. It is desired that the paint products be furnished by as few manufacturers as possible to meet the requirements of the Specifications. Coating products of the same type must be supplied by the same manufacturer. Do not mix products from different sources.

B. Applicator's Qualifications: Applicators must be qualified in this line of work and have a minimum of 5 years of experience in the application of the protective coatings of the types specified herein. Submit a list of recent projects and names of references for those projects.

C. Product Quality:

1. Use only the coatings specified in this Section. Use only those thinners and solvents recommended by the manufacturer, only in the amounts necessary to produce the manufacturer's recommended spreading rate, and in amounts not exceeding the maximum quantities stated in the manufacturer's literature.

2. The coating material must not show excessive settling in a freshly opened full can and must be easily re-dispersed with a paddle to a smooth, homogeneous state. It must show no curdling, livering, caking, or color separation and must be free of lumps or skim surfaces.

D. Inspection:

1. Inspect and provide substrate surfaces prepared in accordance with the Contract Documents and the printed directions and recommendations of paint manufacturer whose product is to be applied.

2. Provide Engineer minimum of 3 days of notice prior to start of surface preparation work or coating application work.

3. Perform Work only in the presence of Engineer, unless Engineer grants prior approval to perform such Work in Engineer's absence. Approval to perform Work in the Engineer's absence is limited to the current day unless specifically noted to extend beyond the completion of the workday.

4. Inspection by the Engineer, or the waiver of inspection of any particular portion of the Work, must not be construed to relieve the Contractor of responsibility to perform the Work in accordance with the Contract Documents.

5. Contractor is solely responsible for testing for this Section, at no further cost to the Owner. Engineer may also make such tests if it is considered necessary. Cooperate with the Engineer, providing equipment, scaffolds, and other equipment as requested by the Engineer.

E. Testing Equipment: Furnish the testing apparatus necessary for testing coatings, including the following:

1. One set of U.S. Department of Commerce thickness calibration plates, certified by the National Bureau of Standards, to test dry film thickness.
2. Wet-film thickness gauges. Give one to Owner's representative. Each painter must keep one to test paint as it is applied.
3. One electronic dry-film thickness gauge capable or measuring 0-200 mils with calibration standards approved by the Bureau of Standards.
4. One Elcometer 319 Dewpoint Meter or approved equal.
5. One Tinker and Rasor Model M 1 Holiday Detector and recommended wetting agent and/or High Voltage Holiday Detector if required for coating thickness specified.
6. One set of SSPC-VIS 1**,** 3 and 4 **-** Visual Standards as applicable.

F. Testing Reports: Submit an inspection report for each coating applied on the Project. The testing report must be completed on a form furnished by the Engineer and must bear the signature of the Contractor and the Owner's representative.

G. Contractor must schedule a construction conference prior to any field work being completed. The meeting will be at the Site and will include the Owner, Contractor, painting superintendent, Engineer, Owner's representative and coating manufacturer's representative. At this meeting the coating plan and schedule will be reviewed in detail.

1.03 SUBMITTALS

A. Submittals must be in accordance with Section 01 33 00 "Document Management."

B. The following Product Data for products, including manufacturer's data sheets, are due prior to ordering coating and surface preparation materials:

1. Coating manufacturer's color selection literature for coating materials and caulk.
2. Sample warranty document for products.
3. Provide certification from the manufacturer that all coatings will not contain more than 0.06 percent by weight of lead in the cured coating for each coat applied.
4. Coating manufacturer's Product Information and Safety Data Sheets (SDS) for each coating and caulk material. Product Information must include the following:
    a. The manufacturer's published instructions for use in specifying and applying all proposed coatings.
    b. Application instructions written and published by the coating manufacturer.

c. All anticipated limitations, precautions and requirements that may adversely affect the coating, that may cause unsatisfactory results after the application or that may cause the coating not to serve the purpose for which it was intended, must be clearly and completely stated in the instructions. Limitations and requirements must include, but are not necessarily limited to the following:

1). Surface preparation.

2). Method(s) of application.

3). Thickness of each coat (maximum and minimum DFT).

4). Drying and curing time of each coat.

5). Time (minimum and maximum) allowed between coats.

6). Thinner and use of thinner.

7). Proper mixing of coating before application.

8). Weather limitations during and after application (temperature and humidity, time weighted).

9). Physical properties of coating, including percent solids content by volume.

10). Equipment settings (air cap, fluid tip, equipment pressure settings, etc.).

11). Pot life at various temperature and humidity conditions.

12). Provide documentation that interior coating system is compatible with the cathodic protection system.

C. The following samples are required prior to ordering the materials:

1. Three samples of selected exterior finish colors for approval on 6-inch by 6-inch swatches. Label each swatch with the manufacturer's name, coating name/type, color name and number.

D. The following Product Data is required prior to coating Work:

1. Coating Plan:

a. Anticipated coating process schedule by date, including dates when hold-point inspections are anticipated. Schedule must indicate detailed activities on a daily basis.

b. Detailed procedures and schedule for all pre-cleaning, surface preparation and application of coating, including touch-up and repair procedures for all coating systems.

c. Recoat schedule on the submitted coating materials.

d. Data sheets must include curing characteristics and recommendations regarding complete coating curing.

e. Provide a written plan documenting how spent cleaning debris and/or paint over spray or droplets will be contained/confined to the jobsite and tank site during the surface preparation and coating application operations. Reasonable care must be exercised by the Contractor to prevent damage, nuisance, or hazardous conditions

to adjacent or nearby property owners. Include all materials and method to be used for protection of exterior surfaces and allow for recovery and disposal of paint scraps and blast media.

2. Provide documentation on proposed containment system methods for blasting and coating operations.
3. Contractor must submit evidence of notification of the appropriate office of the Georgia Environmental Protection Division (GA EPD) prior to abrasive blasting as required. Submit copies of any obtained permits.
4. Coating Manifest - Within 48 hours of coating delivery to the jobsite, the Contractor must record the batch number stamped on each coating container and submit a typed list to the Owner's representative. Minimum information required is listed below.
    a. Date of delivery to jobsite.
    b. Name and signature of superintendent recording the data.
    c. List of batch number including corresponding coating identification, color, date of manufacture and volume of each container.

E. The following Certified Test Report(s) are required prior to coating Work:

1. SDS sheets for all abrasive to be used on the Project.
2. Certification and laboratory test results indicating recycled metallic abrasive per SSPC-AB 2 or 4 and atomic absorption test results.

1.04 STANDARDS

A. The applicable provisions of the following standards apply as if written here in their entirety. Adhere to the latest standards and codes published by the following organizations.

B. In the event of a conflict between the published standards, codes, and this Section, the more stringent requirement govern as interpreted by the Engineer.

1. NSF International (NSF) / American National Standards Institute (ANSI):

NSF/ANSI Standard 61	Drinking Water System Components – Health Effects
NSF/ANSI/CAN 600	Health Effects Evaluation and Criteria for Chemicals in Drinking Water

2. ASTM International (ASTM):

ASTM A780	Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings
ASTM D523	Standard Test Method for Specular Gloss
ASTM D610	Standard Practice for Evaluating Degree of Rusting on Painted Steel Surfaces
ASTM D2244	Standard Practice for Calculation of Color Tolerances and Color Differences from Instrumentally Measured Color Coordinates
ASTM D3359	Standard Test Methods for Rating Adhesion by Tape Test
ASTM D4214	Standard Test Methods for Evaluating the Degree of Chalking of Exterior Paint Films
ASTM D4258	Standard Practice for Surface Cleaning Concrete for Coating

ASTM D4259	Standard Practice for Preparation of Concrete by Abrasion Prior to Coating Application
ASTM D4260	Standard Practice for Liquid and Gelled Acid Etching of Concrete
ASTM D4263	Standard Test Method for Indicating Moisture in Concrete by the Plastic Sheet Method
ASTM D4285	Standard Test Method for Indicating Oil or Water in Compressed Air
ASTM D4417	Standard Test Methods for Field Measurement of Surface Profile of Blast Cleaned Steel
ASTM D4541	Standard Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers
ASTM D4787	Standard Practice for Continuity Verification of Liquid or Sheet Linings Applied to Concrete Substrates
ASTM D5162	Standard Practice for Discontinuity (Holiday) Testing of Nonconductive Protective Coating on Metallic Substrates
ASTM D6386	Standard Practice for Preparation of Zinc (Hot-Dip Galvanized) Coated Iron and Steel Product and Hardware Surfaces for Painting
ASTM D7234	Standard Test Method for Pull-Off Strength of Coatings on Concrete Using Pull-Off Adhesion Testers
ASTM D7682	Standard Test Method for Replication and Measurement of Concrete Surface Profiles Using Replica Putty
ASTM E337	Standard Test Method for Measuring Humidity with a Psychrometer (the Measurement of Wet- and Dry-Bulb Temperatures)
ASTM F1869	Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride

3. American Water Works Association (AWWA):

AWWA C210	Standard for Liquid-Epoxy Coating and Linings for Steel Water Pipe and Fittings
AWWA C213	Fusion-Bonded Epoxy Coatings and Linings for Steel Water Pipe and Fittings
AWWA C222	Polyurethane Coatings and Linings for Steel Water Pipe and Fittings

4. Consumer Product Safety Act, Part 1303.
5. Environmental Protection Agency (EPA).
6. International Concrete Repair Institute (ICRI):

Technical Guideline No. 03732	Selecting and Specifying Concrete Surface Preparation for Coatings, Sealers and Polymer Overlays
Standard 310.2	Selecting and Specifying Concrete Surface Preparation for Sealers, Coatings, Polymer Overlays and Concrete Repair with CSP Chips

7. Association for Materials Protection and Performance (AMPP) (formally NACE/SSPC):

NACE TPC2	Coatings and Linings for Immersion Service: Chapter Safety, Chapter 2 Surface Preparation, Chapter 3 Curing, and Chapter 4 Inspection
NACE SP0178	Design, Fabrication, and Surface Finish Practices for Tanks and Vessels to be Lined for Immersion Service
NACE SP0188	Discontinuity (Holiday) Testing of New Protective Coatings on Conductive Substrates
NACE SP0178	Surface Finishing of Welds Prior to Coating; Weld Replica Only to be used with NACE SP0178
NACE RP0287	Field Measurement of Surface Profile of Abrasive Blast-Cleaned Steel Surfaces Using a Replica Tape
SSPC-VIS 1	Guide and Reference Photographs for Steel Surfaces Prepared by Dry Abrasive Blast Cleaning
SSPC-VIS 3	Guide and Reference Photographs for Steel Surfaces Prepared by Power and Hand Tool Cleaning
SSPC Vol. 1	Good Painting Practice
SSPC-AB 1	Mineral and Slag Abrasives
SSPC-AB 2	Cleanliness of Recycled Ferrous Metallic Abrasives
SSPC-AB 3	Ferrous Metallic Abrasives
SSPC-AB 4	Recyclable Encapsulated Abrasive Media (in a compressible cellular matrix)
SSPC-SP 1	Solvent Cleaning
SSPC-SP 2	Hand Tool Cleaning
SSPC-SP 3	Power Tool Cleaning
SSPC-SP 11	Power Tool Cleaning to Bare Metal
SSPC-SP 16	Brush-Off Blast Cleaning of Coated and Uncoated Galvanized Steel, Stainless Steels, and Non-Ferrous Metals
SSPC-PA 1	Shop, Field and Maintenance Painting of Steel
SSPC-PA 2	Procedure for Determining Conformance to Dry Coating Thickness Requirements
SSPC-PA 10	Guide to Safety and Health Requirements for Industrial Painting Projects
SSPC-PA 17	Procedure for Determining Conformance to Steel Profile/Surface Roughness/Peak Count Requirements
SSPC Paint #20	Zinc-Rich Coating (Type I – Inorganic, and Type II – Organic)
SSPC Guide 6 (CON)	Guide for Containing Surface Preparation Debris Generated during Paint Removal Operations
SSPC Guide 12	Guide for Illumination of Industrial Painting Projects
SSPC Guide 15	Field Methods for Retrieval and Analysis of Soluble Salts on Steel and Other Nonporous Substrates
SSPC-SP 5/NACE 1	White Metal Blast Cleaning
SSPC-SP 6/NACE 3	Commercial Blast Cleaning
SSPC-SP 7/NACE 4	Brush-Off Blast Cleaning
SSPC-SP 10/NACE 2	Near White Metal Blast Cleaning
SSPC-SP 13/NACE 6	Surface Preparation of Concrete

8. National Association of Pipe Fabricators (NAPF):

NAPF 500-03	Surface Preparation Standard for Ductile Iron Pipe and Fittings in Exposed Locations Receiving Special External Coatings and/or Special Internal Linings

9. Occupational Safety & Health Administration (OHSA):

1915.35 Standards - 29 CFR	Painting
1926.62 Standards - 29 CFR	Lead

1.05 DELIVERY AND STORAGE

A. Deliver coating products to the jobsite in original unopened containers, with manufacturer's label and batch number attached. Do not apply products until the Owner's field representative has approved the product for use.

B. Use one location at each job site for the storage of coating products. Protect the floor from spills and other damage. Protect the products from extreme heat or cold. Keep containers covered. Keep the storage rooms clean of trash and debris. Dispose of oily or used rags daily. Under no circumstances will they be allowed to accumulate. Take precautions to prevent fires. The storage of flammable liquids must comply with the city, state, or other fire codes.

C. Storage of coatings and other products must be in accordance with the manufacturer's requirements. Coatings that have been damaged or not stored properly must not be applied and must be removed from the jobsite.

D. All products and coatings that are not approved for the Project must be removed from the jobsite and must not be stored at the jobsite.

E. All materials must be delivered to the jobsite in original sealed containers with the date of manufacture and batch number stamped thereon by the coating manufacturer. Materials are subject to random observations by the Owner's representative at the jobsite.

1.06 ENVIRONMENTAL CONDITIONS

A. Do not apply coatings under conditions that are unsuitable for the production of good results. Remove trash and debris from enclosed buildings and thoroughly clean prior to application of coatings. Do not begin application of coatings in areas where other trades are working, or where construction activities result in airborne dust or other debris. Do not apply coatings in conditions which do not conform to the recommendations of the coatings manufacturer.

B. Coatings must only be applied when conditions fall within the parameters listed in the manufacturer's printed data.

C. Contractor must provide dehumidification equipment sized to maintain dew point temperature 5 deg F or more above surface temperature of metal surfaces to be prepared and coated.

D. Do not apply any coatings when weather conditions are unfavorable. In the event that climatic conditions are not conducive for best results, postpone application of coatings until conditions conform to the manufacturer's recommendations and the provisions of this Section.

E. Do not apply coatings to a wet or damp surface in wet or damp weather conditions, or when there is dust in the air. Surfaces exposed to direct sunlight must be shaded by awnings or other protective devices while coatings are being applied, if recommended by coating manufacturer. When necessary, provide temporary heating devices of a type that produces no fumes or water vapor which will discolor the paint system.

F. Heating and Dehumidification:

1. Dehumidification equipment must be used to control the environment during surface preparation, rehabilitation, coating application and coating curing at no additional cost to the Owner, if acceptable environmental conditions cannot be met.

2. If the Contractor cannot meet the required environmental conditions to apply the interior coating system per this Section and the coating manufacturer's written recommendations, Contractor will cease operations until approved dehumidification equipment has been provided and acceptable environmental conditions are achieved.

3. If coating system is applied without dehumidification or in conditions not acceptable by this Section and by the coating manufacturer's written requirements, Contractor must fully remove coating system applied and replace per the Engineer's direction.

4. Contractor must furnish all labor, materials, equipment, fabrication and quality control inspections, and all other incidentals required to control and maintain the environment of the reservoir within the parameters stated in this Section and must incorporate these and any other expenses into its bid.

5. Owner reserves the rights, in the event the dehumidification equipment is not performing to the minimum requirements stated in this Section, to require the Contractor to modify and or add additional equipment to satisfy the conditions of this Section, at the sole cost to the Contractor.

6. It is the Contractor's responsibility to provide adequate dehumidification equipment to meet this specification and the coating manufacturer's requirements of this Section and coating manufacturer's requirements. The coating manufacturer's limits of surface temperature, tank inside air temperature and relative humidity requirements will govern, if more stringent than the requirements stated within this Section.

G. Forced Ventilation:

1. Provide continuous forced fresh air ventilation when working inside of containment systems or enclosed areas that are not openly vented from the beginning of surface preparation through final coating operations and coating curing.

2. Forced ventilation must be supplied per the recoat time required by the coating manufacturer and at least 48 hours after the final coat has been applied.

3. From the beginning of interior coating applications to until the coating system is cured, the Contractor must monitor the air for the lower explosion limit (LEL) as published in the coating manufacturer's product SDS.

4. Contractor is responsible for supplying, installing and maintaining the forced ventilation system.

H. Containment System:

1. Contractor must provide containment methods, either full or partial, which allows for the containment of the environmentally sensitive waste, dust and paint over spray that will be generated during the abrasive blasting and painting operation.

2. Minimum Containment for Field Surface Preparation:

   a. Provide a minimum SSPC Guide 6 (CON) Class 2A containment system when dry abrasive blasting.

   b. Provide a minimum SSPC Guide 6 (CON) Class 2W containment system when wet abrasive blasting. All water must be contained and properly disposed of.

   c. Provide a minimum SSPC Guide 6 (CON) Class 2P.E3 containment system when power tool cleaning.

3. The ground surrounding the project area must be protected from all debris, emissions, dust, and other materials generated in the cleaning operations with a minimum of two layers of polyethylene covered with plywood or the same material used for the perimeter containment system.

4. Containment is not required when blasting on the interior of a completely enclosed area (i.e. roof is in place) as long as no visible emissions are created.

5. Contractor must ensure that no spent cleaning/blasting debris, dust, overspray, coating droplets, or emissions of any kind, escape to the atmosphere, or to adjacent buildings, private property, work sites, parking lots, etc.

6. Owner reserves the right to stop Work or require containment, additional containment or different containment methods if the Contractor's operations create a nuisance beyond the tank site property line in the sole opinion of the Owner, the Engineer, the Owner's representative, any regulatory agency, or neighbor. All costs of providing an adequate containment system must be included by the Contractor in the Base Bid.

7. Contractor will be responsible for all materials that are used and for any apparatus used to contain dust emissions, debris, overspray, and coating droplets. The containment system attachments to existing or proposed structures must be designed by a professional engineer, licensed in the state where the Project is located, not to impose excessive loading on the structure. Contractor must submit the designed and sealed details of the containment system on the tank.

8. Any damage to the structure(s) as a direct or indirect result of the containment system must be repaired or sections replaced by the Contractor at no additional cost to the Owner. Neither the Owner, nor the Owner's Engineer, assumes any responsibility for the structural ability of the structure to support the containment system.

9. If tarps are used as part of the containment system, the tarps must be an impervious, solid, flame-resistant material, reinforced with a fiber mesh and must allow as much light as possible to pass through the material.

I. Visible Emissions:

1. Contractor must control visible emissions and releases while dust producing activities are underway.

2. Visible emissions more than SSPC Guide 6, Level 1 (1 percent of the workday or 5 minutes in an 8-hour shift) are unacceptable. Sustained emissions of more than 1 minute, regardless of the total time of emissions for the day is unacceptable. If unacceptable emissions are observed, Contractor must shut down immediately and correct the situation and clean up any debris generated from the release to the satisfaction of the Engineer before continuing Work.

1.07 WORKING CONDITIONS

A. Provide adequate lighting at any location that coatings are being applied or testing is performed. Illumination must be of sufficient intensity to achieve good results. Provide explosion-proof lighting when required.

B. Temporary ladders and scaffolds must conform to applicable safety requirements. Erect temporary scaffolds where needed to cover large areas. Provide ladders or scaffolding during testing procedures.

1.08 WARRANTY/GUARANTEE

A. Protective coating must be guaranteed for a period of 1 year from the date of the Owner's acceptance of the Project.

B. A warranty inspection must be conducted prior to the end of the warranty period. Any Defective Work discovered at this date must be corrected by the Contractor in accordance with the Contract Documents at no additional cost to the Owner.

2.00 PRODUCTS

2.01 GENERAL COATING REQUIREMENTS

A. All coatings must be free of heavy metals such as arsenic, barium, chromium, selenium, silver, lead, mercury and cadmium.

B. All coatings in contact with potable water must meet the applicable requirements of NSF/ANSI/CAN 600 according to the requirements of NSF/ANSI/CAN 61, including the most current health effects criteria for xylenes, toluene and ethylbenzene for the application and volume of tank on the Project.

C. All coatings submitted or used on this Project must comply with the EPA's Clean Air Act for maximum VOC (volatile organic compound) limits.

D. Finish coatings must be from the same batch.

2.02 MATERIALS

A. Coating products are to be as follows:

Type A - Alkyd-Phenolic Universal Primer	
Manufacturer	**Approved Coating**
Tnemec	Series 37H Chem-Prime H.S.
Sherwin-Williams	Kem Kromik Universal
Akzo Nobel / International Paint, LLC	Interlac 573
Devoe Coatings	Devprime 1403
Carboline	Carbocoat 150UP
PPG	Multiprime 4360

Type B - Epoxy-Polyamide Primer	
Manufacturer	**Approved Coating**
Tnemec	Series 66
Sherwin-Williams	Macropoxy 240
Akzo Nobel / International Paint, LLC	Intergard 251; Intergard 269 for valves and gates, submerged structural steel and misc. metals, and submerged piping
Devoe Coatings	Devran 201V Series
Carboline	890
PPG	Amercoat 385

Type C - Penetrating Epoxy Pre-Primer	
Manufacturer	**Approved Coating**
Tnemec	Series 108 ProBond
Sherwin-Williams	Macropoxy 920 Pre-Prime
Akzo Nobel / International Paint, LLC	Interbond 600
Devoe Coatings	Approved Equal
Carboline	Rustbond Penetrating Sealer
PPG	Amerlock Sealer

Type D - Inorganic Zinc Primer (Minimum 80% Zinc by Weight)	
Manufacturer	**Approved Coating**
Tnemec	Series 90-98 Tneme-Zinc
Carboline	Carbozinc 11 VOC
Sherwin-Williams	Zinc Clad II Plus

Type D - Inorganic Zinc Primer (Minimum 80% Zinc by Weight)	
Manufacturer	**Approved Coating**
PPG	Dimetcote 9 VOC
Approved Manufacturer	Approved Equal

Type E - Organic Zinc Primer (Minimum 80% Zinc by Weight)	
Manufacturer	**Approved Coating**
Tnemec	Series 90-97 or 90G-1K97 Tneme-Zinc
Carboline	Carbozinc 859
Sherwin-Williams	Corothane I Galvapac
PPG	Amercoat 68HS
Akzo Nobel / International Paint, LLC	Interzinc 52
Approved Manufacturer	Approved Equal

Type F - Alkyd Enamel	
Manufacturer	**Approved Coating**
Tnemec	Series 2H Hi-Build Tneme-Gloss
Sherwin-Williams	DTM Alkyd Enamel
Akzo Nobel / International Paint, LLC	Interlac 665
Devoe Coatings	Devlac 1431
Carboline	Carbocoat 8225
PPG	Fast Dry 35

Type G - Epoxy-Polyamide Coatings	
Manufacturer	**Approved Coating**
Tnemec	Series 66
Sherwin-Williams	Macropoxy 646 Epoxy
Akzo Nobel / International Paint, LLC	Intergurd 475HS; Interseal 670HS for valves and gates, PVC pipe and conduit, submerged structural steel and misc. metals, and submerged piping
Devoe Coatings	Bar-Rust 235
Carboline	Carboguard 60
PPG	Amerlock 385

Type H – NSF/ANSI 600 Coatings for Potable Water (NSF 600 Certified)	
Manufacturer	**Approved Coating**
Tnemec	Series 21 Epoxoline
Sherwin-Williams	Sher-Plate 600 Epoxy
Akzo Nobel / International Paint, LLC	Interline 850 or Interseal 670HS (NSF colors)
Devoe Coatings	Bar-Rust 233H Series
Carboline	Carboguard 61
PPG	Amerlock 2/400

Type I - Aliphatic Polyurethane Enamel	
Manufacturer	**Approved Coating**
Tnemec	Series 1094 Endura-Shield
Sherwin-Williams	Hi-Solids Polyurethane
Akzo Nobel / International Paint, LLC	Interthane 990 Series
Devoe Coatings	Devthane 379 Series
Carboline	Carbothane 133HB (Satin) or Carbothane 134HG (High Gloss)
PPG	Pitthane Ultra Series

Type J - Silicone Aluminum Coatings for High Temperature	
Manufacturer	**Approved Coating**
Tnemec	Series 39 Silicone Aluminum
Sherwin-Williams	Heatflex 500 Aluminum
Akzo Nobel / International Paint, LLC	Intertherm 50 Series
Devoe Coatings	Intertherm 50 Series
PPG	Hi-Temp 500
Carboline	Carbozinc 11; Finish: Thermaline 4700 Series (up to 1000 deg F); Thermaline 4900 (up to 450 deg F)

Type K- Epoxy Concrete Coating	
Manufacturer	**Approved Coating**
Tnemec	Series 46H-413 Hi-Build Tneme-Tar
Sherwin-Williams	Tar Guard Epoxy
Akzo Nobel / International Paint, LLC	Interzone 954
Devoe Coatings	Devtar 5A Series

Type K- Epoxy Concrete Coating	
Manufacturer	**Approved Coating**
PPG	Amercoat 78HB Coal Tar Epoxy
Carboline	Bitumastic 300M

Type L - Novolac Vinyl Ester/Novolac Epoxy Concrete Coating - High Friction Surface (HFS)	
Manufacturer	**Approved Coating**
Tnemec	Series G436 Perma-Shield / Chembloc Series 252SC
Sherwin Williams	Dura-Plate 8200
Akzo Nobel / International Paint, LLC	Ceilcote 380 / 242GF Flakeline System
PPG	SFT 675 / FlakeRez 8303
Carboline	Carboguard 510 Series / Plasite 4500 Series

Type M - High Solids Epoxy Siloxane	
Manufacturer	**Approved Coating**
Carboline	Carboxane 2000
PPG	PSX 700 Polysiloxane
Tnemec	Siloxilon Series 690
Sherwin-Williams	Sher-Loxane 800

Type N - Epoxy Mastic	
Manufacturer	**Approved Coating**
Carboline	Carbomastic 15
Sherwin-Williams	Macropoxy 646 Epoxy
PPG	Amerlock 2/400 AL
Tnemec	Chembuild Series 135 or Series 133 ProTuff
AkzoNobel/International Paint, LLC	Interseal 670HS

Type O - Elastomeric Polyurethane Hybrid	
Manufacturer	**Approved Coating**
Carboline	Reactamine 760 Series
Sherwin-Williams	Poly-Cote 115
PPG	Amerthane 490

Type O - Elastomeric Polyurethane Hybrid	
Manufacturer	**Approved Coating**
Tnemec	Elasto-Shield Series 406
AkzoNobel/International Paint, LLC	Polibrid 705E Elastomeric

Type P - Glass Flake Reinforced Epoxy	
Manufacturer	**Approved Coating**
Carboline	Carboguard 890GF
Sherwin-Williams	Sher-Glass FF
PPG	Amerlock 2/400 GF
Tnemec	Pre-Approved Equal Glass Filled Product
AkzoNobel/International Paint, LLC	Approved Equal

Type Q - 100 Percent Solids Epoxy for Wastewater	
Manufacturer	**Approved Coating**
Carboline	Plasite 4550-S Novolac Epoxy
Sherwin-Williams	Dura-Plate 6000 Amine Epoxy
PPG	Novaguard 890 or Novaguard 810 Novolac Epoxy
Tnemec	Perma-Glaze Series G435 or Series G436 Modified Polyamine Epoxy
AkzoNobel/International Paint, LLC	Approved Equal

2.03 COLOR SELECTION

A. The color chart must include the complete available range of colors, including tints and shades. Owner will select the colors during construction.

B. Use a multi-color system coating for any surface receiving more than one coat. Each coat must be tinted differently from the preceding coat in a manner that will allow the various coats to be easily distinguished. Colors must generally be from light to dark shades, but the Contractor may have the option to select tint shades to insure coats will receive adequate coverage without bleeding or otherwise showing through the preceding coat.

C. Piping and equipment must be color coded in accordance with the requirements of the Owner.

3.00 EXECUTION

3.01 GENERAL

A. All coatings must be applied in strict conformance with the coating manufacturer's published specifications, this Section, or as approved by the Engineer.

B. Surfaces which will be inaccessible after installation must be coated prior to installation or must be coated and approved in stages as the Work is installed.

C. Engineer will approve surfaces for application of coatings at each stage. Any material that is coated prior to the Engineer's approval will be stripped back to bare metal and repainted.

D. At least 7 days or as required by the coating manufacturer, must be allowed for drying of finished surfaces before any machinery can be placed into service.

E. The number of coats called for in this Section are considered the minimum required. If more coats are required to provide the specified dry film thickness or for complete coverage and uniform appearance, they must be provided at no additional cost to the Owner.

F. Illumination equipment must be provided by the Contractor in accordance with SSPC Guide 12. Explosion-proof lights and electrical equipment must be provided. The minimum illumination at the surface of the work during surface preparation and coatings is 215 lux (20 fc). The minimum illumination during inspection is 538 lux (50 fc). Whenever required by the Owner's representative, the Contractor must provide additional illumination and necessary supports to cover all areas to be inspected.

3.02 DUCTILE IRON PIPE AND FITTINGS SURFACE PREPARATION

A. Prepare surfaces in accordance with the following requirements:

1. NAPF 500-03-01 — Solvent Cleaning.
2. NAPF 500-03-02 — Hand Tool Cleaning.
3. NAPF 500-03-03 — Power Tool Cleaning.
4. NAPF 500-03-04 — Abrasive Blast Cleaning for Ductile Iron Pipe.
5. NAPF 500-03-05 — Abrasive Blast Cleaning for Cast Ductile Iron Fittings.

B. "Solvent Cleaning" must be performed prior to subsequent surface preparation as specified in NAPF 500-03.

3.03 CONCRETE SURFACE PREPARATION

A. The adequacy of the preparation of concrete surfaces will be determined by comparing the surface with ICRI Surface Finish Comparators. Prepare surfaces in accordance with the following requirements and the coating manufacturer's recommendations:

1. SSPC-SP 13 / NACE 6 — Surface Preparation of Concrete.
2. ICRI CSP 3 – 5, or as required by the coating manufacturer.

B. Allow a minimum of 28 days curing time to elapse before coatings are applied. Concrete surfaces which are scheduled to receive coatings must be in accordance with the coating manufacturer's moisture requirements. Contractor must provide any primers required by the coating manufacturer to address outgassing, as needed.

C. Contractor must field verify that the pH of the concrete is suitable for application per the coating manufacturer's product requirements.

D. Bug holes, air pockets, voids or imperfections in the concrete surface must be filled or patched with a cementitious resurfacing material approved by the coating manufacturer.

E. All coating terminations points, including from concrete to metal are to include a 1/4-inch key cut.

F. Concrete Surface Preparation Inspection:

1. Adhesion Testing:

a. Tensile testing of the surface preparation must be performed by the Contractor using a Type 4 or Type 5 pneumatic adhesion testing equipment in accordance with ASTM D7234 using 2-inch diameter dollies for concrete surface adhesion testing. Provide a minimum of three tests (dollies) per area and coating system. Engineer will select location of test dollies.

b. Concrete surface or applied coating must be scored for concrete adhesion testing.

c. Adhesive failure greater than 50 percent of the dolly surface area indicate inadequate surface preparation.

d. Cohesive failures which result in loss of sound concrete will be acceptable provided the loss is greater than 50 percent of the dolly surface area.

e. Low adhesion cohesive failures with a thin layer of concrete due to weak concrete or laitance over 50 percent of the dolly surface will be rejected.

2. Concrete Soundness: Concrete soundness will be determined using the scratching or hammer impact methods as defined in SSPC-SP 13.

3. Moisture Content: Moisture must be tested as specified in SSPC-SP 13 and in accordance with ASTM D4263 and ASTM F1869 (for conditioned spaces). Moisture content cannot exceed the moisture content recommended by the coating manufacturer.

3.04 SURFACE PREPARATION

A. Clean and degrease surfaces prior to abrasive blasting by solvent cleaning as specified using solvents, detergent/water, emulsions, and steam. Proposed method must be documented in the coating plan. Contractor must contain and properly dispose of all runoff and debris from cleaning.

B. If the following conditions exist or are prevalent, surface preparation and coating must be delayed or postponed until conditions are favorable. Each day's coating must be completed in time to permit the film sufficient drying time prior to damage by atmospheric conditions or changes. No surface preparation can begin or coating applied:

   1. When the surface, air or material is below or above the manufacturer's printed instructions.
   2. When surfaces are wet or damp.
   3. During weather conditions of rain, snow, fog or mist.
   4. When the air and steel temperature is less than 5 deg F above the dew point temperature.
   5. If the relative humidity is above 85 percent.
   6. When it is expected that the dew point, air and/or surface temperature will be below or above the coating manufacturer's recommended temperatures within 4 hours after applications of coating, minimum. Coating manufacturer may require additional time between application and temperature and weather changes.

C. Shop Surface Preparation:

   1. Notify Engineer at least 7 days prior to start of shop blast cleaning to allow for inspection of the Work during surface preparation and shop application of paints. Work is subject to the Engineer's approval before shipment to the jobsite.
   2. Items such as structural steel, metal doors and frames, metal louvers, and similar items as reviewed and approved by the Engineer may be shop prepared and primed. Centrifugal wheel blast cleaning is an acceptable alternate to shop blast cleaning. Blast clean and prime in accordance with the Specifications.
   3. Prepare surfaces by abrasive blasting as specified and apply shop prime coat. Shop primed steel plates must not have primer extended within 4 inches along all edges to be welded. All primer within 4 inches of an area to be welded must be removed prior to welding. Welding of painted surfaces will not be allowed.

D. All pre-assembled shop primed items must be prepared in accordance with these specifications and inspected by the Owner's representative before and after priming.

E. Abrasive Blasting:

   1. Prior to commencing abrasive blasting operations, the Contractor must perform a test blast to verify that the surface cleanliness and profile meet the requirements of this Section and meet the coating manufacturer's requirements for the coating to be applied. If the test section does not meet the requirements, the Contract must make changes to the abrasive materials and/or methods to provide suitable blast.
   2. Abrasive blast only the amount of surface area which can be primed the same day or before any rust starts to form, whichever occurs first. Areas which are not painted the same day must be re-blasted on the day the prime coat is applied.
   3. Shrouding or recovery of all blast material will be mandatory during all exterior blasting.
   4. Contractor must contain all waste and process discharge in accordance with the accepted methods for the process and materials that are in abatement.

5. Where abrasive blast cleaning will not remove or properly prepare metal surfaces, hand and/or power tool cleaning must be used to remove such conditions as weld splatter, laminations and radius-sharp edges. Hand tool or power tool must be used on areas less than 2 feet in diameter or smaller or on corners and edges.
6. All abrasive blast equipment must be equipped with, including but not limited to the following:
    a. Noise reducing devices.
    b. Hose coupling safety devices.
    c. Electrical grounding devices.
    d. Moisture traps and filters.
    e. Fresh air hoods for all blasters.
    f. “Dead Man” switches on all blast hoses.
    g. Air dryers.

F. Surface profile must be in accordance with manufacturer’s printed requirements.

G. The adequacy of the preparation of surfaces must be determined by comparing the surface with SSPC-VIS 1, SSPC-VIS 3, NACE RP0178 and ICRI Surface Finish Comparators.

H. Adequate surface preparation must be verified throughout surface preparation per SSPC-PA 17. Minimum testing requirements:
1. Test the surface profile within the first 15 minutes and one additional time during each work shift or 12-hour period, whichever is shorter for each gun or blasting apparatus used or at any time the process producing the acceptable profile indicated above is changed, as interpreted by the Engineer.
2. Select a minimum of three 6-inch square locations and take two readings. The average to the two readings is a “profile measurement.” The group of three locations is the “location average.” The location average must be within the specified profile range.
3. Contractor must report the location averages (lowest location average and highest location average, and the profile measurement for each surface preparation apparatus.
4. If the substrate has been previously coated, an existing profile may exist. Contactor must adjust blast media size to ensure that the resulting surface profile meets the profile required.

I. Wherever the words “solvent cleaning”, “hand tool cleaning”, “wire brushing”, or “blast cleaning”, or similar words of equal intent are used in the Specifications or in paint manufacturer’s specifications, they are understood to refer to the applicable specifications indicated.

J. Where OSHA or EPA regulations preclude standard abrasive blast cleaning, wet or vacuum-blasting methods may be required. Coating manufacturer’s recommendations for wet blast additives and first coat application will apply.

K. Clean surfaces of dust and residual particles from cleaning operations by dry (no oil or water vapor) air blast cleaning or other method prior to painting. Vacuum clean enclosed areas and other areas where dust settling is a problem and wiped with a tack cloth.

3.05 PREPARATION OF EXISTING COATED OR SHOP PRIMED SURFACES

A. General:

1. Factory-applied primers to equipment must be those specified or verified by the Contractor to be compatible with the specified coating systems. Where possible, notify manufacturers which shop prime coats will be required in order to be compatible with field-applied finish coats.

2. Where equipment is purchased which has the manufacturer's standard primer or a factory finish which is other than as specified in this Section, remove the factory-applied paint system or apply passivators or other special coatings as required to make the surface compatible with the finish coat specified.

3. Do not apply any coating to machinery, piping, or other surfaces before testing has been completed and systems approved. Any damage to coatings resulting from subsequent corrective procedures must be stripped back to bare metal and repainted with the appropriate paint system as directed by the Engineer.

4. Check for compatibility when applying coatings over existing coatings. Apply a test patch of the recommended coating system, covering at least 2 to 3 square feet or as directed by the Engineer. Allow to cure 1 week before testing adhesion per ASTM D3359 in the presence of the Engineer. If adhesion does not meet the manufacturer's published data, consult with the Engineer.

5. Shop primed or coated surfaces must be reviewed with the Engineer to determine if the extent of damage to the coating and suitability of finish coats to adhere to shop applied coats.

6. If a cured epoxy, polyurethane, or plural-component material is to be top coated provide brush-off blast as specified herein or as recommended by the coating manufacturer.

7. Surface preparation recommendations of coating manufacturer are subject to approval of the Engineer.

B. To Be Recoated or Final Coated:

1. Solvent clean.

2. Perform touch-up repairs of existing coating.

C. Touch-Up Repairs:

1. Clean loose, abraded, or damaged coatings to substrate by power tool to bare metal per SSPC-SP 11 and/or NAPF 500-03-03 "Power Tool Cleaning."

2. Feather surrounding intact coating.

3. Apply one spot coat of the specified primer to bare areas overlapping the prepared existing coating.

4. Apply one full finish coat of the specified primer or finish coat(s) overall.

D. Application of a Cosmetic Coat:

1. The exact nature of shop-applied coatings is not known in all cases.

2. Check compatibility by application to a small area prior to starting the coating.

3. If lifting or other problems occur, request disposition from the Engineer.

3.06 APPLICATION

A. Contractor and painting technicians are responsible for the application of the coating system and must have current applicator approvals from the coating manufacturer, as required.

B. After abrasive blast cleaning, dust and spent abrasive must be removed from the surfaces by vacuum process or with clean, dry, oil-free compressed air.

C. The prime coat must be applied as soon as possible after the blasting and surface cleaning is completed, inspected and approved by the Inspector. Blasted surfaces must be coated before rust forms on the surface. No prepared surface will be allowed to receive a coating if "rust bloom" or surface discoloration has occurred. All blasted surfaces must be coated to within 6 inches of the edge of a blasted area. No visible rust must be coated under any circumstances, including rust bloom or if discoloration has occurred, regardless of elapsed time between blasting and coating. Leave an uncoated strip of exposed metal to clearly identify where abrasive blasting was halted.

D. Provide mist coat if recommended by the coating manufacturer.

E. All weld seams, gaps, edges, bolts and difficult areas to coat must receive a stripe coat. Stripe coat must be a contrasting color. Stripe coat may be applied with intermediate or finish coating, but must be applied prior to the installation of the finish coat.

F. Contractor must apply each coat at the rate and in the manner specified by the coating manufacturer, except as may be modified herein. If material has thickened or must be diluted for application, coating must be built up to achieve the dry film thickness as specified for each coat of the complete system.

G. Maximum and minimum DFT must be per the supplied coating manufacturer's printed requirements and as required by this Section. DFT will be measured per SSPC-PA 2, Level 2 with an allowable measurement of spot DFT of:

1. Minimum DFT, as specified.

2. 120 percent of maximum DFT specified.

H. Contractor and painting technicians are responsible for the application of coating system and must have current applicator certifications from the coating manufacturer. Submit certifications with coating submittal.

I. Coatings which have an expired shelf or pot life may not be used and must be removed from the jobsite.

J. Coating must be applied by skilled workmen and must be brushed out or sprayed evenly, without runs, crazing, sags, or other blemishes.

K. Sand between coats to remove over spray and dry fall.

L. Apply the first coat to the surface, including cutting in around edges, before the second coat is applied. The second coat and any successive coats must not to be applied before notifying the Owner's field representative and obtaining approval. Each coat must be tested before the successive coat is applied.

M. The coating curing period must be adjusted to compensate for less than adequate weather conditions, as recommended by the coating manufacturer, for complete curing of the entire coating system. The full curing time recommended by the manufacturer must be provided.

N. Coating must be continuous and must be accomplished in an orderly manner to facilitate proper inspection control.

O. Where a roller or brush is used to apply the coating, additional coats may be necessary to achieve the recommended dry film thickness and/or to achieve total coverage of the underlying surface. Coated surfaces must be totally free of all roller nap, roller marks, brush bristles and brush marks.

P. When using conventional coating spray equipment for coating operations, effective oil and water separators combined with after coolers or deliquescent dryers must be used in compressed air lines to remove detrimental oil and moisture from the air. Separators must be placed as far as practical from the compressor. Compressors must be tested periodically by the Contractor for oil and water contamination of compressed air. Testing must follow ASTM D4285 “Standard Test Method of Indicating Oil and Water in Compressed Air.” All compressor units found to produce unacceptable amounts of oil and or water, as determined by results of ASTM D4285 test data must be replaced with a compressor that is acceptable.

Q. For porous surfaces, such as concrete or masonry, a prime coat may be thinned to provide maximum penetration and adhesion. The type and amount of thinning must be determined by the coating manufacturer and is dependent on surface density and type of coating.

R. Concrete and Steel Floors and Walks, including Bulk Storage Areas:

1. Provide non-skid surface in walkway areas and on floors.

2. Contractor is to include non-skid additive such as aluminum oxide to coatings or may use 50 mesh dry wash silica sand broadcasted into the film and back rolled to encapsulate as recommended by the coating manufacturer.

3. Contractor is to provide a test area to confirm with Owner that the non-skid surface is adequate and consistent. Contractor must modify method or products used as required to provide an acceptable surface.

3.07 COLOR SELECTION

A. A color chart must be submitted and include the complete available range of colors, including tints and shades. Reference specification 40 05 97 “Identification for Process Piping and Equipment” for color selection. Owner may also select the colors during construction from the color charts or may require custom colors.

B. Prior to any coating operations, Contractor must submit samples of each finish coat color utilized on the project for approval by the OPT.

C. Use a multi-color system coating for any surface receiving more than one coat. Each coat must be tinted differently from the preceding coat in a manner that will allow the various coats to be easily distinguished. Colors must generally be from light to dark shades, but the Contractor may have the option to select tint shades to ensure coats will receive adequate coverage without bleeding or otherwise showing through the preceding coat. All colors must be approved by the Engineer.

3.08 FIELD QUALITY CONTROL

A. Field Tests: Make wet film tests during painting operations to assure proper thicknesses of coating are being applied. After each coat has been applied, test the paint film thickness with a nondestructive, magnetic type thickness gauge. The total dry-film thickness for each coat must be per Paragraph 3.14. Apply additional coats until the specified thickness is reached or exceeded.

B. Holiday Testing:

1. Holiday testing must be performed in accordance with NACE SP0188 or ASTM D5162 for steel substrates and ASTM D4787 for concrete substrates.

2. Test the entirety of the following surfaces:

a. All piping and valves inside of vaults.

3. For coating thickness between 10 and 20 mils (250 to 500 microns) a non-sudsing type wetting agent, as recommended by the holiday detector manufacturer, must be added to the water prior to wetting the detector sponge.

4. Holiday detect coatings in excess of 20 mils with high voltage holiday testers as recommended by the coating manufacturer.

5. Mark and repair failures in accordance with the manufacturer's printed instructions, then retest failure areas. No failures or other irregularities will be permitted in the final coats. Areas containing holidays must be repaired until tests indicate no holidays.

3.09 PROTECTION OF SURFACES NOT TO BE PAINTED

A. Remove, mask, or otherwise protect hardware, lighting fixtures, switch plates, aluminum surfaces, machined surfaces, couplings, shafts, bearings, nameplates on machinery, and other surfaces not intended to be painted.

B. Provide drop cloths to prevent paint materials from falling on or marring adjacent surfaces.

C. Protect working parts of mechanical and electrical equipment from damage during surface preparation and painting process.

D. Mask openings in motors to prevent paint and other materials from entering the motors.

3.10 DAMAGED COATINGS, PINHOLES, AND HOLIDAYS

A. Feather edges and repaired in accordance with the recommendations of the paint manufacturer.

B. Repair fusion bonded coatings to be as recommended by the original applicator. Applicator must provide liquid repair kits for this purpose as recommended by the coating manufacturer.

C. Apply finish coats, including touchup and damage-repair coats in a manner that will present a uniform texture and color-matched appearance.

3.11 UNSATISFACTORY APPLICATION

A. If the item has an improper finish color, or insufficient film thickness, clean and topcoat surface with specified paint material to obtain the specified color and coverage. Obtain specific surface preparation information from the coating manufacturer.

B. Hand or power sand visible areas of chipped, peeled, or abraded paint and feather the edges. Follow with primer and finish coat in accordance with the Specifications. Depending on the extent of repair and its appearance, a finish sanding and topcoat may be required.

C. Evidence of runs, bridges, shiners, laps, or other imperfections are cause for rejection.

D. Repair defects in coating system per written recommendations of coating manufacturer.

E. Leave all staging up until the Engineer has inspected the surface or coating. Replace staging removed prior to approval by Engineer.

3.12 COATING INSPECTION

A. General:

1. All coats will be subject to inspection by the Engineer and the coating manufacturer's representative.

2. Visually inspect concrete, nonferrous metal, plastic, and wood surfaces to ensure proper and complete coverage has been attained.

3. Give particular attention to edges, angles, flanges, and other areas where insufficient film thicknesses are likely to be present and ensure proper millage in these areas.

B. Coating Thickness Testing:

1. Owner's representative may conduct coating thickness testing as necessary and without limitation.

2. Measure coating thickness specified in mils with an electronic type dry film thickness gauge.

3. Check each coat for the correct millage.

4. Tests for concrete coating thickness may be taken using a Tooke Gauge or gauge approved for testing coatings over concrete substrates. Contractor must repair coating after thickness testing, if required.

C. Coating Continuity (Holiday) Testing: Owner's representative will witness holiday testing performed by the Contractor.

3.13 CLEANING AND ADJUSTING

A. Promptly remove trash and debris resulting from painting operation from the Site. Remove drop cloths, masking tapes and other protective coverings. Remove paint spills, splatters, overlap of paint from adjacent material and other defects. Spot paint nicks and other defects.

B. Remove paint containers and waste products. Thoroughly clean paint storage rooms, removing spilled paint from walls and floors.

C. Damages due to over spray on buildings, vehicles, trees, or other surfaces not specified to be painted would be the responsibility of the Contractor.

D. Remove surplus materials, protective coverings, and accumulated rubbish after completing coating. Thoroughly clean surfaces and repair overspray or other coating-related damage.

3.14 FINAL INSPECTION

A. Conduct final inspection of coating system work to determine whether it meets specifications requirements.

B. Conduct subsequent final inspection with the Engineer to ensure Work is in accordance with Contract Documents requirements.

C. Mark any rework required.

1. Re-clean and repair, as specified, at no additional cost to the Owner.

3.15 SCHEDULE

A. Protective coatings must be applied in accordance with the following paint schedule. If additional or alternate primers, etc. are recommended by the coating manufacturer for any of the coatings specified, they must be provided at no additional cost to the Owner to provide a complete and compatible coating system, as approved by the Engineer.

PROTECTIVE COATINGS PAINT SCHEDULE

System	Application	Surface Prep	Product Type	No. of Coats	DFT/Coat (mils)
No. 2	**Above-Grade Interior/Exterior Steel and D.I. Piping Non-Immersion/Non-Corrosive Environment** All metal surfaces new and existing, such as inside pump station buildings, exterior piping and valves, exterior structural steel, etc. **Application Notes:** 1. Proposed piping and valves may be provided with factory applied prime coat(s), with fusion bonded epoxy or Type H epoxy. For damaged factory applied coatings spot prime with Epoxy Mastic. Provide application of Type C and Type M coatings in the field. 2. Proposed Field Coated and Existing Previously Coated Piping and Valves: Prepare as indicated and provide full coat of Epoxy Mastic and continue with stripe, intermediate and top coat as indicated.	**For New Piping and Valves:** SSPC-SP 1 SSPC-SP 6 NAPF 500-03-01 NAPF 500-03-04 NAPF 500-03-05 **For Previously Coated Piping and Valves:** SSPC-SP 1 SSPC-SP 3 NAPF 500-03-01 NAPF 500-03-03	TYPE N - Epoxy Mastic TYPE C - Penetrating Epoxy Pre-Primer TYPE M - Stripe Coat Type M - HS Epoxy Siloxane	1 1 1	5.0 2.0 5.0-7.0
				Total Minimum Dry Film Thickness	**12.0 mils**
No. 4	**Electrical Equipment - Exterior** All new and existing exterior electrical panels and equipment with factory coatings. Not for pumps and motors.	SSPC-SP 1 SSPC-SP 2	TYPE A - Alkyd-Phenolic Universal Primer TYPE F - Stripe Coat TYPE F - Alkyd Enamel	1 2	2.0 3.0
				Total Minimum Dry Film Thickness	**8.0 mils**
No. 6	**Above-Grade Interior and Exterior PVC Pipe** Exterior surfaces PVC piping.	SSPC-SP 1 Light Sanding	TYPE B - Epoxy-Polyamide Primer TYPE I - Aliphatic Polyurethane Enamel	1 1	3.0 3.0
				Total Minimum Dry Film Thickness	**6.0 mils**
No. 7	**Metal Piping and Valves – Immersion in Wet Wells Moderate to Severe Environment (Non-Potable)** Exterior/interior surfaces of submersed valves & pumps, penstocks, piping, sewer interceptors, wastewater vessels, settling tanks and buried piping connecting to them for severe conditions with exposure to H2S gas, including wastewater digesters, etc.	SSPC-SP 1 SSPC-SP 6 NAPF 500-03-01 NAPF 500-03-04 NAPF 500-03-05	Type Q - 100% Solids Epoxy for Wastewater	1-2	40.0

System	Application	Surface Prep	Product Type	No. of Coats	DFT/Coat (mils)
	Application Notes: Coating may be applied in two coats, as recommended by the manufacturer.				
				Total Minimum Dry Film Thickness	**40.0 mils**
No. 8	**New and Existing Metal Piping and Valves within Vaults and Under Insulation** **Moderate to Severe Environment** All metal surfaces new and existing that will be installed in areas where temporary submerged conditions can occur, such as within vaults and for piping and valves covered with insulation. **Application Notes:** 1. Proposed piping and valves may be provided with factory applied prime coat(s), with fusion bonded epoxy or Type H epoxy. For damaged factory applied coatings spot prime with Epoxy Mastic. Provide application of Type C and Type G coatings in the field. 2. Proposed Field Coated and Existing Previously Coated Piping and Valves: Prepare as indicated and provide full coat of Epoxy Mastic and continue with stripe, intermediate and top coat as indicated.	**For New Piping and Valves:** SSPC-SP1 SSPC-SP6 NAPF 500-03-01 NAPF 500-03-04 NAPF 500-03-05 **For Previously Coated Piping and Valves:** SSPC-SP1 SSPC-SP3 NAPF 500-03-01 NAPF 500-03-03	TYPE N – Epoxy Mastic TYPE C – Penetrating Epoxy Pre-Primer TYPE G - Stripe Coat TYPE G – Epoxy-Polyamide	1 1 2	4.0 2.0 4.0
				Total Minimum Dry Film Thickness	**12.0 mils**

END OF SECTION

09 96 01 CONCRETE PROTECTIVE COATINGS

1.00 GENERAL

1.01 SCOPE OF WORK

A. Contractor will furnish all labor, materials, equipment and incidentals necessary to apply protective coatings as shown on the Drawings or as specified herein, including the preparation and/or repair of surfaces prior to application of coatings.

B. Protective coatings will be applied at the following locations:

1. Concrete Valve Vaults.

C. Contain, treat, and dispose of any dust, spray, drainage, or spillage resulting from coating operations. It will be the Contractor's responsibility to determine if the materials to be disposed of are classified as Hazardous Waste. Disposal of waste, hazardous or otherwise, will be in accordance with applicable regulations. Contractor will be aware of and understand the regulations concerning disposal of waste generated by coating operations.

D. Contractor will ensure that coating manufacturer's technical representative will be on-site for the initial surface preparation and coating application processes. The technical representative will confirm, with a follow-up report, that surface preparation and coating application processes were performed in compliance with the coating manufacturer's written guidelines.

1.02 QUALITY ASSURANCE

A. Manufacturer's Qualifications:

1. Certified in compliance with latest version of ISO 9001 Quality Standards for formulation (research and development), manufacture, and technical support.

2. Manufacturer must provide an authorized technical specialist to assist the Contractor, if necessary.

3. Products will be manufactured in the United States.

B. Applicator's Qualifications: Applicators must be qualified in this line of work and have a minimum of 5 years of experience in the successful application of the protective coatings of the types specified herein. Submit a list of five recent projects, completed within the last 3 years, including names of references with contact information for those projects. Submit manufacturer's approved applicator and training certificates for those who will be installing the coating. Applicator's qualifications and training certificates to be included in coating submittal and will be filed as Record Data.

C. Applicator Prove-Out: Prior to beginning the coating procedure for the entirety of the structure, the applicator will coat a 2-foot by 2-foot test section which will include a corner in the structure. The section to be coated will be determined through coordination with the Owner and the Owner's representative. The purpose of the prove-out will be to identify and define a level of expected quality that is agreed upon by both the Owner and the Owner's representative prior to coating the entire structure per the on-site manufacturer's representative's observations and direction regarding application requirements. After the completion of a successful prove-out, the test section will be left in place and incorporated

into the final coating. Therefore, additional payment will not be made for this prove-out and the cost will be considered subsidiary to the unit price bid. The prove-out will be to evaluate the following:

1. Surface Preparation: Surface preparation will be observed by the manufacturer's representative, Owner, and Owner's representative. The methods and materials used will be verified to comply with manufacturer's recommendation and that the resulting surface is prepared as required to achieve proper coating application and bonding.
2. Application Techniques and Equipment / Personnel Skill Demonstration: The applicator's personnel, the equipment used, and their techniques followed will be observed by the manufacturer's representative, Owner, and Owner's representative during the prove-out to verify that qualified and experienced personnel using the manufacturer's recommended equipment and application techniques are used and followed.
3. Coating Thickness and Uniformity Testing: The coating thickness and uniformity of the thickness will be tested during the application of the 10-foot by 10-foot test section. Tests will be witnessed by the manufacturer's representative, Owner, and Owner's representative. The testing of the thickness will be in accordance with the testing procedure outlined in Paragraph 3.02, Application, and will serve to verify the applied coating thickness meets the manufacturer's minimum required thickness or the required minimum thickness outlined within this specification, whichever is greater. Tests will be made on a 2-foot by 2-foot grid for the purposes of this prove-out.
4. Visual Coating Uniformity and Texture Observation: The uniformity and texture of the coating will be observed during the application by the manufacturer's representative, Owner, and Owner's representative. The texture and uniformity of the applied coating will be adjusted until a level of uniformity and texture is reached that is agreed upon by the Owner and Owner's representative.
5. Coating Pull-Off Adhesion Testing (Destructive Testing): The applied coating will be tested for adhesion during the application to the 10-foot by 10-foot test section. Tests will be witnessed by the manufacturer's representative, Owner, and Owner's representative. The testing of the adhesion will be in accordance with the testing procedure outlined in Paragraph 3.03, Field Quality Control/Testing and will serve to verify the applied coating is adequately adhering to the test section. Tests will be made on a 2-foot by 2-foot grid for the purposes of this prove-out.

D. Testing: Protective coatings will be applied under quality control procedures that include inspection of surface preparation before each coat. Do not proceed with the next step until the Owner has approved the previous step (refer to Applicator Prove-Out in Paragraph 1.02.C). Contractor will be solely responsible for all testing for this work. Engineer may request additional tests if it is considered necessary. Cooperate with the Owner, providing equipment, scaffolds, and other equipment as requested by the Owner for inspection purposes.

1.03 SUBMITTALS

A. Submittals will be in accordance with Section 01 33 00 “Document Management” and will include:

1. Manufacturer’s product data sheet for each coating type, including surface preparation requirements, recommended spreading rates, application procedures, recommended primers, environmental limits (temperature, humidity, and dew point) and other instructions.

2. Material Safety Data Sheets (MSDS) for all coatings, solvents, etc.

3. Applicator’s qualifications, including training certificates for those who will be performing the coating application.

4. Manufacturer’s statement regarding applicator instruction on product use and application.

5. Warranty documentation.

6. Certified Material Test Reports.

7. Documentation of Field Testing: The location and results of the thickness tests will be documented during field testing. The documentation will include test method and procedure used, equipment used, air temperature, surface temperature, humidity, dew point, quantity of structure(s) lined (square footage covered), number of gallons of lining compound expended and materials used. If a location fails a test, the failing result will be included in the documentation along with what actions were taken to repair the failing area and the results of the subsequent retest of the area. After successful completion of the coating installation, this documentation will be submitted to the Owner as Record Data. This documentation shall be included in the weekly inspection reports.

8. Coating Plan:

a. Anticipated coating process schedule by date, including dates when hold-point inspections are anticipated. Schedule must indicate detailed activities performed daily.

b. Detailed procedures and schedule for all pre-cleaning, surface preparation and application of coating, including touch-up and repair procedures for all coating systems.

c. Recoat schedule on the submitted coating materials.

d. Data sheets complete with a graduated scale or curve, produced by the coating manufacturer, with curing characteristics and recommendations regarding complete coating curing.

e. Provide a written plan documenting how spent cleaning debris and/or paint over-spray or droplets will be contained/confined to the Site during the surface preparation and coating application operations. Reasonable care must be exercised by the Contractor to prevent damage, nuisance, or hazardous conditions to adjacent or nearby property owners. Include all materials and method to be used for

protection of exterior surfaces and allow for recovery and disposal of paint scraps and blast media.

f. Provide written plan documenting how paint and/or abrasive damage to automobiles and property will be addressed, including a process for quick removal of the paint or abrasive, and how the Work will be accomplished (this will not relieve the Contractor from the responsibility of setting claims for damage, but is intended to expedite and minimize said claims).

1.04 REFERENCE STANDARDS

A. The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by designation only. In the event of a conflict between the published standards, codes, and this Section, the more stringent requirement will govern.

1. ASTM International (ASTM):

ASTM C307	Standard Test Method for Tensile Strength of Chemical-Resistant Mortar, Grouts, and Monolithic Surfacings
ASTM C531	Standard Test Method for Linear Shrinkage and Coefficient of Thermal Expansion of Chemical-Resistant Mortars, Grouts, Monolithic Surfacings, and Polymer Concretes
ASTM C579	Standard Test Methods for Compressive Strength of Chemical-Resistant Mortars, Grouts, Monolithic Surfacings, and Polymer Concretes
ASTM C580	Standard Test Method for Flexural Strength and Modulus of Elasticity of Chemical-Resistant Mortars, Grouts, Monolithic Surfacings, and Polymer Concretes
ASTM C884	Standard Test Method for Thermal Compatibility Between Concrete and an Epoxy-Resin Overlay
ASTM C1028	Standard Test Method for Determining the Static Coefficient of Friction of Ceramic Tile and Other Like Surfaces by the Horizontal Dynamometer Pull-Meter Method
ASTM D543	Standard Practices for Evaluating the Resistance of Plastics to Chemical Reagents
ASTM D638	Standard Test Method for Tensile Properties of Plastics
ASTM D695	Standard Test Method for Compressive Properties of Rigid Plastics
ASTM D790	Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials
ASTM D1653	Standard Test Methods for Water Vapor Transmission of Organic Coating Films
ASTM D2240	Standard Test Method for Rubber Property-Durometer Hardness
ASTM D2584	Standard Test Method for Ignition Loss of Cured Reinforced Resins
ASTM D4060	Standard Test Method for Abrasion Resistance of Organic Coatings by the Taber Abraser
ASTM D4258	Standard Practice for Surface Cleaning Concrete for Coating

ASTM D4262	Standard Test Method for pH of Chemically Cleaned or Etched Concrete Surfaces
ASTM D4263	Standard Test Method for Indicating Moisture in Concrete by the Plastic Sheet Method
ASTM D4272	Standard Test Method for Total Energy Impact of Plastic Films by Dart Drop
ASTM D4414	Standard Practice for Measurement of Wet Film Thickness by Notch Gages
ASTM D4541	Standard Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testing
ASTM D4787	Standard Practice for Continuity Verification of Liquid or Sheet Linings Applied to Concrete Substrates
ASTM D6132	Standard Test Method for Nondestructive Measurement of Dry Film Thickness of Applied Organic Coatings Using an Ultrasonic Coating Thickness Gage
ASTM D7234	Standard Test Method for Pull-Off Adhesion Strength of Coatings on Concrete Using Portable Pull-Off Adhesion Testing
ASTM E337	Standard Test Method for Measuring Humidity with a Psychrometer (the Measurement of Wet- and Dry-Bulb Temperatures)
ASTM F1869	Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride
ASTM F2170	Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes
ASTM F2659	Standard Guide for Preliminary Evaluation of Comparative Moisture Condition of Concrete, Gypsum Cement and Other Floor Slabs and Screeds Using a Non-Destructive Electronic Moisture Meter
ASTM G210	Standard Practice for Operating the Severe Wastewater Analysis Testing Apparatus

1.05 JOB CONDITIONS

A. The material must provide a permanent impermeable, high strength, monolithic lining for concrete structures that is sulfuric acid corrosion, hydrogen sulfide gas, abrasion and impact resistant.

B. All steps of the coating system will be subject to observation prior to progression to succeeding steps. Phases of observation will include, but not be limited to:

1. Pre-cleaning (before surface preparation) survey of facilities to be resurfaced or primed.
2. During surface preparation and prior to coating application.
3. During and immediately after each coating application.
4. Final coating observation.

C. Environmental Conditions:

1. Do not apply coating under conditions that are unsuitable to produce good results. Do not begin application of coatings in areas where other trades are working, or where construction activities result in airborne dust or other debris. Do not apply coatings in conditions which do not conform to the recommendations of the coating manufacturer.

2. Coatings will only be applied when conditions fall within the parameters listed in the manufacturer's printed data.

3. Concrete will be cured for 28 days minimum and attain the required strength before coating is applied.

4. Do not apply any coatings when weather conditions are unfavorable. If climatic conditions are not conducive for best results, postpone application of coatings until conditions conform to the manufacturer's recommendations and the provisions of this Section. Do not apply coatings to a wet or damp surface in wet or damp weather conditions, or when there is dust in the air. Surfaces exposed to direct sunlight will be shaded by awnings or other protective devices while coatings are being applied. When necessary, provide temporary heating devices of a type that produces no fumes, and which will not discolor the paint system.

D. Working Conditions:

1. Provide adequate lighting at any location where coatings are being applied or testing is performed. Illumination will be of enough intensity to allow for safe working conditions and ability to properly apply and test the coating. Provide explosion-proof lighting when required.

2. Temporary ladders and scaffolds will conform to applicable safety requirements. Erect temporary scaffolds were needed to cover large areas. Provide ladders or scaffolding during testing procedures.

E. Forced Ventilation:

1. Provide continuous forced fresh air ventilation when working inside of containment systems or enclosed areas that are not openly vented from the beginning of surface preparation through final coating operations and coating curing.

2. Forced ventilation must be supplied per the recoat time required by the coating manufacturer and at least 48 hours after the final coat has been applied.

3. From the beginning of interior wet and/or dry coating application and until the coating is cured, the Contractor must monitor the air for the lower explosion limit (LEL) as published in the coating manufacturer's project SDSs.

4. Contractor is responsible for supplying, installing and maintaining the forced ventilation system.

F. Contractor will conform to all local, state, and federal regulations including those set forth by OSHA, RCRA and the EPA and any other applicable authorities.

G. Confined space entry program and other required safety training certificates will be submitted by the Contractor as Record Data to the Owner as necessary to perform the specified work.

H. Exterior concrete waterproofing has not been specified. If the coating manufacturer or the Contractor requires the installation of a waterproofing material on the exterior of the structure in order to warranty the product, then the Contractor will provide waterproofing at no additional cost to the Owner.

1.06 WARRANTY

A. Contractor will warrant all work against defects in materials and workmanship for a period of 10 years from the date of final acceptance of the project. Contractor will, within a reasonable time after receipt of written notice thereof, repair defects in materials or workmanship which may develop during said 10-year period, and any damage to other work caused by such defects or the repairing of same, at his own expense and without cost to the Owner. If the manufacturer's standard warranty does not extend to 10 years, manufacturer will provide documentation of extended warranty.

B. A warranty inspection will be conducted annually for the entire warranty period with the manufacturer present. Any defective work discovered will be corrected by the Contractor in accordance with specifications at no additional cost to the Owner. Other corrective measures may be required during the warranty period.

1.07 DELIVERY AND STORAGE

A. Deliver coating products to the Site in original unopened containers, with manufacturer's label, batch number, warning labels, contents (by volume) attached. Do not apply products until the Owner's field representative has approved the product for use.

B. Use one location at each site for the storage of coating products. Protect the area from spills and other damage. Protect the products from extreme heat or cold. Keep containers covered. Keep the storage rooms clean of trash and debris. Dispose of oily or used rags daily. Under no circumstances will they be allowed to accumulate. Take precautions to prevent fires. The storage of flammable liquids will comply with city, state, or other fire codes.

C. Storage of coating products and associated materials must be in accordance with the manufacturer's requirements. Coatings that have been damaged or not stored properly must not be used and will be removed from the Site.

D. All products and coatings that have not been approved for the Project will be immediately removed from the Project Site.

E. All materials must be delivered to the Site in original sealed containers with the date of manufacture and batch number stamped thereon by the coating manufacturer. Materials shall be subject to random observations by the Owner's representative at the Site.

2.00 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Products listed herein are specified to establish a standard of quality. Products which comply with the Contract Documents and are manufactured by the companies listed in this Section will be acceptable. Products from other coating manufacturers may not be submitted and will not be considered.

B. A.W. Chesterton Company:

Coat	Product	DFT
Top Coat	Chesterton ARC S1HB	125 mils
Primer	Two-component, chemically unique from the topcoat mix, will be hydrophobic, have a low viscosity, and be able to bond to wet concrete	

C. Raven Lining Systems:

Coat	Product	DFT
Top Coat	Raven 405 Series Epoxy, a two component (resin and curing agent)	80 mils
Primer	Two-component, chemically unique from the topcoat mix, will be hydrophobic, have a low viscosity, and be able to bond to wet concrete	

D. CCI Spectrum, Inc.:

Coat	Product	DFT
Resurfacer	Spectra-Grout (Hydrophilic Polyurethane for repairing cracks and leaks)	
Primer	SpectraShield (Multi-layer Liner System): Moisture Barrier - Modified Polymer (Silicone Modified Polyurea) Surfacer - Polyurethane/Polymeric Blend Foam Final Corrosion Barrier - Modified Polymer (Silicone Modified Polyurea)	500 mils

E. Warren Environmental, Inc.:

Coat	Product	DFT
Resurfacer	301-18 Single Coat, Two-Part, Thixotropic Epoxy Spray/Hand System 151 Injection Grout, Hydrophobic water cut-off grout and soil stabilization grout	
Primer	301-14 Single Coat, Two-Part, Thixotropic Epoxy Spray System Series 218 MortarClad	125 mils (new conc) 250 mils (rehabbed)

F. TNEMEC Company, Inc.:

Coat	Product	DFT
Resurfacer	Series 218 MortarClad	
Primer	Series 201 Epoxoprime	6-12 mils
Top Coat	Series 436 PermaShield	100 mils

G. The Sherwin-Williams Company:

Coat	Product	DFT
Resurfacer	Dura-Plate 2300 Cementitious Resurfacer	
Primer	Corobond 100	5-6 mils
Top Coat	Dura-Plate 6100 High Performance Epoxy Mortar, or Dura-Plate 6000 Reinforced Epoxy (Spray or Mortar)	125 mils

2.02 MATERIALS

A. General:

1. All components of the coating system must have a flash point above 203 F.
2. The resurfacer, primer and topcoat composite will contain no chemicals classified by the National Toxicology Program (NTP), the International Agency for Research on Cancer (IARC), or the Occupational Safety and Health Administration (OSHA) as carcinogenic, nor suspected carcinogenic chemicals.
3. Raw materials of the resurfacer, primer and topcoat composite will not contain any non-reactive diluents or solvents.
4. To ensure correct mix ratios are achieved, the packaging of each component will be pre-measured to the correct mix ratio and in the quantities that will be mixed on the job site. Each discrete batch size will not exceed 1.25 cubic feet in volume.
5. The material must be suitable for overhead, vertical and horizontal surfaces, and capable of being spray applied, brushed or rolled at a specified thickness as recommended by the manufacturer.

3.00 EXECUTION

3.01 PREPARATION

A. Prepare surfaces in accordance with manufacturer's written recommendations.

B. Appropriate actions will be taken by the Contractor to comply with local, state, and federal regulatory and other applicable agencies regarding environment, health, and safety during work.

C. All structures to be coated will be readily accessible to the Owner.

D. Thoroughly cure concrete surfaces prior to application of coatings. Allow a minimum of 28 days curing time, or as recommended by manufacturer, to elapse before coatings are applied.

E. Remove all grease, oils, and grime from concrete structure by washing with an emulsifying alkaline water-base cleaner. Follow with a thorough rinsing.

F. Remove all surface contaminants including old coatings, chemical salts, dust, loose concrete, and the laitance layer from concrete structure by method recommended by the manufacturer.

G. Alternate methods of surface preparation, i.e. acid etch or high-pressure water wash, may be used with prior written approval of the coating manufacturer.

H. Resulting surface must be structurally sound and free of contaminants prior to coating application. Repair and resurface any defective areas prior to surface preparation. Apply resurfacing material in accordance with the manufacturer's recommendation.

I. Surface to be coated can be damp, if allowed by manufacturer. There will be no standing water. Refer to the manufacturer's recommendation on maximum allowable moisture vapor transmission.

J. Pre-fill cracks in horizontal surfaces with resurfacer as per the manufacturer's recommendations. For cracks in vertical surfaces, pressure inject with a suitable injection system per manufacturer's recommendations.

K. For coatings to be applied to slab on grade, if no vapor barrier is present, check slab for vapor permeation.

L. Specified surfaces should be shielded to avoid exposure of direct sunlight, other intense heat source or, where cementitious products are employed, excessive ventilation. Where varying surface temperatures do exist, coating installation should be scheduled when the temperature is falling versus rising.

M. Prior to commencing surface preparation, the Contractor will inspect all surfaces specified to receive the coating and notify the Owner, in writing, of any noticeable disparity in the site, structure or surfaces which may interfere with the work, use of materials or procedures as specified herein.

N. If the structure is in an area where water infiltration through the concrete is expected, then an exterior coating will be applied.

1. The exterior surface will be coated with two coats of an approved bituminous coating to obtain a minimum total thickness of 23 mils.

2. Prior to application, dirt, dust, oil, or other contaminants that can interfere with adhesion of the coating will be removed.

3. The coating must be given 3 days of curing time before backfilling around the structure is permitted.

3.02 APPLICATION

A. Application will be in accordance with the manufacturer's written recommendations.

B. Product Quality:

1. Use only the coatings specified in Part 2.00 (Products). Use only those thinners and solvents recommended by the manufacturer, only in the amounts necessary to produce the manufacturer's recommended spreading rate, and in amounts not exceeding the maximum quantities stated in the manufacturer's literature.

2. The coating material will not show excessive settling in a freshly opened full can and will be easily re-dispersed with a paddle to a smooth, homogeneous state. It will show no curdling, thickening, becoming lumpy, caking, or color separation and will be free of lumps or skim surfaces.

3.03 FIELD QUALITY CONTROL / TESTING

A. Owner or Owner's third-party inspector will approve surfaces for application of coating at each stage. Any surface that is coated prior to the approval will be stripped back and recoated.

B. Observations must be conducted by the Owner's representative or a third-party inspection company. Final observations will be performed in the presence of the Owner or its representative and the Contractor's superintendent. All materials and equipment used in the accomplishment of testing are subject to observation at any time by the Owner and/or inspector. Periodic observation times will be agreed upon by the inspector and Contractor and approved by the Owner.

C. Owner may conduct the tests and observations to verify the coating manufacturer's data. If the coating testing results fall below the test requirements or visual observation, the Owner reserves the right to have the Contractor change coating materials and/or coating manufacturer to a coating that will meet all the stated requirements in this Section. All coating runs, sags, pinholes, voids, and skips will be repaired in accordance with the coating manufacturer's written recommendations and be retested. All disbonded coatings will be removed and replaced in accordance with the coating manufacturer's written recommendations.

D. All steps of the coating system will be subject to observation prior to progression to succeeding steps. Phases of observation will include, but not be limited to:

   1. Pre-cleaning (before surface preparation) survey of facilities to be resurfaced or primed.

   2. During surface preparation and prior to coating application.

   3. During and immediately after each coating application.

   4. Final coating observation.

E. Contractor may not move or remove scaffolding, ladders or other fixtures necessary to provide proper observation until such work has been observed and approved by the inspector and/or the Owner's representative.

F. Any work found to be deficient, damaged, or otherwise unacceptable will be repaired in accordance with the coating manufacturer's latest written repair recommendations at no additional cost to the Owner.

G. Owner and Owner's representative will make every attempt to minimize damage to newly coated areas during observation activities, but any damage caused, regardless of by whom, will be repaired by the Contractor at no additional cost to the Owner.

H. Observation and/or acceptance of the Contractor's Work by the Owner, inspector or their representatives in no way releases the Contractor from any of the terms and conditions of the Contract Documents.

I. The following test and observations will be performed:

   1. Surfaces of all concrete will first be cleaned and observed by the Contractor's superintendent to ensure that all grease, oil, and other foreign materials have been removed before coating. Any area found to be improperly cleaned, will be redone to the Owner's representative's satisfaction. Final surface preparation will be as per the

manufacturer's recommendation. Prior to observation of all interior and exterior surfaces by the Owner's representative, Contractor's superintendent will observe and confirm readiness for inspection.

2. No pinholes, holidays, or other irregularities will be permitted in the final interior coating inspection.

3. On days when coating is being performed, the Contractor will monitor and record ambient climatic conditions and interior conditions as follows:

    a. Air temperature, surface temperature, humidity and dew point will be measured and recorded by the Contractor prior to application of coating, daily. Surface temperature will be measured using Owner-approved thermometers. Temperature of both the sunny side and shady side of the structure will be recorded periodically each day.

    b. The structure surface temperatures, relative humidity, dry bulb, wet bulb and dew point temperatures, both interior and exterior (as appropriate), are to be recorded at least every 3 hours. The dew point will be measured by use of a sling psychrometer in conjunction with U.S. Department of Commerce Weather Bureau Psychometric Tables. Contractor will use a form approved by the Owner for recording this data. The completed forms will be kept on the Site at all times, from the time coating is first applied until the coating system is complete.

4. Destructive Testing: A minimum of five pull off adhesion tests, on each of application, will be performed on surfaces in compliance with ASTM D4541. Tests will be performed on the primer, intermediate and finished coating system. If test results do not meet the criteria of the coating manufacturer's written adhesion limits, additional tests will be performed as deemed necessary by the Owner. Contractor will repair, to the Owner's satisfaction and per the manufacturer's recommendations, all test areas where coating has been damaged and repair all areas where adhesion of coating is below the coating manufacturer's written adhesion limits. Repairs will be made by the Contractor at no additional cost to the Owner. Repair areas will be subject to re-testing and will continue to be re-tested until the adhesion of the repaired coating meets the stated minimum adhesion limit of the coating manufacturer. Retest costs, including actual labor and materials, will be at Contractor's expense.

5. Field Tests: Make wet film tests during coating operations to assure proper thicknesses of coating is being applied. After each coat has been applied, test the paint film thickness with a nondestructive, magnetic type thickness gauge. The total dry-film thickness for each coat will not be less than 75 percent of the amount specified. If the thickness is less than 75 percent, apply additional coats until the total specified thickness is obtained. The total thickness after the final coat has been applied will be 100 percent of the thickness specified, at a minimum. Apply additional coats per the manufacturer's recommendations regarding preparation and application over existing conditions until the specified thickness is reached or exceeded. Tests will be made starting at 2 feet above the bottom of the coating and will be taken every 10 feet vertically on all walls. Additional testing will be performed as required by field observation by the Owner or Owner's representative.

6. Holiday Testing: Test the entire surface of coated structures with a holiday detector. Testing must be conducted using a high voltage holiday detector for coatings with a DFT greater than 20 mils in accordance with ASTM D4787. Mark and repair pinholes in accordance with the manufacturer's printed instructions, then retest pinholes. No pinholes or other irregularities will be permitted in the final coats. Areas containing holidays will receive additional coats until tests indicate no holidays.

3.04 CLEAN AND ADJUST

A. Promptly remove trash and debris and any over-spraying resulting from coating operation from the Site, including all coating containers and waste products.

END OF SECTION

DIVISION 26

ELECTRICAL

26 01 26 TESTING OF ELECTRICAL SYSTEMS

1.00 GENERAL

1.01 WORK INCLUDED

A. Furnish labor, material, equipment and incidentals of an independent testing agency.

B. These specifications cover the suggested field tests and inspections that are available to assess the suitability for initial energization and final acceptance of electrical power equipment and systems.

C. The purpose of these specifications is to assure that electrical equipment and systems are operational, are within applicable standards and manufacturer's tolerances, and are installed in accordance with design specifications.

D. The Work specified in these specifications may involve hazardous voltages, materials, operations, and equipment. These specifications do not purport to address all of the safety issues associated with their use. It is the responsibility of the user to review all applicable regulatory limitations prior to the use of these specifications.

E. Testing shall be inclusive of all low voltage equipment including conductors that are provided under this Contract.

F. Testing shall include all relay protective schemes and operation of the low voltage equipment.

1.02 QUALITY ASSURANCE

A. Testing Organization:

1. The testing organization shall be an independent, third party entity which can function as an unbiased testing authority, professionally independent of the manufacturers, suppliers, and installers of equipment or systems being evaluated.

2. Testing organization shall be regularly engaged in the testing of electrical equipment devices, installations, and systems.

3. The Testing organization shall use technicians who are regularly employed for testing services.

4. An organization having a designation of NETA Accredited Company issued by the International Electrical Testing Association meets the above criteria.

5. Independent testing agency shall follow all tests and recommendations in NETA Acceptance Testing Specification for all equipment provided.

6. Testing Organization performing the Work shall submit appropriate documentation to demonstrate that it satisfactorily complies with these requirements.

7. Acceptable Testing Agencies:

a. National Field Services.

b. Real Power Technologies.

c. Shermco Industries.

d. Electrical Power Systems.

8. Testing Personnel:

a. Technicians performing these electrical tests and inspections shall be trained and experienced concerning the apparatus and systems being evaluated. These individuals shall be capable of conducting the tests in a safe manner and with complete knowledge of the hazards involved. They must evaluate the test data and make a judgment on the serviceability of the specific equipment.

b. Technicians shall be certified in accordance with ANSI/NETA ETT, Standard for Certification of Electrical Testing Technicians. Each on-site crew leader shall hold a current certification, Level 3 or higher, in electrical testing.

1.03 SUBMITTALS

A. Submittals shall be in accordance with Section 01 33 00 “Document Management” and shall include:

1. Electrical Qualifications & List of Test Submittals: 60 days prior to any testing taking place, Contractor shall submit to the Owner/Engineer the name of the testing agency; a list of all tests to be conducted shall also be submitted at this same time. No testing shall take place until this has been submitted and approved by the Engineer.

2. Electrical Testing Plan: A minimum of 2 weeks before testing is to take place, Contractor shall submit a detailed testing plan of the different configurations to be tested for the Owner’s and Engineer’s approval.

3. Electrical Testing Report:

a. A written report shall be submitted by the testing agency performing installation checks, operation and testing of the low voltage equipment. This report shall certify that:

1). The equipment has been properly installed.

2). Is in accurate alignment.

3). Meets the acceptance testing specifications of NETA and the equipment manufacturer.

b. Provide a detailed list of all tests that were performed and the test results as part of the Electrical Testing Report.

c. Electrical Testing Report(s) shall be submitted to the Engineer for approval no later than 1 week after testing has been conducted.

1.04 STANDARDS

A. The applicable provisions of the following standards shall apply as if written here in their entirety:

1. American National Standards Institute (ANSI).

2. Association of Edison Illuminating Companies (AEIC).

3. ASTM International (ASTM).

4. Electrical Apparatus Service Association (EASA).
5. Institute of Electrical and Electronic Engineers (IEEE).
6. Insulated Cable Engineers Association (ICEA).
7. International Electrical Testing Association (NETA).
8. National Electrical Manufacturers Association (NEMA).
9. National Fire Protection Association (NFPA).
10. Occupational Safety and Health Administration (OSHA).
11. State and local codes and ordinances.
12. Underwriters Laboratories, Inc. (UL).

2.00 PRODUCTS (NOT APPLICABLE)

3.00 EXECUTION

3.01 GENERAL

A. All testing shall be witnessed by the Owner's representative. Types of equipment required to be tested by these specifications shall include but not be limited to the following:
   1. Low Voltage Cables
   2. Control-Voltage Electrical Power Cables
   3. Grounding and Bonding for Electrical Systems
   4. Enclosed Switches and Circuit Breakers
   5. Industrial Control Panels
   6. Motor Operators for Valves

B. At a minimum, unless indicated otherwise, all testing shall be in accordance with the manufacturer's recommendations for energization and startup of the equipment.

C. Testing shall include a complete functionality testing of electrical equipment under all the different operating parameters identified by the Owner and Engineer.

D. Electrical testing instrument calibration shall be as indicated in ANSI/NEMA ATS-2017.

3.02 TEST REPORT

A. The test report shall include the following:
   1. Summary of the Project.
   2. Description of equipment tested.
   3. Description of tests.
   4. Test data.
   5. Analysis and recommendations.

B. Test data records shall include the following minimum requirements:

1. Identification of the testing organization.
2. Equipment identification.
3. Nameplate data.
4. Humidity, temperature, and other conditions that may affect the results of the tests and/or calibrations.
5. Date of inspections, test, maintenance, and/or calibrations.
6. Identification of the testing technician.
7. Identification of inspections, tests, maintenance, and/or calibrations to be performed and recorded.
8. Identification of expected results when calibrations are to be performed.
9. Identification of as-found and as-left results, as applicable.
10. Identification of all test results outside of specified tolerances.
11. Sufficient spaces to allow all results and comments to be indicated.

C. The testing organization shall furnish a copy or copies of the complete test report as specified.

3.03 TEST DECAL

A. The testing organization shall affix a test decal on the exterior of equipment or equipment enclosure of protective devices after performing electrical tests.

B. The test decal shall be color-coded to communicate the condition of maintenance for the protective device. Color scheme for condition of maintenance of overcurrent protective device shall be:

1. White: Electrically and mechanically acceptable.
2. Yellow: Minor deficiency not affecting fault detection and operation, but minor electrical or mechanical condition exists.
3. Red: Deficiency exists affecting performance, not suitable for service.

C. The decal shall include:

1. Testing organization.
2. Project identifier.
3. Test date.
4. Technician identifier.

3.04 POWER SYSTEM TESTING

A. Contractor shall test the operation of the power distribution system, i.e. transformers, automatic throw over, double throw disconnect switches, 480V MCC, etc., for the various possible system configurations under load conditions.

B. Testing shall include, but not be limited to the following:

   1. Normal power from Utility Source 1.

C. Contractor shall submit a detailed testing plan of the different configurations to be tested for the Owner's and Engineer's approval.

END OF SECTION

26 05 00 COMMON WORK RESULTS FOR ELECTRICAL

1.00 GENERAL

1.01 WORK INCLUDED

A. Furnish labor, materials, equipment, and incidentals necessary for complete and operational electrical systems, as specified herein.

B. This Section, as well as Division 01, concerns all other Sections in Division 26, and shall be considered a part of each of those Sections as if written in their entirety.

C. Permanent Utilities:

1. Contractor shall be responsible to coordinate power at the Site with local utility company.

2. Owner will be responsible to absorb the cost of providing utility power to the Site. However, Contractor is responsible for providing civil and electrical improvements identified on design drawings to assist local utility in onsite upgrades. Such improvements identified on design drawings include but are not limited to primary service entrance trenching and conduit, riser conduits, transformer, and metering cabinet concrete pads, etc. Coordinate all additional requirements with local utility.

D. Temporary utilities:

1. Contractor may need to include generator power for outages, depending on the Contractor's means and methods of connecting to existing power equipment.

2. Contractor shall provide electrical testing and inspection services for temporary connections to existing equipment.

3. Fusing for temporary equipment shall be coordinated with upstream devices to ensure the fuses will terminate before interrupting electrical service.

E. Electrical outages must be coordinated with operations, as well as the electrical, instrumentation and inspections divisions.

1. Known electrical outages include:

a. Control Valve Panel

2. Shut down sequencing shall be coordinated by the Contractor and if a generator is required to power equipment to maintain service, Contractor shall be responsible to provide the generator, fuel, and conductors required to keep the plant operational.

F. Refer to Section 01 35 00 "Special Procedures" for known critical processes that must remain operational the entire length of construction.

1.02 QUALITY ASSURANCE

A. Electrical Contractors' Qualifications: Use adequate numbers of skilled workmen, trained, and experienced in their crafts, and who are familiar with the specifications and methods of performing the work in this Division. A licensed Journeyman shall be on site at all times when electrical work is being performed. Electrical work shall be performed under the direct supervision of a Master Electrician who holds a valid license in the State of Georgia.

Contractor shall provide a monthly report to the Owner/Engineer for review stating that the Master Electrician has been to the job site and thoroughly reviewed the work. THE REPORT SHALL BE SIGNED BY THE MASTER ELECTRICIAN AND INCLUDE THE DATE AND TIME THE MASTER ELECTRICIAN WAS ON SITE. THE REPORT SHALL BE INCLUDED IN THE PAY APPLICATION. NO PAYMENT WILL BE GRANTED WITHOUT REPORT.

B. Workmanship: Work shall be performed in accordance with quality, commercial practices. The appearance of finished work shall be of equal importance to its operation. Materials and equipment shall be installed based upon the actual dimensions and conditions at the Project Site. Locations for materials or equipment requiring an exact fit shall be field measured. Conduit, transformers, and motors shall be isolated to avoid unacceptable noise levels from objectionable vibrations from all systems.

1.03 SUBMITTALS

A. Submittals shall be in accordance with Division 01, ANY DEVIATIONS FROM THE SPECIFICATIONS MUST BE CLEARLY NOTED AND IDENTIFIED IN THE SUBMITTALS, and shall include:

1. Submittals shall be submitted separated by Specification Section. Combined submittals will not be reviewed. Submittal will be marked not approved, revise and resubmit.
2. Each Section submittal shall be complete, contain all of the items listed in the Specification Section, and shall be clearly marked to indicate which items are applicable on each cut sheet page. The Submittal shall list any exceptions to the Specifications and Drawings, and the reason for such deviation. Shop Drawings, not so checked and noted, will be returned unreviewed.
3. Contractor shall check Shop Drawings for accuracy and contract requirements prior to submittal to the Owner/Engineer. Errors and omissions on approved Shop Drawings shall not relieve the Contractor from the responsibility of providing materials and workmanship required by the Specifications and Drawings. Shop Drawings shall be stamped with the date checked and a statement indicating that the Shop Drawings conform to Specifications and Drawings. Only one Specification Section shall be made per transmittal.
4. Material shall not be ordered or shipped until the Shop Drawings have been approved. No material shall be ordered, or shop work started if Shop Drawings are marked “APPROVED AS NOTED CONFIRM”, “APPROVED AS NOTED RESUBMIT” or “NOT APPROVED”.
5. Submittals in PDF format shall be provided with bookmarks for each section and component to navigate the file contents.
6. Provide only pertinent information for component. Do not submit entire catalog sections to limit the size of submittals. Complete catalog sections will not be reviewed. Submittal will be marked not approved, revise and resubmit.
7. Component catalog number and manufacturing data sheet, indicating pertinent data and clearly marked identifying each component by the item number and nomenclature as specified.

8. Submit copy of Master Electrician's license and each Journeyman's license that will be working on the Project. Workers must be licensed to work in the city where the Project is located.
9. Component drawings showing dimensions, mounting, and external connection details.
10. Complete interconnection and point to point wiring diagrams in AutoCAD format for all field control and instrumentation wiring between instruments, electrical equipment, starters, VFDs, etc. A hard copy shall be submitted to the Engineer for approval prior to the final AutoCAD files being submitted. Interconnection/wiring diagrams shall include cable numbers, wire tags, actual equipment terminal strip numbers at both ends of the cable, etc.
11. Unless other additional information is required by the detailed equipment specifications, the following information shall be included for motors:
    a. Motor identification number and nomenclature as specified.
    b. Make and motor type.
    c. Brake horsepower of the motor.
    d. Locked rotor current at full load.
    e. Motor efficiency at full load (3-phase motors only).
    f. Starting torque.
    g. Method of insulating and impregnating motor coils (3-phase only).
    h. Speed of the motor at full torque.
    i. Full load current.
    j. Service factor.
    k. Motor temperature rise measured by resistance over 40 degrees C ambient.

B. Contractor shall provide a monthly report to the Owner/Engineer for review stating that the Master Electrician has been to the job site and thoroughly reviewed the work. The report shall be signed by the Master Electrician and include the date and time the Master Electrician was on site.

C. Contractor shall:
    1. Prepare, and keep up to date, the Record Drawings and detailed construction drawings which shall be available at each monthly pay application.
    2. Record the exact locations of each of these differences, sizes and details of the Construction Work as executed, with cross-references to and other requirements on the Record Drawings.
        a. Record Drawings shall include the location of all pull boxes, junction boxes, concrete pull boxes, manholes and hand holes that were provided under this contract and those existing boxes that were modified under this Project (by either the addition or removal of cable/conduits).

1). Contractor shall also include on the Drawings a label next to each pull box, junction box, concrete pull box, manhole and handhole to reflect the nameplate label installed (existing or new) at each device.

2). Refer to Section 26 05 53 “Identification for Electrical Systems” for labeling requirements for pull boxes, junction boxes, concrete pull boxes, manholes and hand holes.

3). Keep the Record Drawings on the Work Site.

4). Upon completion of the Work, or at such other time as may be determined by the Engineer, submit the Record Drawings and copies to the Owner’s representative in accordance with the Owner’s requirements.

5). Underground Interference drawing showing all underground duct banks, ground rods, ground conductors, pipes, piers, vaults, manholes, pull boxes, etc. that clearly identifies the location and routing of these systems. All interferences shall be brought to the Engineer’s attention. Provide as a minimum the ductbank dimensions, burial depth and coordinates of terminations and those of any changes of direction. The GPS coordinates of the ductbank shall be measured (width, depth, and burial depths) prior to back filling.

6). Provide revised final Shop Drawings in AutoCAD format noting any changes made to equipment during start-up.

7). Submit master electricians report with each pay application.

D. Contractor shall provide a copy of the complete one-line diagram at the Site. The one-line diagram shall be as follows:

1. The one-line shall reflect all changes made including but not limited to changes made during construction.

2. Each page of the one-line shall be framed in a separate picture frame with plexiglass. The copy of the sheet shall lay flat against the glass without any wrinkles and other material necessary for the copy to lay flat shall be provided within the picture frame.

1.04 STANDARDS

A. Electrical Work shall be executed in accordance with local, State and national codes, ordinances and regulations which have jurisdiction or authority over the Work. If the standards and codes conflict with each other, the most stringent shall apply. The applicable provisions of the following standard shall apply as if written here in their entirety:

1. National Electrical Manufacturer Association (NEMA).

2. ASTM International (ASTM).

3. National Fire Protection Association (NFPA).

4. National Electrical Safety Code (NESC).

5. Institute of Electrical and Electronic Engineers (IEEE).

6. National Electrical Code (NEC).

7. Underwriters’ Laboratories (UL).

8. American National Standards Institute (ANSI).
9. Uniform Building Code (UBC).
10. Occupational Safety and Health Administration (OSHA).
11. Local utility companies.
12. Local Electrical Ordinance.
13. Rural Electrification Association (REA).
14. Insulated Power Cable Engineers Association (IPCEA).
15. International Electrical Testing Association (NETA).
16. National Electrical Contractors Association (NECA).
17. Association Edison Illuminating Companies (AEIC).

B. Electrical Work shall be performed under the direct supervision of a Master Electrician who holds a Valid license in the State of Georgia.

1.05 DELIVERY AND STORAGE

A. Follow the manufacturer's directions for the delivery, storage and handling of equipment and materials. Tightly cover equipment and materials and protect it from dirt, water, chemical or mechanical injury and theft. Major electrical equipment shall be stored indoors in a climate-controlled atmosphere and space heaters energized where applicable. Stored equipment shall be properly protected from rodents such as mice and rats.

B. Equipment that will be stored indoors for an extended period of time and that do not have space heaters shall have a 100-watt incandescent light placed in it and energized to eliminate the build-up of condensation in the equipment. Coordinate with equipment manufacturer for additional storage requirements. Damaged equipment shall not be acceptable. Upon installation, protect the materials until the Work is completed and accepted by the Owner. Improperly stored equipment is subject to rejection by the Owner/Engineer and will not be allowed to be installed.

1.06 JOB CONDITIONS

A. Permits, licenses, inspections, and testing shall be secured and paid for as required by law by the Contractor for the completion of the Work. Certificates of approval shall be secured, paid for, and delivered to the Owner before receiving the final acceptance of the Work.

B. The location of materials, equipment, devices, and appliances indicated are approximate and subject to revisions at the time the Work is installed. Final location shall be as proposed by the Contractor and approved by the Engineer.

C. Should project conditions require any rearrangement of Work, or if equipment or accessories can be installed to a better advantage than the general arrangement of Work on the Drawings, Contractor shall before proceeding with the Work prepare and submit plans of the proposed rearrangement for the Engineer's review and approval.

D. Motor Horsepower ratings identified are anticipated ratings. If the actual equipment is a different size, the Contractor shall provide the appropriate wiring, conduit, over current

protection, starters, and accessories for a complete and working system at no cost to the Owner.

E. Enclosures for equipment in the air-conditioned rooms shall be NEMA 12, 14-gauge steel and NEMA 3R, 304 Stainless Steel for all other interior locations unless noted otherwise. All enclosures shall have a quick release luggage type clasp or single handle operated, 3-point latching system.

F. All enclosures for equipment unless specified otherwise shall be NEMA 4X, 304 Stainless Steel for exterior applications. All enclosures shall have a quick release luggage type clasp.

G. No equipment is to be energized until the Power System Studies have been completed, the protective relays and breakers have been set per the Short Circuit and Protective Device Study and the arc flash labels have been installed on the equipment. NO EXCEPTIONS.

2.00 PRODUCTS (NOT USED)

3.00 EXECUTION

3.01 INTERPRETATION OF DRAWINGS

A. The Drawings are not intended to show exact locations of conduit runs. Coordinate the conduit installation with other trades and the actual supplied equipment.

B. Install each 3-phase circuit in a separate conduit unless otherwise shown on the Drawings.

C. Unless otherwise approved by the Owner/Engineer, conduit shown exposed shall be installed exposed; conduit shown concealed shall be installed concealed.

D. Where circuits are shown as “home runs” all necessary fittings and boxes shall be provided for a complete raceway installation.

E. Verify the exact locations and mounting heights of lighting fixtures, switches, and receptacles prior to installation.

F. Except where dimensions are shown, the locations of equipment, fixtures, outlets, and similar devices shown on the Drawings are approximate only. Exact locations shall be determined by the Contractor and approved by the Owner/Engineer during construction. Obtain information relevant to the placing of electrical Work and in case of any interference with other Work, proceed as directed by the Owner/Engineer and furnish all labor and materials necessary to complete the Work in an approved manner.

G. Circuit layouts are not intended to show the number of fittings, or other installation details. Furnish all labor and materials necessary to install and place in satisfactory operation all power, lighting and other electrical systems shown.

H. Redesign of electrical or mechanical Work, which is required due to the Contractor’s use of a pre-approved alternate item, arrangement of equipment and/or layout other than specified herein, shall be done by the Contractor at his/her own expense. Redesign and detailed plans shall be submitted to the Owner/Engineer for approval. No additional compensation will be provided for changes in the Work, either his/her own or others, caused by such redesign.

I. Raceways and conductors for lighting, switches, receptacles and other miscellaneous low voltage power and signal systems as specified are not shown on the Drawings. Raceways and conductors shall be provided as required for a complete operating system. Refer to riser diagrams for signal system wiring. Homeruns, as shown on the Drawings, are to assist the Contractor in identifying raceways to be run exposed and raceways to be run concealed. Raceways installed exposed shall be near the ceiling or along walls of the areas through which they pass and shall be routed to avoid conflicts with HVAC ducts, cranes hoists, monorails, equipment hatches, doors, windows, etc. Raceways installed concealed shall be run in the center of concrete floor slabs, above suspended ceilings, or in partitions as required.

J. Contractor shall run all conduit and wire to RTU and/or PLC termination cabinets, where designated on the Drawings. The conduit and wire as shown on the interface drawings may not necessarily be shown on the floor plan.

K. Install conductors carrying low voltage signals (typically twisted shielded pair cables) in raceways totally separate from all other raceways containing power or 120-volt control conductors.

L. Raceways and conductors for thermostats controlling HVAC unit heaters, exhaust fans and similar equipment are not shown on the Drawings. Provide raceways and conductors between the thermostats, the HVAC equipment, and the motor starters for a complete operating system. All raceways and power conductors shall be in accordance with Division 26. Raceways shall be installed concealed in all finished space and may be installed concealed or exposed in process spaces. Refer to the HVAC drawings for the locations of the thermostats and controls.

M. Raceways and conductors for the fire alarm, sound and page party systems are not shown on the Drawings. Provide raceways and conductors as required by the system manufacturer for a complete operating system. All raceways and power conductors shall be in accordance with Division 26. Raceways shall be installed concealed in all finished spaces and may be installed exposed or concealed in process spaces.

3.02 INSTALLATION

A. All enclosures for equipment unless specifically identified otherwise shall be:

1. NEMA 1 enclosures for indoor air-conditioned areas.
2. NEMA 1 enclosures for indoor ventilated areas.
3. NEMA 4X, FRP for rooms housing Chlorine or Chlorine feed equipment.
4. NEMA 3R stainless steel for exterior applications and all other locations.

B. Maintain the waterproof integrity of conduit penetrations through the roof, exterior walls, and floors. Roof penetrations shall not be located above any electrical equipment.

C. Install stainless steel sleeves for each conduit passing through floors. Extend sleeves 1-1/2” above the floor slab and grout watertight. The sleeve sizes shall permit the subsequent insertion of a properly sized conduit or raceway.

D. Submit location drawings and obtain Engineer approval prior to installing conduit penetrations through slabs, beams, ceiling, and walls. Contractor shall not core drill through

existing beams. After the conduits are installed fill the annular space between the conduits with mastic. The complete installation shall be watertight and the fire rating of penetrations through walls, floors and ceilings shall be maintained.

E. Install steel reinforced concrete foundations below floor mounted switchboards, panelboards, motor control centers, soft starters, adjustable frequency drives, transformers, and other floor mounted electrical equipment. Concrete foundations shall not be less than 4 inches high or as indicated on the Drawings. Neatly chamfer top edges. Concrete foundations shall be 6 inches wider and 6 inches longer than the base of the equipment being installed or as indicated on the Drawings. Concrete shall be in accordance with Division 03 and shall be reinforced with a minimum of 6 inches x 6 inches #6 welded wire mesh or as indicated on Drawings.

F. Route all conduits parallel to building lines, columns, or steel route conduits near to columns and roof beams. Conduits shall maintain a minimum of 3 inches away from adjacent Work (duct work, insulations, etc.).

3.03 EQUIPMENT PADS AND SUPPORTS

A. Electrical equipment pads and supports, of concrete or steel including structural reinforcing and lighting pole foundations, are shown on the Structural Drawings.

B. No electrical equipment or raceways shall be attached to or supported from sheet metal walls.

3.04 SLEEVES AND FORMS FOR OPENINGS

A. Provide and place all sleeves for conduits penetrating floors, walls, partitions, etc. Locate all necessary slots for electrical Work and form before concrete is poured.

B. Exact locations are required for stubbing up and terminating concealed conduit. Obtain Shop Drawings and templates from equipment vendors or other subcontractors and locate the concealed conduit before the floor slab is poured.

C. Where setting drawings are not available in time to avoid delay in scheduled floor slab pours, the Owner/Engineer may allow the installations of such conduit to be exposed. Requests for this deviation shall be submitted in writing. No additional compensation for such change will be allowed.

D. Seal all openings, sleeves, penetration, and slots as specified in Section 26 05 33 “Raceways and Boxes for Electrical Systems.”

3.05 CUTTING AND PATCHING

A. Coordinate with Divisions 02 and 03 for cutting and patching.

B. Core drill holes in concrete floors and walls as required. Contractor shall obtain written permission from the Owner/Engineer before core drilling any holes larger than 2 inches.

C. Install Work at such time, as to require the minimum amount of cutting and patching.

D. Do not cut joists, beams, girders, columns, or any other structural members.

E. Cut opening only large enough to allow easy installation of the conduit.

F. Patching shall be of the same kind and quality of material as was removed.

G. The completed patching work shall restore the surface to its original appearance or better.

H. Patching of waterproofed surfaces shall render the area of the patching completely waterproofed.

I. Remove rubble and excess patching materials from the premises.

J. When existing conduits are cut at the floor line of wall line, they shall be filled with grout of suitable patching material.

3.06 PHASE BALANCING

A. The Drawings do not attempt to balance the electrical loads across the phases. Circuits on motor control centers and panelboards shall be field connected to result in evenly balanced loads across all phases.

B. Field balancing of circuits shall not alter the conductor color coding requirements.

3.07 TESTS AND SETTINGS

A. Test systems and equipment furnished under Division 26 and repair or replace all defective Work. Make adjustments to the systems as specified and/or required.

B. Prior to energizing electrical equipment, make all tests as required by the individual Specification Sections. Submit a sample test form or procedure and submit the required test reports and data to the Owner/Engineer for approval at least two weeks prior to the startup of the tested equipment. Include names of all test personnel and initial each test.

C. Check motor nameplates for correct phase and voltage. Check bearings for proper lubrication.

D. Check wire and cable terminations for tightness.

E. Check rotation of motors prior to energization. Disconnect driven equipment if damage could occur due to wrong rotation. If the motor rotates in the wrong direction, the rotation shall be immediately corrected, or tagged and locked out until rotation is corrected.

F. Verify all terminations at transformers, equipment, capacitor connections, panels, and enclosures by producing a 1 2 3 rotation on a phase sequenced motor when connected to “A”, “B” and “C” phases.

G. Mechanical inspection, testing and setting of circuit breakers, disconnect switches, motor starters, control equipment, etc. for proper operation.

H. Check interlocking, control, and instrument wiring for each system and/or part of a system to prove that the system will function properly as indicated by schematic and wiring diagrams.

I. Testing shall be scheduled and coordinated with the Owner/Engineer at least two weeks in advance. Provide qualified test personnel, instruments, and test equipment.

J. Refer to the individual equipment Sections for additional specific testing requirements.

K. Make adjustments to the systems and instruct the Owner’s personnel in the proper operation of the systems.

3.08 PAINTING

A. Maintain the original factory finish on material and equipment installed, unless specifically indicated on the Drawings or Specifications. If the finish is marred in transit or during installation, re-finish to a neat, workmanlike appearance equal to the original factory finish. Leave equipment and raceway systems clean and free of grease, dirt, rust, and in a suitable condition for painting.

3.09 EXCAVATION, TRENCHING, BACKFILLING AND GRADING

A. Prior to any excavation or trenching, notify the Owner's representative, utility companies and Owner's facilities department. Allow sufficient time for utilities to be located prior to excavation to avoid disruption of services. Provide a minimum of 72 hours written notice to the Owner prior to trenching or excavation. Do not proceed with trenching or excavation until authorized by the Owner. Utilities or services which are damaged, which are identified prior to excavation or trenching, or where confirmation by utility companies has not been obtained verifying that utilities are marked, shall be repaired to operable condition immediately, at no cost to the Owner.

B. Barricade open trenches and excavations for the entire duration of the Project. Barricades for excavations shall have warning lights maintained during hours of darkness. Trenches shall be marked with warning tape, or access to trenches shall be prohibited with readily identifiable sawhorses, warning tape or other acceptable means. Barriers shall be illuminated or recognizable during hours of darkness. Barriers and tape shall be properly maintained at all times.

C. Protect all adjacent Work, structures, and properties. Damage to adjacent Work, structures or properties shall be repaired, or the cost of repair reimbursed in full.

3.10 LOCKING OF ELECTRICAL FACILITIES

A. Install locks immediately upon the installation of the electrical facility. Provide padlocks for exterior electrical facilities subject to unauthorized entry. Furnish the Owner with 2 keys per lock up to a quantity of 10 keys. Furnish locks to match the Owner's locking system. Locks shall also be provided where required to obtain an electrical Certificate of Occupancy.

3.11 CLEAN AND ADJUST

A. Remove shipping labels, dirt, paint, grease, and stains from equipment. Remove debris as it accumulates. Upon completion of the Work, clean electrical equipment, and the entire electrical installation so that it is suitable for the Owner's use.

3.12 TRAINING

A. Contractor shall provide manufacturer's training as specified in each individual section of the Specifications.

END OF SECTION

26 05 19 LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

1.00 GENERAL

1.01 SUMMARY

A. Scope of Work:

1. Furnish, install and test all wire, cable and appurtenances as shown on the Drawings and as specified herein.

2. Work shall include building wire, cable, wiring connections and terminations, and modular wiring systems.

1.02 SUBMITTALS

A. Product Data:

1. Copper building wire.

2. Metal-clad cable, Type MC.

3. Connectors and Splices.

B. Shop Drawings:

1. Submit catalog data of all wire and cable, connectors and accessories, specified under this Section with all selections, options and exceptions clearly indicated.

a. Low voltage wire.

C. Product Schedule: Indicate type, use, location, and termination locations.

D. Certified Tests:

1. Submit a test report of all installed wire insulation tests.

1.03 REFERENCE CODES AND STANDARDS

A. The equipment in this specification shall be designed and manufactured according to latest revision of the following standards (unless otherwise noted):

1. NFPA 70 – National Electrical Code (NEC).

2. NEMA WC-5 – Thermoplastic-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy.

3. ANSI/TIA/EIA 606A – Standard for telecommunications Infrastructure.

1.04 QUALITY ASSURANCE

A. The general construction of the wire, cables and the insulation material used shall be similar to that used for cable of the same size and rating in continuous production for at least 15 years and successfully operating in the field in substantial quantities.

B. Wire and cable with a manufacture date of greater than 12 months previous will not be acceptable.

C. Wire and cable shall be in new condition, with the manufacturer's packaging intact, stored indoors since manufacture, and shall not have been subjected to the outdoor elements. Date of manufacture shall be clearly visible on each reel.

D. Manufacturer of these materials shall have produced similar electrical materials for a minimum period of 5 years. When requested by the Owner/Engineer, an acceptable list of installations with similar equipment shall be provided demonstrating compliance with this requirement.

1.05 JOBSITE DELIVERY, STORAGE AND HANDLING

A. Prior to jobsite delivery, the Contractor shall have successfully completed all submittal requirements; the Contractor shall present to the Owner/Engineer, upon delivery of the equipment, an approved copy of all such submittals. Delivery of incompletely constructed equipment, onsite factory work, or failed factory tests will not be permitted.

B. Check for reels not completely restrained, reels with interlocking flanges or broken flanges, damaged reel covering or any other indication of damage. Do not drop reels from any height.

C. Unload reels using a sling and spreader bar. Roll reels in the direction of the arrows shown on the reel and on surfaces free of obstructions that could damage the wire and cable.

D. Store cable in a solid, well drained location. Cover cable reels with plastic sheeting or tarpaulin. Do not lay reels flat.

E. Deliver cable and wire to the Project Site in the original packages. Conductors with damaged insulation or exposed nylon jacketing shall not be permitted.

1.06 WARRANTY

A. Manufacturer shall warrant the wiring and installation to be free from defects in material and workmanship for 1 year from the date of final acceptance of the equipment. Within such period of warranty, the Manufacturer shall promptly furnish all material and labor necessary to return the installation to new operating condition.

2.00 PRODUCTS

2.01 CONDUCTORS AND CABLES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Alpha Wire Company
2. Belden Inc
3. Encore Wire Corporation.
4. General Cable Technologies Corporation.
5. Service Wire Co.
6. Southwire Company.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Conductor and Cable Marking: Comply with wire and cable marking according to UL's "Wire and Cable Marking and Application Guide."

D. Conductors: Tin-plated Copper, complying with NEMA WC 70/ICEA S-95-658.

1. Conductor Insulation: Conductor with thermoplastic insulation rated at 600 volts. Wire shall be water tank tested and approved as machine tool wire, in accordance with National Machine Tool Builders Association. Comply with NEMA WC 70/ICEA S-95-658 for Type XHHW-2.

2.02 CONNECTORS AND SPLICES

A. Description: Factory-fabricated connectors, splices, and lugs of size, ampacity rating, material, type, and class for application and service indicated; listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.

B. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. 3M Electrical Products.
2. AFC Cable Systems, Inc.
3. Hubbel Power systems, Inc.
4. Ideal Industries, Inc.
5. ILSCO.
6. O-Z/Gedney; a brand of Emerson Industrial Automation.
7. Thomas & Betts Corporation, A Member of the ABB Group.
8. Tyco Electronics Corp.

C. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated; listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

D. Connectors, Compression, Copper, 600 Volt: The appropriate hole sizes and spacing which are in accordance with NEMA standards; two holes in the tongue for use on conductor sizes 250 kcmil or larger; not required for connections to the circuit breakers in the lighting and/or receptacle panels. All compression connectors shall be long-barrel type, no exceptions.

E. 600-Volt Plastic Tape: Scotch Vinyl 35.

F. Wirenuts: Silicone-based pre-filled spring wire connecting devices with plastic covering; UL listed for damp and wet locations. Wirenut shall meet requirements of UL 486D for Sealed Wire Connector Systems. Wirenut shall be spring insulated, properly sized and resistant to vibration may be used for No. 12 through No. 10 solid gauge conductor for lighting and branch circuits only.

G. Split Bolts: Shall be usable for connecting conductors which are both copper, both aluminum or one copper and one aluminum. Split bolts shall have a spacer between the two conductors, which it connects.

H. Mechanical Set Screw Connector: Consisting of an aluminum body which has openings on opposite ends for insertion of the conductors. Conductors inserted into these holes shall each be clamped by two set screws. Connectors shall be suitable for use with copper conductors.

I. Rubber Tape: Scotch 2210.

J. Vinyl Tape: Scotch 88.

K. Arc Proofing Tape: 3M "Scotch 77 Fire and Electric Arc Proofing Tape". Fireproofing shall be done with a half-lapped layer of arc proofing tape, anchored at each end with a double wrap of 3M "Scotch 69 Glass Cloth Electrical Tape".

L. Insulating Resin: 3M Scotchcast Electrical Insulating Resin 4 or 2104.

M. Power Distribution Blocks: Rated for 600 VAC and termination of copper conductors. Individual poles shall be constructed of tin-plated aluminum and mounted on an insulating base.

3.00 EXECUTION

3.01 CONDUCTOR MATERIAL APPLICATIONS

A. Feeders: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

B. Branch Circuits: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

3.02 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

A. Service Entrance: Type XHHW-2, single conductors in raceway.

B. Exposed Feeders: Type XHHW-2, single conductors in raceway.

C. Feeders Concealed in Concrete, below Slabs-on-Grade, and Underground: Type XHHW-2, single conductors in raceway.

D. Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and Underground: Type XHHW-2, single conductors in raceway.

E. Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and Underground: Type XHHW-2, single conductors in raceway.

3.03 INSTALLATION, GENERAL

A. Conceal cables in finished walls, ceilings, and floors unless otherwise indicated.

B. Complete raceway installation between conductor and cable termination prior to pulling conductors and cables.

C. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.

D. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.

E. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.

F. Complete cable tray systems installation prior to installing conductors and cables.

G. Installed unapproved wire shall be removed and replaced at the Contractor's expense.

H. Grouping conductors together into one conduit shall not be allowed where the Drawings indicate the conductors to be placed in separate conduits. Each home run shown on the Drawings shall be in its own conduit.

1. Neatly train wiring inside boxes, equipment and panelboards. Pull conductors into a raceway at the same time and use UL listed, wire pulling lubricant for pulling No. 4 AWG and larger wire.

2. Except for hand-pulled conductors into raceways, all wire and cable installation shall be in-stalled with tension-monitoring equipment. Where conductors are found to have been installed without tension-monitoring, the conductors and cables shall be immediately re-moved from the raceways, permanently identified as rejected material, and removed from the Site. New conductors and cables shall be reinstalled, tagged and raceways re-sealed, all at the Contractor's expense.

3. Do not exceed cable manufacturer's recommendations for maximum pulling tensions and minimum bending radii. Where pulling compound is used, use only UL listed compound compatible with the cable outer jacket and with the raceway involved.

4. Where single conductors and cables in manholes, hand holes, vaults, cable trays, and other indicated locations are not wrapped together by some other means such as arc and fire-proofing tapes, bundle throughout their exposed length all conductors entering from each conduit with nylon, self-locking, releasable, cable ties placed at intervals not exceeding 4 inches on center.

5. Properly support cables in accordance with the NEC and manufacturer's recommendations in all raceways. Provide strain relief as required.

6. Arrange wiring in cabinets and panels neatly cut to proper length, remove surplus wire, and bundle and secure in an acceptable manner. Identify all circuits entering motor control centers or other control cabinets in accordance with the conductor identification system specified herein and in Section 26 05 53 "Identification for Electrical Systems."

I. Cap and label each side of spare conductors not terminated with the UL listed end caps.

J. For conductors that will be connected by others, provide at least 6 feet spare conductors in free standing panels and at least 2 feet spare in other assemblies. Provide additional spare conductor in any particular assembly where it is obvious that more conductor will be needed to reach the termination point.

K. Each circuit shall include a ground wire. Sharing grounds or neutrals is not allowed.

L. Conductors 600 Volts and Below:

1. Provide conductor sizes indicated on Drawings, as a minimum.
2. Use crimp connectors on all stranded conductors.
3. Soldered mechanical joints insulated with tape will not be acceptable.
4. Arrange wiring in cabinets and panels neatly cut to proper length, remove surplus wire, and bridle and secure in an acceptable manner. Identify all circuits entering motor control centers or other control cabinets in accordance with the conductor identification system specified herein.
5. Terminate control and instrumentation wiring with methods consistent with terminals provided, and in accordance with terminal manufacturer's instructions.
6. Attach compression lugs, larger than #6 AWG, with a tool specifically designed for that purpose which provides a complete, controlled crimp where the tool will not release until the crimp is complete. Use of plier type crimpers is not acceptable.
7. Cap spare conductors and conductors not terminated with the UL listed end caps.
8. Where conductors pass through holes or over edges in sheet metal, remove all burrs, chamfer all edges, and install bushings and protective strips of insulating material to protect the conductors.
9. For conductors that will be connected by others, provide at least 6 feet spare conductors in freestanding panels and at least 2 feet spare in other assemblies. Provide an additional spare conductor in any particular assembly where it is obvious that more conductors will be needed to reach the termination point.

M. Terminations and Splices:

1. No splices of wire and cable will be permitted, except where specifically permitted by the Owner/Engineer in writing, or as shown on the Drawings.
2. Power conductors: Terminations shall be made with connectors as specified. Splices, where specifically allowed as stated above, shall be made in a Termination Cabinet (TC).
3. Control Conductors: Splices of control conductors will not be permitted between terminal points. Terminations shall be made with approved terminals as specified.
4. Instrumentation Signal Conductors (including graphic panel, alarm, low and high level signals): Splices of Instrumentation conductors will not be permitted between terminal points. Terminations shall be made with connectors as specified. Each termination of paired shielded or triad shielded shall be coated with silicone jelly after termination. The shield of pair shielded and triad shielded shall be terminated on terminal strips.

3.04 CONNECTIONS

A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A-486B.

B. Make splices, terminations, and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.

C. Wiring at Outlets: Install conductor at each outlet, with at least 6 12 inches of slack.

3.05 IDENTIFICATION

A. Identify each spare conductor at each end with identity number and location of other end of conductor, and identify as spare conductor.

3.06 FIRESTOPPING

A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly.

3.07 FIELD QUALITY CONTROL

A. Tests and Inspections:

1. After installing conductors and cables and before electrical circuitry has been energized, test service entrance and feeder conductors for compliance with requirements.
2. Perform each of the following visual and electrical tests:
    a. Inspect exposed sections of conductor and cable for physical damage and correct connection according to the single-line diagram.
    b. Test bolted connections for high resistance using one of the following:
        1). A low-resistance ohmmeter.
        2). Calibrated torque wrench.
        3). Thermographic survey.
    c. Inspect compression-applied connectors for correct cable match and indentation.
    d. Inspect for correct identification.
    e. Inspect cable jacket and condition.
    f. Insulation-resistance test on each conductor for ground and adjacent conductors. Apply a potential of 500 V(DC) for 300 V rated cable and 1000 V(DC) for 600 V rated cable for a 1-minute duration.
    g. Continuity test on each conductor and cable.
    h. Uniform resistance of parallel conductors.

B. Cables will be considered defective if they do not pass tests and inspections.

C. Prepare test and inspection reports to record the following:

1. Procedures used.
2. Results that comply with requirements.
3. Results that do not comply with requirements, and corrective action taken to achieve compliance with requirements.

END OF SECTION

26 05 23 CONTROL-VOLTAGE ELECTRICAL POWER CABLES

1.00 GENERAL

1.01 WORK INCLUDED

A. Furnish labor, materials, equipment, and incidentals necessary to install 600-volt wires and cables. Electrical Work shall be in accordance with Section 26 05 00 “Common Work Results for Electrical.”

B. Work shall include building wire, cable, wiring connections and terminations, and modular wiring systems.

1.02 SUMMARY

A. Section Includes:

1. Low-voltage control cabling.
2. Control-circuit conductors.
3. Paired Shielded Cable
4. Identification products.

1.03 DEFINITIONS

A. When used in this Section, the terms listed below will be defined as follows:

1. EMI: Electromagnetic interference.
2. Low-Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50 volts or for remote-control and signaling power-limited circuits.
3. Plenum: A space forming part of the air distribution system to which one or more air ducts are connected. An air duct is a passageway, other than a plenum, for transporting air to or from heating, ventilating, or air-conditioning equipment.

1.04 SUBMITTALS

A. Submittals shall be in accordance with Section 01 33 00 “Document Management” and shall include:

1. Shop Drawings: For each type of product.
2. Qualification Data: For testing agency, RCDD, layout technician, installation supervisor, and field inspector.
3. Source quality-control reports.
4. Field quality-control reports.

1.05 QUALITY ASSURANCE

A. Testing Agency Qualifications: Member company of NETA or nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7.

B. Testing Agency's Field Supervisor: Currently certified by BICSI as an RCDD to supervise on-site testing.

2.00 PRODUCTS

2.01 SYSTEM DESCRIPTION

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. Flame Travel and Smoke Density in Plenums: As determined by testing identical products according to NFPA 262, by a qualified testing agency. Identify products for installation in plenums with appropriate markings of applicable testing agency.

1. Flame Travel Distance: 60 inches or less.
2. Peak Optical Smoke Density: 0.5 or less.
3. Average Optical Smoke Density: 0.15 or less.

C. Flame Travel and Smoke Density for Riser Cables in Non-Plenum Building Spaces: As determined by testing identical products according to UL 1666.

D. Flame Travel and Smoke Density for Cables in Non-Riser Applications and Non-Plenum Building Spaces: As determined by testing identical products according to UL 1685.

E. RoHS compliant.

2.02 LOW-VOLTAGE CONTROL CABLE

A. Paired Cable: NFPA 70, Type CMG.

1. Individually and overall shielded one pair, twisted, No. 18 AWG, stranded {19x30} tinned-copper conductors with 0.021-inch extruded PVC; 0.004-inch nylon insulation twisted into pairs, stranded into a core and enclosed by a non-hygroscopic core tape, 100 percent coverage, helically wound, aluminum foil shield, and drain wire. Pairs shall be black/red or black/white numbered. Cables shall be 600 volts in accordance with NEC-725 and IEEE 383 and shall be suitable for wet location.
2. Shielded.
3. Extruded PVC jacket minimum 0.050.
4. Flame Resistance: Comply with UL 1685.

B. Plenum-Rated, Paired Cable: NFPA 70, Type CMP.

1. Individually and overall one, twisted, No. 18 AWG, stranded {19x30} tinned-copper conductors.
2. PVC insulation.
3. Shielded.
4. PVC jacket.
5. Flame Resistance: Comply with NFPA 262.

2.03 CONTROL-CIRCUIT CONDUCTORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. General Cable; General Cable Corporation.
2. Southwire Company.
3. Alpha.
4. Okonite.
5. Belden.
6. Houston Wire and Cable.

B. General:

1. Wires and cables shall be soft-drawn, annealed copper with a conductivity of not less than that of 98 percent pure copper, UL 83 and UL 1063 listed, rated 600 volts and certified for continuous operation at maximum conductor temperature of 90 degrees Celsius in dry locations and in wet locations.
2. Control, signal and instrumentation circuits and as specifically indicated on the Drawings the minimum conductor permitted is #12.

C. Single Conductor Cables: Conductor with thermoplastic insulation rated at 600 volts and insulated with type XHHW-2 insulation. Wire shall be water tank tested and approved as machine tool wire, in accordance with National Machine Tool Builders Association.

D. Class 1 Control Circuits: Stranded tinned copper, Type THHN/THWN-2, complying with UL 83 in raceway Type THW, complying with UL 83 in raceway Type XHHW-2, complying with UL 44 in raceway Type TC, complying with UL 1277 in raceway Type MC, complying with UL 1569.

E. Class 2 Control Circuits: Stranded tinned copper, Type THHN/THWN-2, complying with UL 83 in raceway Type XHHW-2, complying with UL 44 in raceway power-limited cable, concealed in building finishes power-limited tray cable, in cable tray.

F. Class 3 Remote-Control and Signal Circuits: Stranded tinned copper, Type THHN/THWN-2, complying with UL 83 in raceway Type XHHW-2, complying with UL 44 in raceway power-limited cable, concealed in building finishes power-limited tray cable, in cable tray Type TW or Type TF, complying with UL 83, in raceway.

2.04 PAIRED SHIELDED CABLE

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. General Cable; General Cable Corporation.
2. Okonite.
3. Belden.
4. Houston Wire and Cable.

B. General

1. Two (2) 18 AWG conductors.
2. Pairs shall each have individual shield and overall shield.
3. Each conductor insulated for 600V and entire cable rated for 90 Celsius in dry locations and 75 Celsius in wet locations.
    a. Primary Insulation: 15 mils nominal; PVC; 4 mils nylon.
    b. Number of Conductors: 2.
    c. Color Code: Black and white and red.
    d. Group Identification: Each pair numbered.
    e. Paired Shield: 100% coverage; .35 mil aluminum x .5 mil Mylar tape and 20-gauge 7 strand tin-plated copper drain wire; shield tape to be applied to give a total shield isolation from all other paired shields.
    f. Cable Shield: 100% coverage; 2.35 mil aluminum Mylar tape shield and an 18-gauge 7 strand tin-plated copper drain wire.
    g. Jacket: Black 90 Celsius FR PVC.

2.05 SOURCE QUALITY CONTROL

A. Testing Agency: Owner will engage Engage a qualified testing agency to evaluate cables.

B. Factory test twisted pair cables according to TIA-568-C.2.

C. Factory test optical-fiber cables according to TIA-568-C.3.

D. Cable will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.

3.00 EXECUTION

3.01 EXAMINATION

A. Test cables on receipt at the Site.

1. Test optical-fiber cable to determine the continuity of the strand end to end. Use optical-fiber flashlight optical loss test set optical-fiber flashlight or optical loss test set.
2. Test optical-fiber cable on reels. Use an optical time domain reflectometer to verify the cable length and locate cable defects, splices, and connector; include the loss value of each. Retain test data and include the record in maintenance data.
3. Test each pair of twisted pair cable for open and short circuits.

3.02 INSTALLATION OF RACEWAYS AND BOXES

A. Comply with requirements in Section 26 05 33 “Raceways and Boxes for Electrical Systems” for raceway selection and installation requirements for boxes, conduits, and wireways as supplemented or modified in this Section.

1. Outlet boxes shall be no smaller than 2 inches wide, 3 inches high, and 2-1/2 inches deep.
2. Outlet boxes for cables shall be no smaller than 4 inches square by 1-1/2 2-1/8 inches deep with extension ring sized to bring edge of ring to within 1/8 inch of the finished wall surface.
3. Flexible metal conduit shall not be used.

B. Comply with TIA-569-B for pull-box sizing and length of conduit and number of bends between pull points.

C. Install manufactured conduit sweeps and long-radius as required elsewhere in the Drawings and Specifications or as required to meet cable bend radius requirements.

D. Raceway Installation in Equipment Rooms:

1. Position conduit ends adjacent to a corner on backboard if a single piece of plywood is installed, or in the corner of the room if multiple sheets of plywood are installed around perimeter walls of the room.
2. Install cable trays to route cables if conduits cannot be located in these positions.
3. Secure conduits to backboard if entering the room from overhead.
4. Extend conduits 3 inches above finished floor.
5. Install metal conduits with grounding bushings and connect with grounding conductor to grounding system.

E. Backboards: Install backboards with 96-inch dimension vertical. Butt adjacent sheets tightly and form smooth gap-free corners and joints.

3.03 INSTALLATION OF CONDUCTORS AND CABLES

A. Comply with NECA 1 and NFPA 70.

B. General Requirements for Cabling:

1. Comply with TIA-568-C Series of standards.
2. Comply with BICSI ITSIMM, Ch. 5, “Copper Structured Cabling Systems” and Ch. 6, “Optical Fiber Structured Cabling Systems.”
3. Terminate all conductors and optical fibers; no cable shall contain unterminated elements. Make terminations only at indicated outlets, terminals, and cross-connect and patch panels.
4. Cables may not be spliced and shall be continuous from terminal to terminal. Do not splice cable between termination, tap, or junction points.
5. Cables serving a common system may be grouped in a common raceway. Install network cabling and control wiring and cable in separate raceway from power wiring. Do not group conductors from different systems or different voltages.
6. Secure and support cables at intervals not exceeding 30 inches and not more than 6 inches from cabinets, boxes, fittings, outlets, racks, frames, and terminals.

7. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI ITSIMM, Ch. 5, "Copper Structured Cabling Systems" and Ch. 6, "Optical Fiber Structured Cabling Systems." Install lacing bars and distribution spools.
8. Do not install bruised, kinked, scored, deformed, or abraded cable.
9. Remove and discard cable if damaged during installation and replace it with new cable.
10. Cold-Weather Installation: Bring cable to room temperature before de-reeling. Do not use heat lamps for heating.
11. Pulling Cable: Comply with BICSI ITSIMM, Ch. 5, "Copper Structured Cabling Systems" and Ch. 6, "Optical Fiber Structured Cabling Systems." Monitor cable pull tensions.
12. Support: Do not allow cables to lay on removable ceiling tiles.
13. Secure: Fasten securely in place with hardware specifically designed and installed so as to not damage cables.

C. Balanced Twisted Pair Cable Installation:
1. Comply with TIA-568-C.2.
2. Do not untwist balanced twisted pair cables more than 1/2 inch at the point of termination to maintain cable geometry.

D. Installation of Control-Circuit Conductors:
1. Install wiring in raceways.
2. Use insulated spade lugs for wire and cable connection to screw terminals.
3. Comply with requirements specified in Section 26 05 33 "Raceways and Boxes for Electrical Systems."

E. Optical-Fiber Cable Installation:
1. Comply with TIA-568-C.3.
2. Terminate cable on connecting hardware that is rack or cabinet mounted.

F. Open-Cable Installation:
1. Install cabling with horizontal and vertical cable guides in telecommunications spaces with terminating hardware and interconnection equipment.
2. Suspend copper cable not in a wireway or pathway a minimum of 8 inches above ceilings by cable supports not more than 30 inches apart.
3. Cable shall not be run through or on structural members or in contact with pipes, ducts, or other potentially damaging items. Do not run cables between structural members and corrugated panels.

G. Installation of Cable Routed Exposed under Raised Floors:
1. Install plenum-rated cable only.
2. Install cabling after the flooring system has been installed in raised floor areas.

3. Below each feed point, neatly coil a minimum of 72 inches of cable in a coil not less than 12 inches in diameter.

H. Separation from EMI Sources:

1. Comply with BICSI TDMM and TIA-569-B recommendations for separating unshielded copper voice and data communications cable from potential EMI sources including electrical power lines and equipment.

2. Separation between open communications cables or cables in nonmetallic raceways and unshielded power conductors and electrical equipment shall be as follows:

a. Electrical Equipment or Circuit Rating Less Than 2 kVA: A minimum of 5 inches.

b. Electrical Equipment or Circuit Rating Between 2 and 5 kVA: A minimum of 12 inches.

c. Electrical Equipment or Circuit Rating More Than 5 kVA: A minimum of 24 inches.

3. Separation between communications cables in grounded metallic raceways and unshielded power lines or electrical equipment shall be as follows:

a. Electrical Equipment or Circuit Rating Less Than 2 kVA: A minimum of 2-1/2 inches.

b. Electrical Equipment or Circuit Rating Between 2 and 5 kVA: A minimum of 6 inches.

c. Electrical Equipment or Circuit Rating More Than 5 kVA: A minimum of 12 inches.

4. Separation between communications cables in grounded metallic raceways and power lines and electrical equipment located in grounded metallic conduits or enclosures shall be as follows:

a. Electrical Equipment or Circuit Rating Less Than 2 kVA: No requirement.

b. Electrical Equipment or Circuit Rating Between 2 and 5 kVA: A minimum of 3 inches.

c. Electrical Equipment or Circuit Rating More Than 5 kVA: A minimum of 6 inches.

5. Separation between Communications Cables and Electrical Motors and Transformers, 5 kVA or 5 HP and Larger: A minimum of 48 inches.

6. Separation between Communications Cables and Fluorescent Fixtures: A minimum of 5 inches.

3.04 REMOVAL OF CONDUCTORS AND CABLES

A. Remove abandoned conductors and cables. Abandoned conductors and cables are those installed that are not terminated at equipment and are not identified for future use with a tag.

3.05 CONTROL-CIRCUIT CONDUCTORS

A. Minimum Conductor Sizes:

1. Class 1 remote-control and signal circuits; No. 14 AWG.

2. Class 2 low-energy, remote-control, and signal circuits; No. 16 AWG.

3. Class 3 low-energy, remote-control, alarm, and signal circuits; No. 12 AWG.

3.06 FIRESTOPPING

A. Comply with TIA-569-D, Annex A, “Firestopping.”

B. Comply with BICSI TDMM, “Firestopping” Chapter.

3.07 GROUNDING

A. For data communication wiring, comply with ANSI-J-STD-607-A and with BICSI TDMM, “Bonding and Grounding (Earthing)” Chapter.

B. For low-voltage control wiring and cabling, comply with requirements in Section 26 05 26 “Grounding and Bonding for Electrical Systems.”

3.08 IDENTIFICATION

A. Comply with requirements for identification specified in Section 26 05 53 “Identification for Electrical Systems.”

B. Identify data and communications system components, wiring, and cabling according to TIA-606-B; label printers shall use label stocks, laminating adhesives, and inks complying with UL 969.

C. Identify each wire on each end and at each terminal with a number-coded identification tag. Each wire shall have a unique tag.

3.09 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage Engage a qualified testing agency to perform tests and inspections.

B. Manufacturer’s Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

C. Perform the following tests and inspections with the assistance of a factory-authorized service representative:

1. Visually inspect cable jacket materials for UL or third-party certification markings. Inspect cabling terminations to confirm color-coding for pin assignments and inspect cabling connections to confirm compliance with TIA-568-C.1.

2. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components.

3. Test cabling for direct-current loop resistance, shorts, opens, intermittent faults, and polarity between conductors. Test operation of shorting bars in connection blocks. Test cables after termination but not after cross-connection.

a. Test instruments shall meet or exceed applicable requirements in TIA-568-C.2. Perform tests with a tester that complies with performance requirements in “Test Instruments (Normative)” Annex, complying with measurement accuracy specified in “Measurement Accuracy (Informative)” Annex. Use only test cords and adapters that are qualified by test equipment manufacturer for channel or link test configuration.

4. Optical-Fiber Cable Tests:

a. Test instruments shall meet or exceed applicable requirements in TIA-568-C.0. Use only test cords and adapters that are qualified by test equipment manufacturer for channel or link test configuration.

b. Link End-to-End Attenuation Tests:

1). Multimode Link Measurements: Test at 850 or 1300 nm in one direction according to TIA/EIA-526-14-A, Method B, One Reference Jumper.

2). Attenuation test results for links shall be less than 2.0 dB that calculated according to equation in TIA-568-C.0.

D. Document data for each measurement. Print data for submittals in a summary report that is formatted using Table 10.1 in BICSI TDMM as a guide or transfer the data from the instrument to the computer, save as text files, print, and submit.

E. End-to-end cabling will be considered defective if it does not pass tests and inspections.

F. Prepare test and inspection reports.

3.10 PREPARATION

A. Completely swab raceway system before installing conductors. Do not use cleaning agents and lubricants which have a deleterious effect on the conductors or their insulation.

3.11 INSTALLATION

A. General:

1. Conductors shall be continuous from terminal block to terminal block without splices.

2. Condulet type fittings shall not contain splices. No splicing of conductors shall be performed in any below ground structure.

3. If rejected, the cables shall be removed, discarded, replaced, reinstalled and re-terminated at the Contractor's expense.

4. Grouping conductors together into one conduit shall not be allowed where the Drawings indicate the conductors to be placed in separate conduits. Each home run shown on the Drawings shall be in its own conduit.

5. Properly support cables in accordance with the NEC and manufacturer's recommendations in all raceways. Provide strain relief as required.

6. The cable shall not be bent to a radius no smaller than the manufacturer cable's minimum bending radius.

7. All terminated conductors shall be labeled as specified prior to testing and final terminations being done. Any conductor that is de-terminated for any reason shall be re-tested. All associated controls, if tested before, shall be re-tested following final re-termination.

B. Paired Shielded and Triad Shielded Cable:

1. Ground paired shielded and triad shielded cables at the instrument panel or starter end only and insulate from ground elsewhere.

2. The shield shall be continuous for the entire run.

3. The paired shielded and triad shielded cable shall not be laced with or placed in the same conduit with power cables and control cables.
4. Each termination of paired shielded or triad shielded cable shall be coated with silicone jelly after termination.
5. The shield of pair shielded cable and triad shielded cable shall only be broken when the conductors are terminated on terminal strips.
6. Each conductor and shield shall be landed on its own terminal. Double terminations of any conductor or shield shall not be allowed.

C. Ground Conductors:

1. Conduits and other raceway shall contain an insulated equipment grounding conductor whether the raceway is metallic or not.
2. Conduits, cabinets, and other equipment shall be properly grounded in accordance with National Electrical Code requirements.
3. Where ground wire is exposed to mechanical damage, install wire in rigid aluminum conduit.
4. Bond each end of each of the conduit to the ground system. Make connections to equipment with solderless connections.

END OF SECTION

26 05 26 GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

1.00 GENERAL

1.01 WORK INCLUDED

A. Furnish labor, materials, equipment, and incidentals necessary to install a complete grounding system in strict accordance with Article 250 of the National Electrical Code (NEC) as shown on the Drawings or as specified herein. Electrical Work shall be in accordance with Section 26 05 00 “Common Work Results for Electrical.”

1.02 SUMMARY

A. Section includes grounding and bonding systems and equipment.

1. Underground distribution grounding.
2. Ground bonding common with lightning protection system.
3. Foundation steel electrodes.

1.03 SUBMITTALS

A. Submittal shall be in accordance with Section 01 33 00 “Submittal Procedures” and shall include:

1. Product Data: For each type of product indicated.
2. Test wells.
3. Ground rods.
4. Ground Conductors.
5. Connectors.
6. Grounding arrangements and connections for separately derived systems.
7. Qualification Data: For testing agency and testing agency’s field supervisor.
8. Field quality-control reports in accordance with Section 26 01 26 “Testing of Electrical Systems.”

1.04 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a member company of the InterNational Electrical Testing Association or is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.

B. Testing Agency’s Field Supervisor: Person currently certified by the InterNational Electrical Testing Association to supervise on-site testing specified in Part 3.

2.00 PRODUCTS

2.01 SYSTEM DESCRIPTION

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. Comply with UL 467 for grounding and bonding materials and equipment.

2.02 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Burndy; Brand of Hubbell Electrical Systems.
2. ERICO ; brand of nVent Electrical plc.
3. Harger Lightning & Grounding.
4. ILSCO.
5. O-Z/Gedney; a brand of Emerson Electric Company.
6. Thomas & Betts Corporation, A Member of the ABB Group.

2.03 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. Comply with UL 467 for grounding and bonding materials and equipment.

2.04 CONDUCTORS

A. Insulated Conductors: Tinned-copper Copper wire or cable insulated for 600 V unless otherwise required by applicable code or authorities having jurisdiction.

B. Bare Tin-Plated Copper Conductors:

1. Solid Conductors: ASTM B3.
2. Stranded Conductors: ASTM B8.
3. Tinned Conductors: ASTM B33.
4. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG conductor, 1/4 inch in diameter.
5. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
6. Bonding Jumper: Copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.
7. Tinned Bonding Jumper: Tinned-copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.

C. Grounding Bus: Predrilled rectangular bars of annealed copper, 1/4 inch by 4 inches in cross-section, with 9/32-inch holes spaced 1-1/8 inches apart. Stand-off insulators for mounting shall comply with UL 891 for use in switchboards, 600 V and shall be Lexan or PVC, impulse tested at 5000 V.

2.05 CONNECTORS

A. Listed and labeled by a NRTL acceptable to authorities having jurisdiction for applications in which used and for specific types, sizes, and combinations of conductors and other items connected.

B. Bolted Connectors for Conductors and Pipes: Copper or copper alloy, bolted pressure-type, with at least two bolts.

C. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.

D. Bus-Bar Connectors: Mechanical type, cast silicon bronze, solderless compression exothermic-type wire terminals, and long-barrel, two-bolt connection to ground bus bar.

E. Cable-to-Cable Connectors: Compression type, copper or copper alloy.

F. Cable Tray Ground Clamp: Mechanical type, zinc-plated malleable iron.

G. Conduit Hubs: Mechanical type, terminal with threaded hub.

H. Ground Rod Clamps: Mechanical type, copper or copper alloy, terminal with hex head bolt socket set screw.

I. Ground Rod Clamps: Mechanical type, copper or copper alloy, terminal with hex head bolt.

J. Lay-in Lug Connector: Mechanical type, aluminum copper rated for direct burial terminal with set screw.

K. Service Post Connectors: Mechanical type, bronze alloy terminal, in short- and long-stud lengths, capable of single and double conductor connections.

L. Signal Reference Grid Clamp: Mechanical type, stamped-steel terminal with hex head screw.

M. Straps: Solid copper, cast-bronze clamp copper lugs. Rated for 600 A.

N. Tower Ground Clamps: Mechanical type, copper or copper alloy, terminal one two-piece clamp.

O. U-Bolt Clamps: Mechanical type, copper or copper alloy, terminal listed for direct burial.

P. Water Pipe Clamps:

1. Mechanical type, two pieces with zinc-plated stainless-steel bolts.
    a. Material: Tin-plated aluminum Die-cast zinc alloy.
    b. Listed for direct burial.

Q. U-bolt type with malleable-iron clamp and copper ground connector copper ground connector rated for direct burial.

2.06 GROUNDING ELECTRODES

A. Ground Rods: Copper-clad Zinc-coated 316 Stainless steel , sectional type; 3/4 inch by 10 feet 5/8 inch by 96 inches.

B. Chemical-Enhanced Grounding Electrodes: Copper tube, straight or L-shaped, charged with nonhazardous electrolytic chemical salts.

1. Termination: Factory-attached No. 4/0 AWG bare conductor at least 48 inches long.
2. Backfill Material: Electrode manufacturer's recommended material.

C. Ground Plate Electrodes: 1/4-inch thick, 2-foot-wide by 2-foot-long serrated copper plate with #4/0 bare tinned copper conductor terminated ten (10) foot welded pigtail connection, ALT Fabrication Item #3280-40 or equal.

2.07 MISCELLANEOUS

A. Conduit Ground Fittings: Fittings for bonding ground cable to the conduit shall be Thomas & Betts No. 3951 series.

B. Ground Rod Boxes: Precast Box with cast iron lid. Lid shall read "ground rod". H-10 rated boxes shall be Brooks Precast Model "3-RT" or approved equal. Ground rod boxes located in driveway areas shall have an AASHO HS-20 rating by ALT Fabrication Item #3114 or approved equal.

C. Exothermic Welding Process: CADWELD MATERIALS – as manufactured by ERICO products or approved equal.

3.00 EXECUTION

3.01 PROCESSES

A. All grounding system connections to building steel and ground rods shall be exothermically welded including all cable connections, and cable steel terminations. The use of mechanical type connections is not acceptable.

B. Any concealed connection (buried, encased in concrete, or otherwise sealed) shall be done only with exothermic welds.

C. All materials involved must be from the same sources to insure compatibility. Connections made from this process shall meet the requirements of IEEE Standards 80 and 837 and as listed in MIL 419 and other standards, National Electrical Code, etc.

3.02 GROUNDING SYSTEM

A. Provide a complete grounding system that includes all connections and the testing of ground rods, ground cables, ground buses, conduits, fittings, anchor supports, thermite process materials and equipment and other materials required for a complete installation. Grounding system shall be installed and sized in accordance with the National Electrical Code.

3.03 APPLICATIONS

A. Conductors: Install solid conductor for No. 8 AWG and smaller, and stranded conductors for No. 6 AWG and larger unless otherwise indicated.

B. Underground Grounding Conductors: Install bare tin-plated copper conductor, No. 2/0 AWG minimum.

1. Bury at least 30 inches below grade.

2. Duct-Bank Grounding Conductor: Place conductor on top of duct bank prior to back filling above duct bank when indicated as part of duct-bank installation.

C. Isolated Grounding Conductors: Green-colored insulation with continuous yellow stripe. On feeders with isolated ground, identify grounding conductor where visible to normal inspection, with alternating bands of green and yellow tape, with at least three bands of green and two bands of yellow.

D. Grounding Bus: Install in electrical equipment rooms, in rooms housing service equipment, and elsewhere as indicated.

1. Install bus horizontally, on insulated spacers 2 inches minimum from wall, 6 inches above finished floor unless otherwise indicated.

2. Where indicated on both sides of doorways, route bus up to top of door frame, across top of doorway, and down; connect to horizontal bus.

E. Conductor Terminations and Connections:

1. Pipe and Equipment Grounding Conductor Terminations: Bolted/clamp type connectors.

2. Underground Connections: Welded connectors except at test wells and as otherwise indicated. Exothermically welded connectors.

3. Connections to Ground Rods at Test Wells: Exothermically welded connectors. Bolted connectors.

4. Connections to Structural Steel: Exothermically welded connectors.

5. Connections to Equipment: NEMA ground pads and insulated jumpers.

6. Connections to Ground Pad: Exothermic.

7. The use of “pig tails” for connections to ground loops or equipment shall not be allowed. Welded connectors.

3.04 GROUNDING AT THE SERVICE

A. Equipment grounding conductors and grounding electrode conductors shall be connected to the ground bus. Install a main bonding jumper between the neutral and ground buses.

3.05 GROUNDING SEPARATELY DERIVED SYSTEMS

A. Generator: Install grounding electrode(s) at the generator location. The electrode shall be connected to the equipment grounding conductor and to the frame of the generator.

3.06 GROUNDING UNDERGROUND DISTRIBUTION SYSTEM COMPONENTS

A. Comply with IEEE C2 and NFPA 70 grounding requirements.

B. Grounding Manholes and Handholes: Install a driven ground rod through manhole or handhole floor, close to wall, and set rod depth so 4 inches will extend above finished floor. If necessary, install ground rod before manhole is placed and provide No. 4/0 AWG bare, tinned-copper conductor from ground rod into manhole through a waterproof sleeve in manhole wall. Protect ground rods passing through concrete floor with a double wrapping

of pressure-sensitive insulating tape or heat-shrunk insulating sleeve from 2 inches above to 6 inches below concrete. Seal floor opening with waterproof, non-shrink grout.

C. Grounding Connections to Manhole Components: Bond exposed-metal parts such as inserts, cable racks, pulling irons, ladders, and cable shields within each manhole or handhole, to ground rod or grounding conductor. Make connections with No. 4 AWG minimum, stranded, hard-drawn copper bonding conductor. Train conductors' level or plumb around corners and fasten to manhole walls. Connect to cable armor and cable shields according to written instructions by manufacturer of splicing and termination kits.

D. Pad-Mounted Transformers and Switches: Install two ground rods and ground ring around the pad. Ground pad-mounted equipment and noncurrent-carrying metal items associated with substations by connecting them to underground cable and grounding electrodes. Install tinned-copper conductor not less than No. 2 AWG for ground ring and for taps to equipment grounding terminals. Bury ground ring not less than 6 inches from the foundation.

3.07 EQUIPMENT GROUNDING

A. Install insulated equipment grounding conductors with all feeders and branch circuits.

B. Install insulated equipment grounding conductors with the following items, in addition to those required by NFPA 70:

1. Feeders and branch circuits.
2. Lighting circuits.
3. Receptacle circuits.
4. Single-phase motor and appliance branch circuits.
5. Three-phase motor and appliance branch circuits.
6. Flexible raceway runs.
7. Armored and metal-clad cable runs.
8. Busway Supply Circuits: Install insulated equipment grounding conductor from grounding bus in the switchgear, switchboard, or distribution panel to equipment grounding bar terminal on busway.
9. Computer and Rack-Mounted Electronic Equipment Circuits: Install insulated equipment grounding conductor in branch-circuit runs from equipment-area power panels and power-distribution units X-Ray Equipment Circuits: Install insulated equipment grounding conductor in circuits supplying x-ray equipment.

C. Air-Duct Equipment Circuits: Install insulated equipment grounding conductor to duct-mounted electrical devices operating at 120 V and more, including air cleaners, heaters, dampers, humidifiers, and other duct electrical equipment. Bond conductor to each unit and to air duct and connected metallic piping.

D. Water Heater, Heat-Tracing, and Antifrost Heating Cables: Install a separate insulated equipment grounding conductor to each electric water heater and heat-tracing cable. Bond conductor to heater units, piping, connected equipment, and components.

E. Isolated Grounding Receptacle Circuits: Install an insulated equipment grounding conductor connected to the receptacle grounding terminal. Isolate conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service unless otherwise indicated.

F. Isolated Equipment Enclosure Circuits: For designated equipment supplied by a branch circuit or feeder, isolate equipment enclosure from supply circuit raceway with a nonmetallic raceway fitting listed for the purpose. Install fitting where raceway enters enclosure and install a separate insulated equipment grounding conductor. Isolate conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service unless otherwise indicated.

G. Signal and Communication Equipment: For telephone, alarm, voice and data, and other communication equipment, provide No. 4 AWG minimum insulated grounding conductor in raceway from grounding electrode system to each service location, terminal cabinet, wiring closet, and central equipment location.

1. Service and Central Equipment Locations and Wiring Closets: Terminate grounding conductor on a 1/4-inch by 2-inch by 12-inch grounding bus.

H. Terminal Cabinets: Terminate grounding conductor on cabinet grounding terminal.

I. Poles Supporting Outdoor Lighting Fixtures: Install grounding electrode and a separate insulated equipment grounding conductor in addition to grounding conductor installed with branch-circuit conductors.

J. Metallic Fences: Comply with requirements of IEEE C2.

1. Grounding Conductor: Bare, tin-plated copper, not less than No. 8 AWG.

2. Gates: Shall be bonded to the grounding conductor with a flexible bonding jumper.

3. Barbed Wire: Strands shall be bonded to the grounding conductor.

3.08 INSTALLATION

A. Grounding Conductors: Route along shortest and straightest paths possible unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.

B. Ground Bonding Common with Lightning Protection System: Comply with NFPA 780 and UL 96 when interconnecting with lightning protection system. Bond electrical power system ground directly to lightning protection system grounding conductor at closest point to electrical service grounding electrode. Use bonding conductor sized same as system grounding electrode conductor and install in conduit.

C. Ground Rods: Drive rods until tops are 6 inches below finished floor or final grade unless otherwise indicated.

1. Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating if any.

2. For grounding electrode system, install at least three rods spaced at least two-rod lengths from each other and located at least the same distance from other grounding electrodes, and connect to the service grounding electrode conductor.

D. Test Wells: Ground rod driven through open bottom of Ground Rod Test Well. Ground Rod Box shall be at least 6 inches deep, with cover.

1. Test Wells: Install at least one test well for each service unless otherwise indicated. Install at the ground rod electrically closest to service entrance. Set top of test well flush with finished grade or floor.

E. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance except were routed through short lengths of conduit.

1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.

2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install bonding so vibration is not transmitted to rigidly mounted equipment.

3. Use exothermic-welded connectors for outdoor locations; if a disconnect-type connection is required, use a bolted clamp.

F. Grounding and Bonding for Piping:

1. Metal Water Service Pipe: Install insulated tin-plated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes; use a bolted clamp connector or bolt a lug-type connector to a pipe flange by using one of the lug bolts of the flange. Where a dielectric main water fitting is installed, connect grounding conductor on street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.

2. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with a bolted connector.

3. Bond each aboveground portion of gas piping system downstream from equipment shutoff valve.

G. Bonding Interior Metal Ducts: Bond metal air ducts to equipment grounding conductors of associated fans, blowers, electric heaters, and air cleaners. Install tinned bonding jumper to bond across flexible duct connections to achieve continuity.

H. Ground Ring: Install a grounding conductor, electrically connected to each building structure ground rod and to each steel column indicated item, extending around the perimeter of building area or item indicated.

1. Install tinned-copper conductor not less than No. 2/0 AWG for ground ring and for taps to building steel.

2. Bury ground ring not less than 24 inches from building's foundation.

I. Concrete-Encased Grounding Electrode (Ufer Ground): Fabricate according to NFPA 70; use a minimum of 20 feet of bare copper conductor not smaller than No. 4 AWG.

1. If concrete foundation is less than 20 feet long, coil excess conductor within base of foundation.

2. Bond grounding conductor to reinforcing steel in at least four locations and to anchor bolts. Extend grounding conductor below grade and connect to building's grounding grid or to grounding electrode external to concrete.

J. Concrete-Encased Grounding Electrode (Ufer Ground): Fabricate according to NFPA 70; using electrically conductive coated steel reinforcing bars or rods, at least 20 feet long. If reinforcing is in multiple pieces, connect by the usual steel tie wires or exothermic welding to create the required length.

1. Bond grounding conductor to reinforcing steel in at least four locations and to anchor bolts. Extend grounding conductor below grade and connect to building's grounding grid or to grounding electrode external to concrete.

K. Ground electrical Work in accordance with the National Electrical Code Article 250 and local codes.

L. Install ground cables continuously between connections. Splices shall not be permitted, except were indicated on the Drawings. Where ground cables pass through floor slabs. buildings, etc., and when not in metallic enclosures, provide a sleeve of approved, non-metallic materials.

M. Install a green-colored, equipment grounding conductor in raceways. Size conductors in accordance with NEC Article 250.

N. Where ground wire is directly buried in earth or concrete, use standard bare tinned- copper cable, in all other cases install a green-colored insulation, equipment grounding conductor in accordance with Section 26 05 19 "Low Voltage Electrical Power Conductors and Cables." Size conductors in accordance with NEC Article 250. Provide grounding conductors as required per the NEC.

O. Metal conduits stubbed up into switchgear, motor control center or other electrical equipment shall be terminated with insulated grounding bushings and connected to the equipment ground bus. Size the grounding wire in accordance with applicable sections of the National Electrical Code.

P. Grounding extensions to an existing stubbed-up grounding conductor shall be exothermic weld connections.

Q. Liquid tight flexible metal conduit in sizes 1-1/2 inches or larger shall have bonding jumpers. Bonding jumpers shall be external, run in parallel (not spiraled) and fastened with plastic tie wraps. Contractor shall provide bonding jumpers sized in accordance with the National Electrical Code.

R. All equipment enclosures, motor and transformer frames, conduit systems, cable armor, exposed structural steel and all other equipment and materials required by the NEC to be grounded, shall be grounded, and bonded in accordance with the NEC. Provide grounding and bonding jumpers as required per the NEC.

S. Ground transformer neutrals to the nearest available grounding electrode with a conductor sized in accordance with NEC Article 250.

T. Run a grounding cable the full length of each cable tray section and bond to each cable tray section. Provide #4/0 bare copper in cable tray.

U. Where exothermic bonding is used, molds shall be of the appropriate size for the wire and rod used. All bonds shall remain exposed for inspection of the Owner's representative.

V. At each convenience outlet, install a grounding clip attached to the outlet box and leave a sufficient length of #12 wire with green-colored insulation to connect to the grounding terminal at the receptacle.

W. A ground pad shall be installed in concrete foundations for connections to equipment and the grounding system. Flat plate all copper alloy Erico CADWELD B164-2Q or approved equal. Connections between the ground pad and ground cables shall be an exothermic weld.

1. Transformer Pads: Provide a ground pad in the concrete pad. Provide a #4/0 bare copper to the grounding system. Provide two-hole spade terminals connected to a #4/0 bare copper conductor at each end and connect to the transformer enclosure and to the ground pad.

2. Motor Grounding: Provide a ground pad in the concrete slab. Provide a #4/0 bare copper to the grounding system. Provide two-hole spade terminals connected to a #4/0 bare copper conductor at each end and connect to the motor enclosure and to the ground pad and to the pump frame.

3. The use of "pig tails" for connections to ground loops or equipment shall not be allowed.

X. Provide a minimum of two ground connections to all medium voltage equipment including VFD's and transformer frames.

3.09 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections. Testing shall be in accordance with Section 26 01 26 "Testing of Electrical Systems" and the latest version of NETA Acceptance Testing Specification.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

C. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

D. Tests and Inspections:

1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.

2. Inspect the grounding and bonding system conductors and connections for tightness and proper installation.

3. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions.

4. Use Biddle Direct Reading Earth Resistance Tester or equivalent to measure resistance to ground of the system. Perform testing in accordance with the test instrument manufacturer's recommendation using the fall of potential method.
5. All test equipment provided under this section shall be approved by the Engineer.
6. Resistance to ground testing shall be performed during dry season when the ground is dry. Submit test results in the form of a graph showing the number of points measured (12 minimum) and the numerical resistance to ground. The Contractor shall test the grounding system at each ground rod shown on the Drawings.
7. Testing shall be performed before energizing the distribution system.
8. A separate test shall be conducted for each building or system.
9. Notify the Engineer immediately if the resistance to ground for any building or system is greater than 5 ohms. Provide additional ground rods and conductors as required to bring the resistance to 5 ohms.
10. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal, at ground test wells, and at individual ground rods. Make tests at ground rods before any conductors are connected.
    a. Measure ground resistance no fewer than 2 full days after last trace of precipitation and without soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance.
    b. Perform tests by fall-of-potential method according to IEEE 81.
11. Prepare dimensioned drawings locating each test well, ground rod and ground-rod assembly, and other grounding electrodes. Identify each by letter in alphabetical order, and key to the record of tests and observations. Include the number of rods driven and their depth at each location and include observations of weather and other phenomena that may affect test results. Describe measures taken to improve test results.

E. Grounding system will be considered defective if it does not pass tests and inspections.

F. Prepare test and inspection reports.

G. Report measured ground resistances that exceed the following values:
1. Power and Lighting Equipment or System with Capacity of 500 kVA and Less: 10 ohms.
2. Power and Lighting Equipment or System with Capacity of 500 to 1000 kVA: 5 ohms.
3. Power and Lighting Equipment or System with Capacity More Than 1000 kVA: 3 ohms.
4. Power Distribution Units or Panelboards Serving Electronic Equipment: 1 3 ohm(s).
5. Substations and Pad-Mounted Equipment: 5 ohms.
6. Manhole Grounds: 10 ohms.

H. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Owner/Engineer promptly and include recommendations to reduce ground resistance.

END OF SECTION

26 05 53 IDENTIFICATION FOR ELECTRICAL SYSTEMS

1.00 GENERAL

1.01 SUMMARY

A. Section Includes:

1. Labels.
2. Bands and tubes.
3. Tapes and stencils.
4. Tags.
5. Signs.
6. Cable ties.
7. Miscellaneous identification products.

1.02 SUBMITTALS

A. Record Data:

1. Labels.
2. Bands and tubes.
3. Tapes and stencils.
4. Tags.
5. Signs.
6. Cable ties.
7. Miscellaneous identification products.

2.00 PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Comply with ASME A13.1.

B. Comply with 29 CFR 1910.144 for color identification of hazards; 29 CFR 1910.145 for danger, caution, warning, and safety instruction signs and tags; and the following:

1. Fire-protection and fire-alarm equipment, including raceways, must be finished, painted, or suitably marked safety red.
2. Ceiling-mounted hangers, supports, cable trays, and raceways must be finished, painted, or suitably marked safety yellow where less than 7.7 feet above finished floor.

C. Signs, labels, and tags required for personnel safety must comply with the following standards:

1. Safety Colors: NEMA Z535.1.

2. Facility Safety Signs: NEMA Z535.2.
3. Safety Symbols: NEMA Z535.3.
4. Product Safety Signs and Labels: NEMA Z535.4.
5. Safety Tags and Barricade Tapes for Temporary Hazards: NEMA Z535.5.

D. Comply with NFPA 70E "Arc-Flash Hazard Analysis" requirements for arc-flash warning labels.

E. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, must comply with UL 969.

F. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.

1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

2.02 COLOR AND LEGEND REQUIREMENTS

A. Color-Coding for Phase- and Voltage-Level Identification, 1000 V or Less: Use colors listed below for ungrounded service feeder and branch-circuit conductors. Contractor must verify with the Authority Having Jurisdiction.

1. Color must be factory applied or field applied for sizes larger than 8 AWG if authorities having jurisdiction permit.
2. Colors for 208Y/120 V Circuits:
    a. Phase A: Black.
    b. Phase B: Red.
    c. Phase C: Blue.
3. Colors for 240 V Circuits:
    a. Phase A: Black.
    b. Phase B: Red.
4. Colors for 480Y/277 V Circuits:
    a. Phase A: Brown.
    b. Phase B: Orange.
    c. Phase C: Yellow.
5. Color for Neutral: White or gray.
6. Color for Equipment Grounds: Bare copper Green Green with yellow stripe.
7. Colors for Isolated Grounds: Green with two or more yellow stripes.

2.03 LABELS

A. Vinyl Wraparound Labels: Preprinted, flexible labels laminated with clear, weather- and chemical-resistant coating and matching wraparound clear adhesive tape for securing label ends.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    a. Brady Corporation.
    b. Champion America.
    c. Grafoplast Wire Markers.
    d. HellermannTyton.
    e. LEM Products Inc.
    f. Marking Services Inc.
    g. Panduit Corp.
    h. Seton Identification Products; a Brady Corporation company.
    i. emedco.

B. Self-Adhesive Wraparound Labels: Preprinted, 3 mils thick, polyester vinyl flexible label with acrylic pressure-sensitive adhesive.
    1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
        a. A'n D Cable Products.
        b. Brady Corporation.
        c. Brother International Corporation.
        d. Grafoplast Wire Markers.
        e. Ideal Industries, Inc.
        f. LEM Products Inc.
        g. Marking Services Inc.
        h. Panduit Corp.
        i. Seton Identification Products; a Brady Corporation company.
        j. emedco.
    2. Self-Lamination: Clear; UV-, weather- and chemical-resistant; self-laminating, protective shield over legend. Labels sized such that clear shield overlaps entire printed legend.
    3. Marker for Labels:
        a. Permanent, waterproof, black ink marker recommended by tag manufacturer.
        b. Machine-printed, permanent, waterproof, black ink recommended by printer manufacturer.

C. Self-Adhesive Labels: Polyester Vinyl, thermal, transfer-printed, 3 mils thick, multicolor, weather- and UV-resistant, pressure-sensitive adhesive labels, configured for intended use and location.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    a. A'n D Cable Products.
    b. Brady Corporation.
    c. Brother International Corporation.
    d. Grafoplast Wire Markers.
    e. HellermannTyton.
    f. Ideal Industries, Inc.
    g. LEM Products Inc.
    h. Marking Services Inc.
    i. Panduit Corp.
    j. Seton Identification Products; a Brady Corporation company.
    k. emedco.
2. Minimum Nominal Size:
    a. 1-1/2 inches by 6 inches for raceway and conductors.
    b. 3-1/2 inches by 5 inches for equipment.
    c. As required by authorities having jurisdiction.

2.04 BANDS AND TUBES

A. Heat-Shrink Preprinted Tubes: Flame-retardant polyolefin tubes with machine-printed identification labels, sized to suit diameter and shrunk to fit firmly. Full shrink recovery occurs at maximum of 200 deg F. Comply with UL 224.
    1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
        a. Brady Corporation.
        b. Panduit Corp.

2.05 TAPES AND STENCILS

A. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.
    1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
        a. Brady Corporation.
        b. Carlton Industries, LP.
        c. Champion America.
        d. HellermannTyton.

e. Ideal Industries, Inc.

f. Marking Services Inc.

g. Panduit Corp.

B. Self-Adhesive Vinyl Tape: Colored, heavy duty, waterproof, fade resistant; not less than 3 mils thick by 1 to 2 inches wide; compounded for outdoor use.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Brady Corporation.

b. Carlton Industries, LP.

c. Marking Services Inc.

d. emedco.

C. Tape and Stencil: 4-inch wide black stripes on 10-inch centers placed diagonally over orange background and are 12-inch wide. Stop stripes at legends.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. HellermannTyton.

b. LEM Products Inc.

c. Marking Services Inc.

d. Pipemarker.com; Brimar Industries, Inc.

e. Seton Identification Products; a Brady Corporation company.

D. Floor Marking Tape: 2-inch wide, 5-mil pressure-sensitive vinyl tape, with black and white yellow and black stripes and clear vinyl overlay.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Brady Corporation.

b. Carlton Industries, LP.

c. Seton Identification Products; a Brady Corporation company.

E. Underground-Line Warning Tape:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Brady Corporation.

b. Ideal Industries, Inc.

c. LEM Products Inc.

d. Marking Services Inc.

e. Pipemarker.com; Brimar Industries, Inc.

f. Reef Industries, Inc.

g. Seton Identification Products; a Brady Corporation company.

2. Tape:

a. Recommended by manufacturer for method of installation and suitable to identify and locate underground electrical and communications utility lines.

b. Printing on tape must be permanent and may not be damaged by burial operations.

c. Tape material and ink must be chemically inert and not be subject to degradation when exposed to acids, alkalis, and other destructive substances commonly found in soils.

3. Color and Printing:

a. Comply with APWA Uniform Color Code using NEMA Z535.1 safety colors.

b. Inscriptions for Red Tapes: "CAUTION BURIED ELECTRIC LINE BELOW".

4. Nonconductive Tape:

a. Multilayer laminate, consisting of high-density polyethylene scrim coated with pigmented polyolefin; bright colored, continuous-printed on one side with inscription of utility, compounded for direct-burial service.

b. Width: 3 inches.

c. Thickness: 12 mils.

d. Weight: 36.1 lb./1000 sq. ft.

e. Tensile in accordance with ASTM D882: 400 lbf and 11,500 psi.

5. Detectable Conductive Tape:

a. Reinforced, detectable three-layer laminate, consisting of printed pigmented woven scrim, solid aluminum-foil core, and clear protective film that allows inspection of continuity of conductive core; bright-colored, continuous-printed on one side with inscription of utility, compounded for direct-burial service.

b. Width: 3 inches.

c. Overall Thickness: 8 mils.

d. Foil Core Thickness: 0.35 mils.

e. Weight: 34 lb./1000 sq. ft.

f. Tensile in accordance with ASTM D882: 300 lbf and 12,500 psi.

F. Stenciled Legend: In nonfading, waterproof, black ink or paint. Minimum letter height must be 1 inch.

2.06 TAGS

A. Metal Tags: Brass or aluminum, 2 inches by 2 inches by 0.05 inches, with stamped legend, punched for use with self-locking cable tie fastener.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    a. Brady Corporation.
    b. Carlton Industries, LP.
    c. Marking Services Inc.
    d. Seton Identification Products; a Brady Corporation company.
    e. emedco.

B. Nonmetallic Preprinted Tags: Polyethylene tags, 0.015 0.023 inches thick, color-coded for phase and voltage level, with factory screened printed permanent designations; punched for use with self-locking cable tie fastener.
    1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
        a. Brady Corporation.
        b. Carlton Industries, LP.
        c. Grafoplast Wire Markers.
        d. LEM Products Inc.
        e. Marking Services Inc.
        f. Panduit Corp.
        g. Seton Identification Products; a Brady Corporation company.
        h. emedco.

2.07 SIGNS

A. Baked-Enamel Signs:
    1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
        a. Brady Corporation.
        b. Carlton Industries, LP.
        c. Champion America.
        d. Marking Services Inc.
        e. emedco.
    2. Preprinted aluminum signs, high-intensity reflective, punched or drilled for fasteners, with colors, legend, and size required for application.
    3. 1/4-inch grommets in corners for mounting.
    4. Nominal Size: 7 inches by 10 inches.

B. Metal-Backed Butyrate Signs:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    a. Brady Corporation.
    b. Champion America.
    c. Marking Services Inc.
    d. emedco.
2. Weather-resistant, nonfading, preprinted, cellulose-acetate butyrate signs, with 0.0396-inch galvanized-steel backing, punched and drilled for fasteners, and with colors, legend, and size required for application.
3. 1/4-inch grommets in corners for mounting.
4. Nominal Size: 10 inches by 14 inches.

C. Laminated Acrylic or Melamine Plastic Signs:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    a. Brady Corporation.
    b. Carlton Industries, LP.
    c. Marking Services Inc.
    d. Seton Identification Products; a Brady Corporation company.
    e. emedco.
2. Engraved legend.
3. Thickness:
    a. For signs up to 20 sq. inches, minimum 1/16 inch thick.
    b. For signs larger than 20 sq. inches, 1/8 inch thick.
    c. Engraved legend with black letters on white face white letters on dark gray background.
    d. Punched or drilled for mechanical fasteners with 1/4-inch grommets in corners for mounting Self-adhesive.
    e. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.

2.08 CABLE TIES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. HellermannTyton.
2. Ideal Industries, Inc.

3. Marking Services Inc.
4. Panduit Corp.

B. General-Purpose Cable Ties: Fungus inert, self-extinguishing, one piece, self-locking, and Type 6/6 nylon.
1. Minimum Width: 3/16 inch.
2. Tensile Strength at 73 deg F in accordance with ASTM D638: 12,000 psi.
3. Temperature Range: Minus 40 to plus 185 deg F.
4. Color: Black, except where used for color-coding.

C. UV-Stabilized Cable Ties: Fungus inert, designed for continuous exposure to exterior sunlight, self-extinguishing, one piece, self-locking, and Type 6/6 nylon.
1. Minimum Width: 3/16 inch.
2. Tensile Strength at 73 deg F in accordance with ASTM D638: 12,000 psi.
3. Temperature Range: Minus 40 to plus 185 deg F.
4. Color: Black.

D. Plenum-Rated Cable Ties: Self-extinguishing, UV stabilized, one piece, and self-locking.
1. Minimum Width: 3/16 inch.
2. Tensile Strength at 73 deg F in accordance with ASTM D638: 7000 psi.
3. UL 94 Flame Rating: 94V-0.
4. Temperature Range: Minus 50 to plus 284 deg F.
5. Color: Black.

2.09 MISCELLANEOUS IDENTIFICATION PRODUCTS

A. Paint: Comply with requirements in painting Sections for paint materials and application requirements. Retain paint system applicable for surface material and location (exterior or interior).

B. Fasteners for Labels and Signs: Self-tapping, stainless steel screws or stainless steel machine screws with nuts and flat and lock washers.

3.00 EXECUTION

3.01 PREPARATION

A. Self-Adhesive Identification Products: Before applying electrical identification products, clean substrates of substances that could impair bond, using materials and methods recommended by manufacturer of identification product.

3.02 INSTALLATION

A. All switchboards, switchgear, and panelboards supplied by a feeder(s) shall be permanently marked in accordance with the following;

1. With the identification and physical location of where the power originates.
2. With a label that is permanently affixed and of sufficient durability to withstand the environment involved.

B. Handwritten labels are not acceptable for any final condition identification.

C. Verify and coordinate identification names, abbreviations, colors, and other features with requirements in other Sections requiring identification applications, Drawings, Shop Drawings, manufacturer's wiring diagrams, and operation and maintenance manual. Use consistent designations throughout Project.

D. Install identifying devices before installing acoustical ceilings and similar concealment.

E. Verify identity of item before installing identification products.

F. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and operation and maintenance manual.

G. Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment. Install access doors or panels to provide view of identifying devices.

H. Apply identification devices to surfaces that require a finish after completing finish work.

I. Install signs with approved legend to facilitate proper identification, operation, and maintenance of electrical systems and connected items.

J. Painted Identification: Comply with requirements in painting Sections for surface preparation and paint application.

K. Aluminum Wraparound Marker Labels and Metal Tags: Secure tight to surface of conductor or cable at a location with high visibility and accessibility.

L. During backfilling of trenches, install continuous underground-line warning tape directly above cable or raceway at 6 to 8 inches below finished grade. Use multiple tapes where width of multiple lines installed in a common trench exceeds 16 inches overall.

M. Cables Carrying Circuits at 1000 V or Less: A conduit identification plate shall be installed on all power, control and instrumentation conduits at the end of each run and at the conduit ends inside intermediate junction and pull boxes, manholes, handholes, etc. Conduit plates shall be installed before conductors are pulled into the conduits. The exact identification plate location shall be coordinated with the Owner/Engineer at the time on installation. The conduit identification tags shall identify the cable numbers as shown on the Drawings and the "to" and "from" information. Provide an example to Owner/Engineer as a formal submittal for approval prior to the installation. Attach conduit identification plate with stainless steel tie wraps or stainless-steel wire.

N. System Identification for Raceways and Cables over 1000 V: Identification must completely encircle cable or conduit. Place adjacent identification of two-color markings in contact, side by side. Secure tight to surface of conductor, cable, or raceway.

O. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, and signal connections.

P. Emergency Operating Instruction Signs: Install instruction signs with white legend on red background with minimum 3/8-inch high letters for emergency instructions at equipment used for power transfer load shedding.

Q. Elevated Components: Increase sizes of labels, signs, and letters to those appropriate for viewing from floor.

R. Accessible Fittings for Raceways: Identify cover of junction and pull box of the following systems with wiring system legend and system voltage. System legends must be as follows:

1. "EMERGENCY POWER."
2. "POWER."
3. "UPS."

S. Vinyl Wraparound Labels:

1. Secure tight to surface of raceway or cable at location with high visibility and accessibility.
2. Attach labels that are not self-adhesive type with clear vinyl tape, with adhesive appropriate to location and substrate.

T. Snap-Around Labels: Secure tight to surface at location with high visibility and accessibility.

U. Self-Adhesive Wraparound Labels: Secure tight to surface at location with high visibility and accessibility.

V. Self-Adhesive Labels:

1. Install unique designation label that is consistent with wiring diagrams, schedules, and operation and maintenance manual.
2. Unless otherwise indicated, provide single line of text with 1/2-inch high letters on 1-1/2-inch high label; where two lines of text are required, use labels 2 inches high.

W. Snap-Around Color-Coding Bands: Secure tight to surface at location with high visibility and accessibility.

X. Heat-Shrink, Preprinted Tubes: Secure tight to surface at location with high visibility and accessibility.

Y. Marker Tapes: Secure tight to surface at location with high visibility and accessibility.

Z. Self-Adhesive Vinyl Tape: Secure tight to surface at location with high visibility and accessibility.

1. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for minimum distance of 6 inches where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding.

AA. Floor Marking Tape: Apply stripes to finished surfaces following manufacturer's instructions.

BB. Underground Line Warning Tape:

1. During backfilling of trenches, install continuous underground-line warning tape directly above cable or raceway at 6 to 8 inches below finished grade. Use multiple tapes where

width of multiple lines installed in common trench or concrete envelope exceeds 16 inches overall. Install underground-line warning tape for direct-buried cables and cables in raceways.

CC. Metal Tags:

1. Place in location with high visibility and accessibility.
2. Secure using general-purpose plenum-rated cable ties.

DD. Nonmetallic Preprinted Tags:

1. Place in location with high visibility and accessibility.
2. Secure using general-purpose plenum-rated cable ties.

EE. Baked-Enamel Signs:

1. Attach signs that are not self-adhesive type with mechanical fasteners appropriate to location and substrate.
2. Unless otherwise indicated, provide single line of text with 1/2-inch high letters on minimum 1-1/2-inch high sign; where two lines of text are required, use signs minimum 2 inches high.

FF. Cable Ties: General purpose, for attaching tags, except as listed below:

1. Outdoors: UV-stabilized nylon.
2. In Spaces Handling Environmental Air: Plenum-rated.

3.03 IDENTIFICATION SCHEDULE

A. Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment. Install access doors or panels to provide view of identifying devices.

B. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, pull points, and locations of high visibility. Identify by system and circuit designation.

C. Concealed Raceways, Duct Banks, More Than 1000 V, within Buildings: Tape and stencil. Stencil legend “DANGER - CONCEALED HIGH-VOLTAGE WIRING” with 3-inch high, black letters on 20-inch centers.

1. Locate identification at changes in direction, at penetrations of walls and floors, and at 10 30-foot maximum intervals.

D. Accessible Raceways, Armored and Metal-Clad Cables, More Than 1000 V: Vinyl wraparound labels Snap-around labels Self-adhesive labels Snap-around color-coding bands for raceway and cables.

1. Locate identification at changes in direction, at penetrations of walls and floors, at 50-foot maximum intervals in straight runs, and at 25-foot maximum intervals in congested areas.

E. Accessible Raceways and Metal-Clad Cables, 1000 V or Less, for Service, Feeder, and Branch Circuits, More Than 30 A and 120 V to Ground: Identify with self-adhesive raceway labels vinyl tape applied in bands.

1. Locate identification at changes in direction, at penetrations of walls and floors, at 50-foot maximum intervals in straight runs, and at 25-foot maximum intervals in congested areas.

F. Accessible Fittings for Raceways and Cables within Buildings: Identify cover of junction and pull box of the following systems with self-adhesive labels containing wiring system legend and system voltage. System legends must be as follows:

1. "EMERGENCY POWER."
2. "POWER."
3. "UPS."

G. Power-Circuit Conductor Identification, 1000 V or Less: For conductors in vaults, pull and junction boxes, manholes, and handholes, use vinyl wraparound labels self-adhesive wraparound labels snap-around label snap-around color-coding bands self-adhesive vinyl tape to identify phase.

1. Locate identification at changes in direction, at penetrations of walls and floors, at 50-foot maximum intervals in straight runs, and at 25-foot maximum intervals in congested areas.

H. Power-Circuit Conductor Identification, More Than 1000 V: For conductors in vaults, pull and junction boxes, manholes, and handholes, use write-on tags nonmetallic preprinted tags colored and marked to indicate phase, and separate tag with circuit designation.

I. Control-Circuit Conductor Identification: For conductors and cables in pull and junction boxes, manholes, and handholes, use self-adhesive labels with conductor or cable designation, origin, and destination. Switchlegs shall have the designation described above on their tags, plus an "S" suffix. Travelers shall have the designation described above on their tags, plus a "T" suffix.

J. Where more than one neutral is present with a group of conductors, a tag shall be applied to each neutral indicating which phase conductors are served by each neutral (e.g., HA-2, 4, 6).

K. Control-Circuit Conductor Termination Identification: For identification at terminations, provide heat-shrink preprinted tubes self-adhesive labels with conductor designation.

L. Locations of Underground Lines: Underground-line warning tape for power, lighting, communication, and control wiring and optical-fiber cable.

M. Concealed Raceways and Duct Banks, More Than 1000 V, within Buildings: Apply floor marking tape to the following finished surfaces:

1. Floor surface directly above conduits running beneath and within 12 inches of floor that is in contact with earth or is framed above unexcavated space.
2. Wall surfaces directly external to raceways concealed within wall.
3. Accessible surfaces of concrete envelope around raceways in vertical shafts, exposed in building, or concealed above suspended ceilings.

N. Workspace Indication: Apply floor marking tape or tape and stencil to finished surfaces. Show working clearances in direction of access to live parts. Workspace must comply with

NFPA 70 and 29 CFR 1926.403 unless otherwise indicated. Do not install at flush-mounted panelboards and similar equipment in finished spaces.

O. Instructional Signs: Self-adhesive labels, including color code for grounded and ungrounded conductors.

P. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Self-adhesive labels.

1. Apply to exterior of door, cover, or other access.
2. Identify system voltage with black letters on an orange background.
3. For equipment with multiple power or control sources, apply to door or cover of equipment, including, but not limited to, the following:
    a. Power-transfer switches.
    b. Controls with external control power connections.

Q. Arc Flash Warning Labeling: Self-adhesive labels.

R. Operating Instruction Signs: Install instruction signs to facilitate proper operation and maintenance of electrical systems and items to which they connect. Install instruction signs with approved legend where instructions are needed for system or equipment operation.

S. Emergency Operating Instruction Signs: Self-adhesive labels Baked-enamel warning signs Metal-backed, butyrate warning signs with white legend on red background with minimum 3/8-inch high letters for emergency instructions at equipment used for power transfer load shedding.

T. Equipment Identification Labels:

1. Indoor Equipment: Baked-enamel signs.
2. Outdoor Equipment: Laminated acrylic or melamine sign.
3. Equipment to Be Labeled:
    a. Panelboards: Typewritten directory of circuits in location provided by panelboard manufacturer. Panelboard identification must be in form of self-adhesive, engraved, engraved, laminated acrylic or melamine label.
    b. Enclosures and electrical cabinets.
    c. Access doors and panels for concealed electrical items.
    d. Switchgear.
    e. Switchboards.
    f. Transformers: Label that includes tag designation indicated on Drawings for transformer, feeder, and panelboards or equipment supplied by secondary.
    g. Substations.
    h. Emergency system boxes and enclosures.

i. Motor-control centers.

j. Enclosed switches.

k. Enclosed circuit breakers.

l. Enclosed controllers.

m. Variable-speed controllers.

n. Push-button stations.

o. Power-transfer equipment.

p. Contactors.

q. Remote-controlled switches, dimmer modules, and control devices.

r. Monitoring and control equipment.

s. UPS equipment.

END OF SECTION

26 27 26 WIRING DEVICES

1.00 GENERAL

1.01 WORK INCLUDED

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Straight-blade convenience, hospital-grade, isolated-ground, and tamper-resistant receptacles.
2. GFCI receptacles.
3. Hazardous (classified) location receptacles.
4. Toggle switches.
5. Wall plates.

1.03 DEFINITIONS

A. Abbreviations of Manufacturers' Names:

1. Cooper: Cooper Wiring Devices; Division of Cooper Industries, Inc.
2. Hubbell: Hubbell Incorporated: Wiring Devices-Kellems.
3. Leviton: Leviton Mfg. Company, Inc.
4. Pass & Seymour: Pass& Seymour/Legrand.

B. BAS: Building automation system.

C. EMI: Electromagnetic interference.

D. GFCI: Ground-fault circuit interrupter.

E. Pigtail: Short lead used to connect a device to a branch-circuit conductor.

F. RFI: Radio-frequency interference.

G. SPD: Surge protective device.

H. UTP: Unshielded twisted pair.

1.04 SUBMITTALS

A. Submittals shall be in accordance with Section 01 33 00 "Document Management" and shall include:

1. Product Data: For each type of product.
2. Shop Drawings: List of legends and description of materials and process used for premarking wall plates.

3. Samples: One for each type of device and wall plate specified, in each color specified.
4. Field quality-control reports.
5. Operation and Maintenance Data: For wiring devices to include in all manufacturers' packing-label warnings and instruction manuals that include labeling conditions.
6. Spare Parts:
    a. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
        1). Service/Power Poles: One for every 10, but no fewer than one.
        2). Floor Service-Outlet Assemblies: One for every 10, but no fewer than one.
        3). Poke-Through, Fire-Rated Closure Plugs: One for every five floor service outlets installed, but no fewer than two.
        4). SPD Receptacles: One for every 10 of each type installed, but no fewer than two of each type.

2.00 PRODUCTS

2.01 GENERAL WIRING-DEVICE REQUIREMENTS

A. Wiring Devices, Components, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with NFPA 70.

C. Devices for Owner-Furnished Equipment:
    1. Receptacles: Match plug configurations.
    2. Cord and Plug Sets: Match equipment requirements.

D. Source Limitations: Obtain each type of wiring device and associated wall plate from single source from single manufacturer.

2.02 STRAIGHT-BLADE RECEPTACLES

A. Duplex Convenience Receptacles:
    1. 125 volts, 20 amps; comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498, and FS W-C-596.
    2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
        a. Eaton (Arrow Hart).
        b. Hubbell Incorporated; Wiring Device-Kellems.
        c. Leviton Manufacturing Co., Inc.
        d. Pass & Seymour/Legrand (Pass & Seymour).

B. Hospital-Grade, Duplex Convenience Receptacles:

1. 125 volts, 20 amps; comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498 Supplement SD, and FS W-C-596.
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    a. Eaton (Arrow Hart).
    b. Hubbell Incorporated; Wiring Device-Kellems.
    c. Leviton Manufacturing Co., Inc.
    d. Pass & Seymour/Legrand (Pass & Seymour).
3. Description: Single-piece, rivetless, nickel-plated, all-brass grounding system. Nickel-plated, brass mounting strap.

2.03 GFCI RECEPTACLES

A. General Description:
1. 125 volts, 20 amps, straight blade, feed non-feed-through type.
2. Comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498, UL 943 Class A, and FS W-C-596.
3. Include indicator light that shows when the GFCI has malfunctioned and no longer provides proper GFCI protection.

B. Duplex GFCI Convenience Receptacles:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    a. Eaton (Arrow Hart).
    b. Hubbell Incorporated; Wiring Device-Kellems.
    c. Leviton Manufacturing Co., Inc.
    d. Pass & Seymour/Legrand (Pass & Seymour).

C. Tamper-Resistant, Duplex GFCI Convenience Receptacles:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    a. Hubbell Incorporated; Wiring Device-Kellems.
    b. Pass & Seymour/Legrand (Pass & Seymour).

D. Hospital-Grade, Duplex GFCI Convenience Receptacles: Comply with UL 498 Supplement SD.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    a. Eaton (Arrow Hart).
    b. Hubbell Incorporated; Wiring Device-Kellems.
    c. Leviton Manufacturing Co., Inc.

d. Pass & Seymour/Legrand (Pass & Seymour).

2.04 HAZARDOUS (CLASSIFIED) LOCATION RECEPTACLES

A. Hazardous (Classified) Locations Receptacles: Comply with NEMA FB 11 and UL 1010.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Eaton (Arrow Hart).

b. EGS/Appleton Electric.

c. Killark.

2.05 WALL PLATES

A. Single and combination types shall match corresponding wiring devices.

1. Plate-Securing Screws: Metal with head color to match plate finish.

2. Material for Finished Spaces: Steel with white baked enamel, suitable for field painting Smooth, high-impact thermoplastic 0.035-inch thick, satin-finished, Type 302 stainless steel 0.04-inch thick, brushed brass with factory polymer finish 0.05-inch thick, anodized aluminum 0.04-inch thick steel with chrome-plated finish.

3. Material for Unfinished Spaces: Galvanized steel Smooth, high-impact thermoplastic.

4. Material for Damp Locations: Thermoplastic Cast aluminum with spring-loaded lift cover, and listed and labeled for use in wet and damp locations.

B. Wet-Location, Weatherproof Cover Plates: NEMA 250, complying with Type 3R, weather-resistant, die-cast aluminum thermoplastic with lockable cover.

2.06 FINISHES

A. Device Color:

1. Wiring Devices Connected to Normal Power System: Almond Black Brown Gray Ivory White As selected by Engineer Specify other unless otherwise indicated or required by NFPA 70 or device listing.

2. Wiring Devices Connected to Emergency Power System: Red.

3. SPD Devices: Blue.

4. Isolated-Ground Receptacles: Orange As specified above, with orange triangle on face.

B. Wall Plate Color: For plastic covers, match device color.

3.00 EXECUTION

3.01 INSTALLATION

A. Comply with NECA 1, including mounting heights listed in that standard, unless otherwise indicated.

B. Coordination with Other Trades:

1. Protect installed devices and their boxes. Do not place wall finish materials over device boxes and do not cut holes for boxes with routers that are guided by riding against outside of boxes.
2. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.
3. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.
4. Install wiring devices after all wall preparation, including painting, is complete.

C. Conductors:

1. Do not strip insulation from conductors until right before they are spliced or terminated on devices.
2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.
3. The length of free conductors at outlets for devices shall meet provisions of NFPA 70, Article 300, without pigtails.
4. Existing Conductors:
    a. Cut back and pigtail, or replace all damaged conductors.
    b. Straighten conductors that remain and remove corrosion and foreign matter.
    c. Pigtailing existing conductors is permitted, provided the outlet box is large enough.

D. Device Installation:

1. Replace devices that have been in temporary use during construction and that were installed before building finishing operations were complete.
2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.
3. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.
4. Connect devices to branch circuits using pigtails that are not less than 6 inches in length.
5. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, two-thirds to three-fourths of the way around terminal screw.
6. Use a torque screwdriver when a torque is recommended or required by manufacturer.
7. When conductors larger than No. 12 AWG are installed on 15- or 20-amp circuits, splice No. 12 AWG pigtails for device connections.
8. Tighten unused terminal screws on the device.
9. When mounting into metal boxes, remove the fiber or plastic washers used to hold device-mounting screws in yokes, allowing metal-to-metal contact.

E. Receptacle Orientation:

1. Install ground pin of vertically mounted receptacles up, and on horizontally mounted receptacles to the right.

2. Install hospital-grade receptacles in patient-care areas with the ground pin or neutral blade at the top.

F. Device Plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.

G. Dimmers:

1. Install dimmers within terms of their listing.

2. Verify that dimmers used for fan-speed control are listed for that application.

3. Install unshared neutral conductors on line and load side of dimmers according to manufacturers' device listing conditions in the written instructions.

H. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical and with grounding terminal of receptacles on top. Group adjacent switches under single, multigang wall plates.

I. Adjust locations of floor service outlets and service poles to suit arrangement of partitions and furnishings.

3.02 GFCI RECEPTACLES

A. Install non-feed-through-type GFCI receptacles where protection of downstream receptacles is not required.

3.03 IDENTIFICATION

A. Comply with Section 26 05 53 "Identification for Electrical Systems."

B. Identify each receptacle with panelboard identification and circuit number. Use hot, stamped, or engraved machine printing with black white red-filled lettering on face of plate, and durable wire markers or tags inside outlet boxes.

3.04 FIELD QUALITY CONTROL

A. Test Instruments: Use instruments that comply with UL 1436.

B. Test Instrument for Convenience Receptacles: Digital wiring analyzer with digital readout or illuminated digital-display indicators of measurement.

C. Perform the following tests and inspections with the assistance of a factory-authorized service representative:

1. In healthcare facilities, prepare reports that comply with recommendations in NFPA 99.

2. Test Instruments: Use instruments that comply with UL 1436.

3. Test Instrument for Convenience Receptacles: Digital wiring analyzer with digital readout or illuminated digital-display indicators of measurement.

D. Tests for Convenience Receptacles:

1. Line Voltage: Acceptable range is 105 to 132 volts.
2. Percent Voltage Drop Under 15-Amp Load: A value of 6 percent or higher is unacceptable.
3. Ground Impedance: Values of up to 2 ohms are acceptable.
4. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.
5. Using the test plug, verify that the device and its outlet box are securely mounted.
6. Tests shall be diagnostic, indicating damaged conductors, high resistance at the circuit breaker, poor connections, inadequate fault current path, defective devices, or similar problems. Correct circuit conditions, remove malfunctioning units and replace with new ones, and retest as specified above.

E. Test straight-blade convenience outlets in patient-care areas hospital-grade convenience outlets for the retention force of the grounding blade according to NFPA 99. Retention force shall be not less than 4 ounces.

F. Wiring device will be considered defective if it does not pass tests and inspections.

G. Prepare test and inspection reports.

END OF SECTION

26 28 16 ENCLOSED SWITCHES AND CIRCUIT BREAKERS

1.00 GENERAL

1.01 WORK INCLUDED

A. Furnish labor, materials, equipment and incidentals necessary to install disconnects. Electrical Work shall be in accordance with Division 26 Specifications.

B. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Disconnect switches.
2. Molded-case circuit breakers (MCCBs).
3. Enclosures.

B. Related Requirements:

1. Section 01 33 04 “Operation and Maintenance Data.”

1.03 DEFINITIONS

A. NC: Normally closed.

B. NO: Normally open.

C. SPDT: Single pole, double throw.

1.04 SUBMITTALS

A. Product Data: For each type of enclosed switch, circuit breaker, accessory, and component indicated. Include nameplate ratings, dimensioned elevations, sections, weights, and manufacturers’ technical data on features, performance, electrical characteristics, ratings, accessories, and finishes.

1. Enclosure types and details for types other than NEMA 250, Type 1.
2. Current and voltage ratings.
3. Short-circuit current ratings (interrupting and withstand, as appropriate).
4. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices, accessories, and auxiliary components.
5. Include time-current coordination curves (average melt) for each type and rating of overcurrent protective device; include selectable ranges for each type of overcurrent protective device. Provide in PDF and SKM PTW32 or ETAP electronic format.

B. Drawings: For enclosed switches and circuit breakers.

1. Include plans, elevations, sections, details, and attachments to other Work.
2. Include wiring diagrams for power, signal, and control wiring.

C. Qualification Data: For qualified testing agency.

D. Field quality-control reports.

E. Operation and Maintenance Data: For enclosed switches and circuit breakers to include in emergency, operation, and maintenance manuals.

1. In addition to items specified in Section 01 33 04 “Operation and Maintenance Data,” include the following:

a. Manufacturer’s written instructions for testing and adjusting enclosed switches and circuit breakers.

b. Time-current coordination curves (average melt) for each type and rating of overcurrent protective device; include selectable ranges for each type of overcurrent protective device. Provide in PDF and SKM PTW32 or ETAP electronic format.

F. Spares: Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Fuses: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.

2. Fuse Pullers: Two for each size and type.

1.05 QUALITY ASSURANCE

A. Testing Agency Qualifications: Accredited by NETA.

1. Testing Agency’s Field Supervisor: Currently certified by NETA to supervise on-site testing.

1.06 FIELD CONDITIONS

A. Environmental Limitations: Rate equipment for continuous operation under the following conditions unless otherwise indicated:

1. Ambient Temperature: Not less than minus 22 deg F and not exceeding 104 deg F.

2. Altitude: Not exceeding 6600 feet.

1.07 WARRANTY

A. Manufacturer’s Warranty: Manufacturer and Installer agree to repair or replace components that fail in materials or workmanship within specified warranty period.

1. Warranty Period: One year(s) from date of Substantial Completion.

2.00 PRODUCTS

2.01 GENERAL REQUIREMENTS

A. Source Limitations: Obtain enclosed switches and circuit breakers, overcurrent protective devices, components, and accessories, within same product category, from single manufacturer.

B. Product Selection for Restricted Space: Drawings indicate maximum dimensions for enclosed switches and circuit breakers, including clearances between enclosures, and adjacent surfaces and other items. Comply with indicated maximum dimensions.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and application.

D. Comply with NFPA 70.

2.02 DISCONNECT SWITCHES:

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Eaton.

2. GE/ABB Inc.

3. SIEMENS Industry, Inc.; Energy Management Division.

4. Square D; by Schneider Electric.

B. Type HD, Heavy-Duty, Three-Pole, Single-Throw, 600-VAC, 1200 Amps and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

C. Accessories:

1. Lugs: Mechanical type, suitable for number, size, and conductor material.

D. Enclosure: NEMA 4X, 316 Stainless Steel for exterior installations not exposed to a hazardous location.

2.03 MOLDED-CASE CIRCUIT BREAKERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Eaton.

2. GE/ABB Inc.

3. SIEMENS Industry, Inc.; Energy Management Division.

4. Square D; by Schneider Electric.

B. Circuit breakers shall be constructed using glass-reinforced insulating material. Current carrying components shall be completely isolated from the handle and the accessory mounting area.

C. Circuit breakers shall have a toggle operating mechanism with common tripping of all poles, which provides quick-make, quick-break contact action. The circuit-breaker handle shall be over center, be trip free, and reside in a tripped position between on and off to provide local trip indication. Circuit-breaker escutcheon shall be clearly marked on and off in addition to providing international I/O markings. Equip circuit breaker with a push-to-trip button, located on the face of the circuit breaker to mechanically operate the circuit-breaker tripping mechanism for maintenance and testing purposes.

D. The maximum ampere rating and UL, IEC, or other certification standards with applicable voltage systems and corresponding interrupting ratings shall be clearly marked on face of circuit breaker. Circuit breakers shall be 100 percent rated.

E. MCCBs shall be equipped with a device for locking in the isolated position.

F. Lugs shall be suitable for 140 deg F rated wire on 125-A circuit breakers and below 167 deg F rated wire 194 deg F rated wire, sized according to the 167 deg F temperature rating in NFPA 70.

G. Standard: Comply with UL 489 with interrupting capacity to comply with available fault currents.

H. Thermal-Magnetic Circuit Breakers: Inverse time-current thermal element for low-level overloads and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 amps and larger.

I. Adjustable, Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.

J. Electronic Trip Circuit Breakers: Field-replaceable rating plug, rms sensing, with the following field-adjustable settings:

    1. Instantaneous trip.
    2. Long- and short-time pickup levels.
    3. Long- and short-time time adjustments.
    4. Ground-fault pickup level, time delay, and I-squared t response.

K. Current-Limiting Circuit Breakers: Frame sizes 400 amps and smaller, and let-through ratings less than NEMA FU 1, RK-5.

L. Integrally Fused Circuit Breakers: Thermal-magnetic trip element with integral limiter-style fuse listed for use with circuit breaker and trip activation on fuse opening or on opening of fuse compartment door.

M. Ground-Fault Circuit-Interrupter (GFCI) Circuit Breakers: Single- and two-pole configurations with Class A ground-fault protection (6-mA trip).

N. Ground-Fault Equipment-Protection (GFEP) Circuit Breakers: With Class B ground-fault protection (30-mA trip).

O. Features and Accessories:

    1. Standard frame sizes, trip ratings, and number of poles.
    2. Lugs: Mechanical type, suitable for number, size, trip ratings, and conductor material.
    3. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge lighting circuits.
    4. Ground-Fault Protection: Comply with UL 1053; remote-mounted and powered type with mechanical ground-fault indicator; relay with adjustable pickup and time-delay settings, push-to-test feature, internal memory, and shunt trip unit; and three-phase, zero-sequence current transformer/sensor.

5. Communication Capability: Circuit-breaker-mounted or Din-rail-mounted communication module with functions and features compatible with power monitoring and control system, specified in Section 26 09 13 “Electrical Power Monitoring and Control.”
6. Shunt Trip: Trip coil energized from separate circuit, with coil-clearing contact.
7. Under-voltage Trip: Set to operate at 35 to 75 percent of rated voltage without intentional time delay.
8. Auxiliary Contacts: One SPDT switch Two SPDT switches with “a” and “b” contacts; “a” contacts mimic circuit-breaker contacts, “b” contacts operate in reverse of circuit-breaker contacts.
9. Alarm Switch: One NO NC contact that operates only when circuit breaker has tripped.
10. Key Interlock Kit: Externally mounted to prohibit circuit-breaker operation; key shall be removable only when circuit breaker is in off position.
11. Zone-Selective Interlocking: Integral with electronic ground-fault trip unit; for interlocking ground-fault protection function.
12. Electrical Operator: Provide remote control for on, off, and reset operations.

P. Accessory Control Power Voltage: Integrally mounted, self-powered Remote mounted and powered; 120 VAC.

2.04 ENCLOSURES

A. Enclosed Switches and Circuit Breakers: UL 489, NEMA KS 1, NEMA 250, and UL 50, to comply with environmental conditions at installed location

B. Enclosure Finish: The enclosure shall be finished with gray baked enamel paint, electrodeposited on cleaned, phosphatized steel (NEMA 250 Type 1) gray baked enamel paint, electrodeposited on cleaned, phosphatized galvannealed steel (NEMA 250 Types 3R, 12) a brush finish on Type 304 stainless steel (NEMA 250 Type 4-4X stainless steel) copper-free cast aluminum alloy (NEMA 250 Types 7, 9).

C. Conduit Entry: NEMA 250 Types 4, 4X, and 12 enclosures shall contain no knockouts. NEMA 250 Types 7 and 9 enclosures shall be provided with threaded conduit openings in both endwalls.

D. Operating Mechanism: The circuit-breaker operating handle shall be externally operable with the operating mechanism being an integral part of the box, not the cover directly operable through the front cover of the enclosure (NEMA 250 Type 1) directly operable through the dead front trim of the enclosure (NEMA 250 Type 3R) externally operable with the operating mechanism being an integral part of the cover (NEMA 250 Types 7, 9). The cover interlock mechanism shall have an externally operated override. The override shall not permanently disable the interlock mechanism, which shall return to the locked position once the override is released. The tool used to override the cover interlock mechanism shall not be required to enter the enclosure in order to override the interlock.

E. Enclosures designated as NEMA 250 Type 4, 4X stainless steel, 12, or 12K shall have a dual cover interlock mechanism to prevent unintentional opening of the enclosure cover when

the circuit breaker is ON and to prevent turning the circuit breaker ON when the enclosure cover is open.

F. NEMA 250 Type 7/9 enclosures shall be furnished with a breather and drain kit to allow their use in outdoor and wet location applications.

3.00 EXECUTION

3.01 EXAMINATION

A. Examine elements and surfaces to receive enclosed switches and circuit breakers for compliance with installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

1. Commencement of Work shall indicate Installer's acceptance of the areas and conditions as satisfactory.

3.02 PREPARATION

A. Interruption of Existing Electric Service: Do not interrupt electric service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electric service according to requirements indicated:

1. Notify Construction Manager and Owner no fewer than 7 days in advance of proposed interruption of electric service.

2. Indicate method of providing temporary electric service.

3. Do not proceed with interruption of electric service without Owner's written permission.

4. Comply with NFPA 70E.

3.03 ENCLOSURE ENVIRONMENTAL RATING APPLICATIONS

A. Enclosed Switches and Circuit Breakers: Provide enclosures at installed locations with the following environmental ratings.

1. Indoor, Dry and Clean Locations: NEMA 250, Type 1.

2. Outdoor Locations: NEMA 250, Type 4X, 316 stainless steel.

3. Hazardous Areas Indicated on Drawings: NEMA 250, Type 7 with cover attached by Type 316 stainless steel bolts.

3.04 INSTALLATION

A. Coordinate layout and installation of switches, circuit breakers, and components with equipment served and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

B. Install individual wall-mounted switches and circuit breakers with tops at uniform height unless otherwise indicated.

C. Temporary Lifting Provisions: Remove temporary lifting of eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.

D. Install fuses in fusible devices.

E. Comply with NFPA 70 and NECA 1.

3.05 IDENTIFICATION

A. Comply with requirements in Section 26 05 53 “Identification for Electrical Systems.”

1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.

2. Label each enclosure with engraved metal or laminated-plastic nameplate.

3.06 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Perform tests and inspections.

C. Tests and Inspections for Switches:

1. Visual and Mechanical Inspection:

a. Inspect physical and mechanical condition.

b. Inspect anchorage, alignment, grounding, and clearances.

c. Verify that the unit is clean.

d. Verify blade alignment, blade penetration, travel stops, and mechanical operation.

e. Verify that fuse sizes and types match the Specifications and Drawings.

f. Verify that each fuse has adequate mechanical support and contact integrity.

g. Inspect bolted electrical connections for high resistance using one of the two following methods:

1). Use a low-resistance ohmmeter.

a). Compare bolted connection resistance values to values of similar connections. Investigate values that deviate from those of similar bolted connections by more than 50 percent of the lowest value.

2). Verify tightness of accessible bolted electrical connections by calibrated torque-wrench method in accordance with manufacturer’s published data or NETA ATS Table 100.12.

a). Bolt-torque levels shall be in accordance with manufacturer’s published data. In the absence of manufacturer’s published data, use NETA ATS Table 100.12.

h. Verify that operation and sequencing of interlocking systems is as described in the Specifications and shown on the Drawings.

i. Verify correct phase barrier installation.

j. Verify lubrication of moving current-carrying parts and moving and sliding surfaces.

2. Electrical Tests:

a. Perform resistance measurements through bolted connections with a low-resistance ohmmeter. Compare bolted connection resistance values to values of similar connections. Investigate values that deviate from adjacent poles or similar switches by more than 50 percent of the lowest value.

b. Measure contact resistance across each switchblade fuseholder. Drop values shall not exceed the high level of the manufacturer's published data. If manufacturer's published data are not available, investigate values that deviate from adjacent poles or similar switches by more than 50 percent of the lowest value.

c. Perform insulation-resistance tests for 1 minute on each pole, phase-to-phase and phase-to-ground with switch closed, and across each open pole. Apply voltage in accordance with manufacturer's published data. In the absence of manufacturer's published data, use Table 100.1 from the NETA ATS. Investigate values of insulation resistance less than those published in Table 100.1 or as recommended in manufacturer's published data.

d. Measure fuse resistance. Investigate fuse-resistance values that deviate from each other by more than 15 percent.

e. Perform ground fault test according to NETA ATS 7.14 "Ground Fault Protection Systems, Low-Voltage."

D. Tests and Inspections for Molded Case Circuit Breakers:

1. Visual and Mechanical Inspection:

a. Verify that equipment nameplate data are as described in the Specifications and shown on the Drawings.

b. Inspect physical and mechanical condition.

c. Inspect anchorage, alignment, grounding, and clearances.

d. Verify that the unit is clean.

e. Operate the circuit breaker to ensure smooth operation.

f. Inspect bolted electrical connections for high resistance using one of the two following methods:

1). Use a low-resistance ohmmeter.

a). Compare bolted connection resistance values to values of similar connections. Investigate values that deviate from those of similar bolted connections by more than 50 percent of the lowest value.

2). Verify tightness of accessible bolted electrical connections by calibrated torque-wrench method in accordance with manufacturer's published data or NETA ATS Table 100.12.

a). Bolt-torque levels shall be in accordance with manufacturer's published data. In the absence of manufacturer's published data, use NETA ATS Table 100.12.

g. Inspect operating mechanism, contacts, and chutes in unsealed units.

h. Perform adjustments for final protective device settings in accordance with the coordination study.

2. Electrical Tests:

a. Perform resistance measurements through bolted connections with a low-resistance ohmmeter. Compare bolted connection resistance values to values of similar connections. Investigate values that deviate from adjacent poles or similar switches by more than 50 percent of the lowest value.

b. Perform insulation-resistance tests for 1 minute on each pole, phase-to-phase and phase-to-ground with circuit breaker closed, and across each open pole. Apply voltage in accordance with manufacturer's published data. In the absence of manufacturer's published data, use Table 100.1 from the NETA ATS. Investigate values of insulation resistance less than those published in Table 100.1 or as recommended in manufacturer's published data.

c. Perform a contact/pole resistance test. Drop values shall not exceed the high level of the manufacturer's published data. If manufacturer's published data are not available, investigate values that deviate from adjacent poles or similar switches by more than 50 percent of the lowest value.

d. Perform insulation resistance tests on all control wiring with respect to ground. Applied potential shall be 500 VDC for 300-volt rated cable and 1000 VDC for 600-volt rated cable. Test duration shall be 1 minute. For units with solid state components, follow manufacturer's recommendation. Insulation resistance values shall be no less than 2 megohms.

e. Determine the following by primary current injection:

1). Long-time pickup and delay. Pickup values shall be as specified. Trip characteristics shall not exceed manufacturer's published time-current characteristic tolerance band, including adjustment factors.

2). Short-time pickup and delay. Short-time pickup values shall be as specified. Trip characteristics shall not exceed manufacturer's published time-current characteristic tolerance band, including adjustment factors.

3). Ground-fault pickup and time delay. Ground-fault pickup values shall be as specified. Trip characteristics shall not exceed manufacturer's published time-current characteristic tolerance band, including adjustment factors.

4). Instantaneous pickup. Instantaneous pickup values shall be as specified and within manufacturer's published tolerances.

f. Test functionality of the trip unit by means of primary current injection. Pickup values and trip characteristics shall be as specified and within manufacturer's published tolerances.

g. Perform minimum pickup voltage tests on shunt trip and close coils in accordance with manufacturer's published data. Minimum pickup voltage of the shunt trip and close coils shall be as indicated by manufacturer.

h. Verify correct operation of auxiliary features such as trip and pickup indicators; zone interlocking; electrical close and trip operation; trip-free, anti-pump function; and trip unit battery condition. Reset all trip logs and indicators. Investigate units that do not function as designed.

i. Verify operation of charging mechanism. Investigate units that do not function as designed.

3. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

4. Perform the following infrared scan tests and inspections and prepare reports:

a. Initial Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each enclosed switch and circuit breaker. Remove front panels so joints and connections are accessible to portable scanner.

b. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each enclosed switch and circuit breaker 11 months after date of Substantial Completion.

c. Instruments and Equipment: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.

5. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.

E. Enclosed switches and circuit breakers will be considered defective if they do not pass tests and inspections.

F. Prepare test and inspection reports.

1. Test procedures used.

2. Include identification of each enclosed switch and circuit breaker tested and describe test results.

3. List deficiencies detected, remedial action taken, and observations after remedial action.

3.07 ADJUSTING

A. Adjust moving parts and operable components to function smoothly, and lubricate as recommended by manufacturer.

B. Set field-adjustable circuit-breaker trip ranges as specified in Section 26 05 73 “Overcurrent Protective Device Coordination Study.”

END OF SECTION

26 29 13.19 INDUSTRIAL CONTROL PANELS

1.00 GENERAL

1.01 WORK INCLUDED

A. Furnish labor, materials, equipment and incidentals necessary to install industrial control panels to measure and control process mechanical equipment as specified in process equipment specifications, and control schematics within Electrical design drawings.

B. Electrical Work shall be in accordance with Division 26, Section 26 05 00 “Common Work Results for Electrical”, and Division 40.

C. Provide UL 508A and UL 698A as indicated labels to all control panels under this Contract. Control panels shall be fabricated by a UL 508A and UL 698A Industrial Control Panel (ICP) shop.

D. Contractor shall be responsible for sizing all control panel enclosures to comply with minimum workspace clearance requirements in Article 110 of NFPA 70.

E. Horsepower Rating: Horsepowers as indicated on the Drawings are approximate. The Contractor shall furnish properly sized motor control equipment when actual motor horsepowers are determined. If actual motor horsepowers differ from the Plans, the Contractor shall obtain assistance from the Engineer in determining whether or not hardware and wiring changes are necessary. The Contractor shall provide all components and wire of the proper size at no cost to the Owner.

F. Pump protection relays supplied by pump supplier must be shipped to control panel manufacturer to be integrated into control panel prior to control panel being shipped to the Site.

1.02 SUMMARY

A. Section Includes:

1. General use industrial control panels.
2. Vendor supplied process mechanical equipment control panels.
3. Contractor supplied process mechanical equipment control panels.

1.03 REFERENCES

A. Abbreviations:

1. SCCR: Short Circuit Current Rating.

B. Reference Standards.

1. The applicable provisions of the following standards shall apply as if written here in their entity.
    a. Local laws and ordinances.
    b. State and federal laws.
    c. NEMA ICS 2.

d. NFPA 70.

e. NFPA 79.

f. UL 508A.

g. UL 698A.

h. American National Standards Institute (ANSI).

i. National Electrical Manufacturers Association (NEMA).

j. Institute of Electrical and Electronics Engineers (IEEE).

1.04 SUBMITTALS

A. Submittals shall be in accordance with Section 01 33 00 “Document Management” and as outlined below.

1. Product Data: Complete manufacturer cutsheets for each component used. Indicate all options selected for each component. Cross out options and accessories not being supplied with component. Submittals that are not clearly marked will be returned without review.

2. Shop Drawing:

a. Control panel layout and wiring diagrams.

1). Complete Bill of Material of all components associated with control panel. Provide a separate Bill of Material for each control panel. Components listed in Bill of Material must have quantities and an Item ID.

2). Submit CAD formatted panel layout drawings for each control panel specified. All components and enclosures must be scaled with dimensions included. Include at a minimum the following drawings:

a). Elevations identifying all components located on the interior backplane, door-in-doors and panel exteriors.

(1). Provide Item ID next to each component.

b). Enclosure NEMA rating.

c). Enclosure SCCR.

d). Nameplate schedule with descriptions and locations of all nameplates.

e). Stub-up locations.

f). Shipping splits and shipping weights.

g). Ventilation details.

3). Wiring Diagrams:

a). FLA of panel.

b). Project specific control schematics.

c). Field instrumentation.

d). Power sources of all 2-wire and 4-wire field instruments.

e). Terminal strip layout clearly identifying all customer and field terminations for power, control and instrumentation.

f). CT and PT ratio.

b. Additional submittal requirements for control panels located within a hazardous location or supplying control and instrumentation circuitry to devices located within Class I Division 1 hazardous locations:

1). Indicate intrinsically safe barrier extents, intrinsically safe circuit components and IS circuitry conduit access location.

2). Submit calculations for intrinsically safe circuits including actual product data and field conditions.

3). Enclosure NEMA rating.

4). Purge system details.

c. Heat Rise Calculations: panel heat rise calculations shall be provided for each control panel supplied with an air conditioner.

d. UPS battery calculations.

3. Spare parts list.

4. Equipment Installation Report.

5. Warranty Information: Manufacturer shall include a 2-year warranty on the control panel provided.

6. O&M Manual: Include record drawings of final control schematic, including any changes made during startup.

1.05 SPARE PARTS

1. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

a. Fuses: Equal to 10 percent of quantity installed for each size and type, but not fewer than six of each size and type.

b. Indication lights: One of each type and lens color.

c. Relays and tube bases: Equal to 10 percent of quantity installed for each size and type, but not fewer than three of each size and type.

1.06 QUALITY ASSURANCE

A. Control panel manufacturer must possess a current UL508A and UL698A certification and hold at least one of the following certifications: ISO-9001 certificate or CSIA Certification.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Temporary Heating: Apply temporary heat to maintain temperature according to manufacturer's written instructions until enclosed controllers are ready to be energized and placed into service.

1.08 SITE CONDITIONS

A. Ambient Temperature: 0-40 45 50 deg C direct sunlight.

B. Altitude: Not exceeding 1000 6600 feet.

C. Relative Humidity: 0 to 95 percent (non-condensing).

2.00 PRODUCTS

2.01 GENERAL REQUIREMENTS

A. Minimum SCCR of all control panels: 5 kA 10 kA 42 kA 65 kA 100 kA , unless indicated otherwise with process equipment specifications.

B. Minimum SCCR of control panels shall be equal or greater than the SCCR or AIC rating of immediate upstream device. If immediate upstream device is a series rated circuit breaker, then the upstream panelboard or switchboard AIC rating shall be met.

2.02 ENCLOSURES

A. General Requirements:

1. Enclosures shall be sized to sufficiently support the mounting of all panel components to the backplane of enclosure, and to support the routing and separation of power and control voltage conductors within enclosure.

2. All components shall be mounted to stud mounted backplane on the rear of enclosure. No components shall be mounted to sides of enclosure interior unless stud mounted backplane or factory welded slotted channel is provided for panel sides. Side mounted components shall not interfere with the removal or testing of backplane mounted components.

3. Panels shall meet the NEMA classifications listed under Paragraph [3.01] - Enclosure Installation Schedule. All components mounted to the exterior of enclosures shall maintain the NEMA rating of enclosure.

4. Each enclosure door shall be fitted with a thermoplastic factory welded steel factory welded stainless steel print storage pocket.

5. Enclosures shall be fitted with factory welded grounding stud on interior of enclosure door and enclosure inner side wall for bonding the two. Separate grounding studs shall be provided for each enclosure door.

6. Enclosures shall be manufactured by Hoffman by nVent, Hammond Manufacturing, Rittal, or Saginaw Control & Engineering.

B. Freestanding Enclosures: Manufactured from 12 gauge sheet metal steel or {304} {316} stainless steel aluminum, with suitable interior stiffeners, continuously welded for rigid construction, continuous piano type hinge with 3-point latching mechanism operated by padlocking handles constructed of like material as enclosure. All enclosures shall be single access enclosures, unless noted otherwise.

1. Panels 48 inches wide or greater shall have two doors with a removable centerpost.

2. Free standing enclosures located outdoors shall have 12-inch floor stands bolted to enclosure.

3. Provide a factory welded stainless steel laptop folding shelf to the inside of door for control panels supplied with a PLC.

4. See enclosure installation schedule at the end of this Section for enclosure material and NEMA rating by location.

C. Wall or Slotted Channel Mounted Enclosures: Manufactured from minimum 16 gauge sheet metal steel or {304} {316} stainless steel aluminum, with integrated mounting feet, with suitable interior stiffeners, continuously welded for rigid construction, continuous piano type hinge with a door clamp assembly three-point latching mechanism operated by padlocking handles constructed of like material as enclosure.

D. Door-In-Door Enclosure Requirements: Where door-in-door enclosures are specified, provide an interior hinged sub-panel within enclosure. Sub-panel must swing a minimum 90 degrees out of enclosure, to provide access to mounted internal equipment. Stud mounted sub-panels will not be permitted in lieu of hinged type.

E. Enclosure Finishing:

1. NEMA 4X stainless steel enclosures shall be finished smooth, free of all burrs, scales and imperfection, brushed smoothed , and unpainted.

2. NEMA 4X stainless steel enclosures shall be powder coated white, factory applied by manufacturer.

3. Painted steel enclosures, where permitted, shall have an ANSI 61 gray finish.

4. Interior Backplanes: Painted white.

F. Enclosure Conditioning:

1. Panel Conditioning: Where components supplied are not rated for site ambient temperature, panel manufacturer shall provide a closed loop panel air conditioner sized to maintain the panel temperature below the lowest components rated operating temperature.

   a. Air conditioners shall be a closed loop type, refrigerant based system, internal component corrosive resistant coating, and a stainless steel enclosure. Air conditioner shall maintain NEMA rating of enclosure.

   b. Air conditioner shall be manufacturer by Hoffman by nVent, Pentair, or ICEqube by Thermo Electric.

2. Condensation Control:

   a. A thermostat hydrostat controlled condensation strip heater and condensate drain shall be provided for all panels located outdoors or in a non-conditioned environment. Strip heater shall be sufficiently guarded to prevent accidental contact by panel components and conductors.

   b. Condensate Drain: 1/2-inch stainless steel vent drain threaded to conduit hub, installed on bottom of enclosure.

G. Nameplates:

1. Panels and exterior mounted panel components will be supplied with unique nameplates. Each device nameplate shall describe the field device (e.g. Transfer Pump 1) and the function it serves (e.g. H/O/A). Nameplates shall be phenolic (Lamicoid), with a minimum 1-inch tall, engraved letters, with fixed to panel with epoxy adhesive.

2. Each component identified on the Bill of Material will have a phenolic nameplate attached to the back panel either beside or above the device. Nameplate will have the same schematic designation assigned on the Drawings (e.g. RTU-01). Nameplate must be clearly visible and not blocked by wiring, wire duct, or other components. Text will be black white, 1/8 inch high, on a black white background. Nameplates will be affixed to back panel with 3M 9472 adhesive or approved equal.

2.03 POWER DISTRIBUTION AND POWER DEVICES

A. General Requirements:

1. All control panels shall be supplied with a single 120 VAC, 3 phase, 3 wire plus ground (wye configuration) power source, unless noted otherwise. All other voltages required to operate the system served by control panel shall be derived from within panel via control power transformers and DC power supplies.

2. Provide separate branch circuit protection for each motor load, panel and motor space heaters, lights, receptacle, control circuit, etc.

B. Main Overcurrent Protective Device:

1. Where 120 VAC circuits enter the control panel, provide an overcurrent protective device. Device shall be either a molded case circuit breaker or fuse type disconnect assembly where permitted, heavy duty, backplane mounted. Provide shaft extension for external handle mounted to front panel door to operate device without opening door. External handle shall indicate open and closed positions, must be pad-lockable, chrome plated, and maintain NEMA rating of enclosure. Nonmetallic type handles will not be permitted.

a. Where door-in-door is specified, disconnect assembly handle shall be mounted to inner door.

2. Device type selection criteria: Provide a molded case circuit breaker for the main overcurrent protective device unless current limiting fuses are required to meet the control panel SCCR specified.

C. For control panels with a 120 VAC power feed, provide a pluggable (replaceable) type surge Protection Device (SPD): Metal oxide varistor, modular pluggable type, parallel connected, UL 1449 4th Edition, Type 2. SPD shall be DIN-rail mountable, with visual status indicator for protection status.

1. Maximum Continuous Operating Voltage (MCOV): L-N: 320V; L-L: 640V.

2. Voltage Protection Rating (VPR): L-N: 1500V; L-L: 2500V.

3. Nominal Discharge Current Rating (In): 20 kA.

4. Provide SPD on incoming power feed after power main overcurrent protective device for each panel provided.
5. Manufactured by Mersen STP Series or Allen Bradley Bulletin 4983-DS.

D. Three Phase Monitor (Phase Failure) Relays: tube style base with pin style terminals, silver nickel contacts, 10A/B300 contact rating, SPDT Form C contact, LED indicators for relay energized (normal state) and relay de-energized (fault state), fixed or adjustable power up delay, and automatic reset with adjustable restart time delay. The following conditions shall be monitored, with adjustable ranges as indicated:

1. Phase Loss & Reversal: Fixed at 1 second.
2. Undervoltage/Overvoltage (Drop-out @+/- 10 percent, Pick-up @+/- 7 percent): 1-25 seconds.
3. Voltage Unbalance (Drop-out @ 2-8 percent): 1-25 seconds.
4. All control panels serving three phase motors shall be supplied with a three phase monitor relay. Relay shall monitor the incoming three phase power supply serving motor(s) fed from control panel and shall open the motor(s) control circuit(s) when a monitored condition is measured out of adjustable relay setpoints.
5. Manufactured by Diversified Electronics SLU-0200, Littlefuse 201A-AU Series, or Macromatic PMP575.

E. Control Power Transformers (CPT): Control power transformers with factory installed primary and secondary fuse blocks for circuit protection. Ground one leg of control transformer on secondary side. CPT is permitted to installed in a separate enclosure to the side of control panel, however the NEMA rating of enclosure must be maintained.

1. Control Power Voltage: Control power shall be 120 VAC from a control transformer located in control panel.
2. Capacity: Sized to handle inrush of all relay coils and all other loads powered by CPT, including motor space heater(s). Coordinate all external loads, including motor space heater(s), with equipment supplier.
    a. If no motor space heater is supplied with a motor powered by the control panel, the CPT shall be sized with extra VA capacity for the appropriate size electric motor space heater for that motor HP.
    b. The following is the amount of extra VA capacity which shall be furnished for each motor:

Motor HP	Control Transformer Extra VA Capacity
1 to 5	50
7.5 to 10	100
15 to 20	150
25 to 30	200
40 to 50	250
60 to 100	400

3. Spare CPT Capacity: 50 VA.
4. Manufactured by Hammond, Acme, Square D, or Eaton.

F. 120 VAC Uninterruptable Power Supply (UPS):
1. Where PLC is supplied within control panel, provide a UPS to power PLC and control components.
2. UPS shall be sized for full PLC and control component capacity for 15 minutes.
3. UPS shall be din rail or backplane mounted, and shall contain nonproprietary sealed lead acid batteries.
4. UPS shall include a LED status display for battery online and replace battery indication.
5. Approved manufacturers are:
   a. Liebert.
   b. Eaton.

G. Motor Starter See Section 26 29 13.13 “Across-the-Line Motor Controllers” for product requirements:
1. Description: Across-the-line start, electrically held, three pole, for nominal system voltage of 600 VAC and less, with field replaceable contacts.
   a. The magnetic starter contactor shall have a maximum pick up voltage requirement of 78 percent of nominal coil voltage and a maximum drop out voltage of 54 percent of nominal coil voltage for starter sizes 1, 2, 3 and 4, and 64 percent of nominal coil voltage for starter size 5.
   b. Minimum size contactor shall be NEMA 1.
   c. IEC starters are not permitted.
2. Configuration: NEMA ICS 2, Class A, full voltage, Nonreversing, unless indicated otherwise specify other configuration.
3. Contactor Coils: Pressure-encapsulated type with coil transient suppressors when indicated, rated for 120 VAC, unless indicated on the Drawings. Coils shall be field replaceable.
4. Auxiliary contacts shall be furnished on the starter contactor and on the overload sensing unit as shown on the Drawings.
5. Overload Relays:
   a. Thermal Overload Relays:
      1). Inverse-time-current characteristic.
      2). {Coordinate overload Class tripping characteristic with motor and load supplier.}
      3). Heaters in each phase shall be matched to nameplate full-load current of actual protected motor and with appropriate adjustment for duty cycle.
      4). Ambient compensated.
      5). Automatic resetting.

b. Overload relays shall be resettable from outside the enclosure by means of an insulated bar or pushbutton.

6. Power Supplies:

a. General Characteristics:

1). 120 VAC or 125 VDC input as shown on the Drawings.

2). 24 VDC output with voltage trimmer potentiometer.

3). Momentary overload capability for downstream fuse breaking.

4). Input voltage tolerance: +/- 10 percent.

5). Minimum Efficiency: 90 percent.

6). Power factor corrected input to a minimum of 0.9 lagging.

7). Load Regulation: +/- 2 percent.

8). Output Ripple: 50 mVpp.

9). DC OK contact.

b. Manufactured by:

1). Altech.

2). Phoenix Contact.

3). Sola HD.

2.04 CONTROL DEVICES

A. General Purpose Relays:

1. General purpose relays shall have coil voltages of 120 VAC, unless indicated otherwise on the Drawings.

2. General purpose relays shall be rated for a minimum 100,000 electrical cycles and dielectric withstand voltage a minimum of 1500V.

3. General Purpose Relays: tube style base with pin style terminals, silver nickel bifurcate silver nickel with gold plating contacts, 10A/B300 contact rating, DPDT Form C contacts or 3PDT, ON/OFF flag indicator, LED power present indicator, push-to-test, with electrical schematic printed on relay. Manufactured by Allen-Bradley 700-HA, Square D 8501KP, or Eaton D5 Series.

4. General Purpose Timing Relays: tube style base with pin style terminals, silver nickel contacts, 10A/B300 contact rating, DPDT Form C contacts, LED indicator for power present and device timing initiated, with knob thumbwheel or dial for adjusting timing range up to 120 minutes 999 hours. Refer to the Drawings for specified timing range. Manufactured by Allen-Bradley 700-HT, Square D 9050JCK, or Eaton TMR5 Manufactured by Allen-Bradley 700-HRM or Square D 9060JCK.

5. Repeat Cycle Timer (Up to 100 Hours): DIN rail mounted, screw type, asymmetrical flashing, 8A/240VAC contact rating, 1 CO contact composition, selector switch front panel, 60 Hertz, LED ON/OFF/Timing indicator, two independently adjustable timing

periods. Provide all accessories/parts for correct operation of timer. Refer to the Drawings for specified timing range. Manufactured by Allen-Bradley 700-HX86SA17, Square D RE17RLMU, or Eaton Universal TR TRW27.

6. Multifunction General Purpose Timing Relays tube style base with pin style terminals, silver nickel contacts, 10A/B300 contact rating, DPDT, LED indicator for power present and device timing initiated, with {thumbwheel} for adjusting timing range up to 999 hours and timing function. Timing functions available shall be at a minimum: On/Off Delay, Interval, Repeat Cycle On/Off, and Watchdog. Refer to the Drawings for specified timing range. Manufactured by Allen-Bradley 700-HX, Square D 9050JCK, or Eaton TMRP.
7. General Purpose Latching Relay: Dual coil latching type with coil clearing contacts hermetically sealed, plug-in type; 120 VAC with four Form C contacts rated 10 amps, manufactured by Potter and Brumfield KBP 17AG series or Clare.
8. General Purpose Tube Base Socket: screw terminal type, DIN rail mounting style, open closed (finger safe) style terminal construction.

B. NEMA Industrial Relays:

1. NEMA Industrial Relays: Heavy-duty machine tool type, bifurcate silver nickel contacts, 10A contact rating at 600 VAC, with field stackable up to [10] [12] contacts, field convertible contacts from normally open to normally closed, and push-to-test. Manufactured by Allen-Bradley 700-P or Square D 8501X.
2. NEMA Industrial Timing Relays: Heavy-duty machine tool type, bifurcate silver nickel contacts, 10A contact rating at 600 VAC, with field stackable sealed contact cartridges containing a minimum 2 instantaneous contacts and a minimum 2 convertible timed contacts, with dial for adjusting timing range up to 64 minutes. Refer to the Drawings for specified timing range. Manufactured by Allen-Bradley 700-RTC or Square D 8501X-TE .
3. NEMA industrial relays shall have coil voltages of 120 VAC, unless indicated otherwise on the Drawings.

C. Pump Alternators:

1. Duplex: 120VAC input power, three Form C contacts rated at 6A at 120V, led indicator for relay energization indication with electrical schematic printed on relay. Either surface mount or tube style base with pin style. Lead/Lag selector switch with pump 1 or pump 2 selector option.
   a. Single Switch (Float) Input: Manufactured by MPE 008.
   b. Two Switch (Float) Input: Manufactured by Littlefuse ALT-100-3-SW.
2. Triplex: 120 VAC input power, three switch (float) input, three Form C contacts rated at 6 A at 120 V, led indicator for relay energization indication with electrical schematic printed on relay. Either surface mount or tube style base with pin style. Sequences available: 1-2-3, 2-3-1 and 3-1-2. Manufactured by MPE 009-120-23 or Littlefuse PC-105.
3. Quadruplex: 120 VAC input power, four switch (float) input, four Form C contacts rated at 6 A at 120 V, led indicator for relay energization indication with electrical schematic

printed on relay. Either surface mount or tube style base with pin style. Sequences available: 1-2-3-4, 2-3-4-1, 3-4-1-2 and 4-1-2-3. Manufactured by MPE 009-120-34 or Littlefuse PC-105.

D. PLC Isolation/Interposing Relays: tube style base with blade style terminals, silver nickel bifurcate silver nickel with gold plating]= contacts, 10A/B300 contact rating, DPDT Form C contacts or 3PDT, ON/OFF flag indicator, LED power present indicator, push-to-test, with electrical schematic printed on relay. Manufactured by Allen-Bradley 700-HC.

E. Level Controller: Panel mounted level controller capable of accepting a single continuous level ultrasonic measurement for pump station wet well level monitoring and control. Controller shall have programmable level setpoints for pump down alternating control for three pumps. Controller shall have built in algorithms and signal processing to suppress false ultrasonic echoes, fixed object avoidance and shall have anti-grease ring buildup function. If transducer selected is not fitted with internal temperature compensation, a standalone temperature sensor shall be provided with controller. Controller backlit LCD display lettering shall be 1.5 inches.

1. Controller enclosure shall be NEMA 3 polycarbonate and shall be panel backplane mounted.
2. Controllers shall have an achievable resolution of 0.1 percent with accuracy to 0.25 percent of range.
3. Input and Outputs: Analog: One 4-20 mA input, two 4-20 mA outputs. Discrete: Six programmable total outputs, 4 SPST Form A and 2 DPDT Form C.
4. Controller must be approved for the hazardous location where the ultrasonic level transducer is located.
5. Manufactured by Siemens HydroRanger 200.

F. CURRENT LOOP ISOLATORS

1. Current isolators shall accept an input of 4-20 mA DC and produce a linearly proportional 4-20 mA DC output signal. Accuracy shall be +/- 0.1 percent of scale. Isolators shall operate on 24 VDC. Output load capability shall be 0-1000 ohms.
2. Current isolators shall be Acromag Model 631T-0500 or pre-approved equal by addendum.

G. Current Splitters:

1. Current splitters shall accept an input of 4-20 mA DC and produce a linearly proportional 4-20 mA DC output signal on each output. Outputs shall be galvanically isolated from each other. Accuracy shall be +/- 0.1 percent of scale. Splitter shall operate on 24 VDC. Output load capability shall be 0-1000 ohms.
2. Current isolators shall be Acromag Model 633T-0500 or pre-approved equal by addendum.

2.05 INDICATION AND CONTROL STATION DEVICES

A. Pushbuttons, selector switches and indication (pilot) lights shall be 30.5 mm type with a chromium plated metal or plastic bezel; dielectric strength of 2200V, 200,000 mechanical

cycles, shall be oil-tight, dust-tight and water-tight, and shall match the NEMA rating of the associated enclosure. All push buttons and selector switches will be able to accept additional contact decks to expand number of poles to those indicated on the Drawings.

B. Pushbuttons, selector switches and indications lights shall be manufactured by Allen-Bradley 800T/H, Square D 9001K or Eaton 10250T.

C. Provide double insulated bezels for all devices where enclosures are located in corrosive environments.

D. Pushbuttons: Spring return type with head flush to bezel, with without finger safe guard, with silver alloy contacts rated for 10A continuous current.

E. Mushroom Head Pushbuttons: Plastic Metal 40 or 45mm red color head, two-position maintained push-pull type,twist-to-release, with silver alloy contacts rated for 10 A continuous current.

F. Selector Switches: "Stay Put" short knob type, silver alloy contacts rated for 10 A continuous current.

G. Indication Lights: LED lamp type, with spring return push-to-test function where indicated on the Drawings. Unless indicated on the Drawings, indication light lens colors shall be:

1. White: Power On.
2. Amber: Alarm.
3. Red: Running, Closed or On.
4. Green: Stopped, Open or Off.

H. Beacon Sounder Combination: Synchronized sounder and LED combination, red lens steady LED in NEMA 4X construction. Manufactured by Allen Bradley Bulletin 855PC or Square D Harmony Type XV.

1. Locate on side of control panel.
2. Beacon sounder shall be shipped loose for field installation by Contractor where indicated.

I. Elapsed Time Meters: Six-digit electromechanical, non-reset type for totaling of hours; 120 VAC power supply, panel face mounted din rail mounted, NEMA 4X rated, manufactured by Yokogawa Type 240, Simpson Electric Model 55ET, or Eaton 6-T-3H. Process Indicator (Level Display): Process indicator shall take a 4-20 mA DC process variable signal input and display the current value of the process variable in engineering units on a 4-1/2 digit display. Display digits shall be bright red 0.56-inch seven-segment LEDs. Accuracy of unit shall be +/- 1 percent and each unit shall have a loop power supply for powering its own loop. Provide sunshield for indicators located outdoors. Process indicator shall be manufactured by Red Lion, Precision Digital or pre-approved equal by addendum.

J. Operator Interface Terminal (OIT):

1. Provide manufacturer's standard OIT, minimum size 10 inches. Each panel provided with an OIT will maintain the enclosure rating.
2. For all outdoor installations, provide OIT protector to prevent UV ray exposure. Protector shall be manufactured by Smith and Loveless.

2.06 PANEL ANCILLARIES

A. Receptacle: Each panel supplied with a PLC shall be supplied with a din rail mounted duplex receptacle for laptop use.

B. Lights: Provide LED strip lights above each door for panels that are 24 inches or greater in depth. Each door shall be fitted with a door switch to turn on lights when door is opened.

2.07 PANEL WIRING AND WIRE MANAGEMENT

A. Wire:

1. Power and discrete control conductors: single conductors, stranded tinned copper with 600 V type MTW insulation rated for 90C.

   a. Minimum 120, 208 and 480 VAC conductor size shall be #12 AWG.

   b. Minimum DC and discrete control conductor size shall be #14 AWG.

2. Analog conductors: #18 AWG shielded, twisted pair, 600 V insulation with extruded PVC jacket.

B. Power Distribution Blocks: Aluminum body with phenolic or thermoplastic holder, rated for 600 VAC at 90C, suitable for termination of copper conductors , with finger safe terminal cover.

1. Power distribution blocks shall be used for all conductors #10 AWG or larger entering or routed within control panel.

2. Mount to control panel backplane.

C. Terminal Blocks: single high stacked 600-volt rated, suitable for up to #10 AWG conductor size, manufactured by Allen-Bradley 1492 H1 or Allen-Bradley 1492-CA2 or approved equal. Two high stacked terminal blocks will not be permitted.

1. Each terminal strip shall have hinged marking surfaces which snap on. Typewritten labels shall denote terminal strip numbers and shall match numbers shown on Shop Drawings, O&M manuals and wiring diagrams. Marking surfaces shall be Allen-Bradley 1492-N41 and labels shall be Allen-Bradley 1492-N43.

2. Provide minimum 25 percent spare terminals on terminal strip for customer's use.

D. Current Loop Isolators: Current isolators shall accept an input of 4-20 mA DC and produce a linearly proportional 4-20 mA DC output signal. Accuracy shall be +/- 0.1 percent of scale. Isolators shall loop powered. Output load capability shall be a minimum of 1000 ohms. Current isolators shall be Phoenix Contact MCR-SL or approved equal.

E. Wire Duct: Slotted duct, with flush cover. Snap back wire retention trap with deep slots to allow larger wire sizes. Wire duct shall be sized to be a maximum of 40 percent fill. Separate wire ducts shall be provided for 480 V power, 120 V power, and control/instrumentation wiring.

F. Braided Expandable Wire Sleeving: Hook and loop fastener; made of 100 percent nylon.

G. Fiber Optic Patch Panel: All fiber connections entering control panel must be terminated on a din rail or backplane mounted patch panel. Provide sufficient number of connectors within patch panel to terminate all fibers, including spare.

H. Colored, vinyl marking tape shall be allowed only on conductors greater than 8 AWG. Under no condition shall conductors of a different color be spliced together. All wiring shall be identified with wiring markers with alphanumeric characters. The identification of each wire shall be the same as that shown on the electrical schematic. Each wire shall be so identified at each end. Each end of every wire shall be provided with a heat shrinkable or equivalent sleeve-type wire marker-labeled in accordance with the electrical schematic. Use of adhesive and clip-on type markers is prohibited.

2.08 PANEL LAYOUT REQUIREMENTS

A. All components in the control panel shall be completely factory wired. All external control connection points shall terminate on power distribution blocks or terminal blocks.

B. Control relays, timing relays, control transformers, control circuit fuse blocks, etc., shall be grouped in the corresponding starter with control wiring kept as short as possible. Ample space shall be allowed between devices so that each component is completely accessible without removing any other device.

C. If any MCP or circuit breaker operating handle is more than 6 feet-6 inches above the floor surface immediately in front of the control panel, a supplementary operating device shall be attached to the operating handle. This supplementary device shall require a person to reach no more than 6 feet-6 inches above the floor surface at any point of opening or closing the MCP or circuit breaker.

D. Wires shall be neatly placed in plastic wireways with the covers installed. Wires not in a wireway shall be zip tied together and fastened to the enclosure or back plane with adhesive mounting base.

E. Wiring in the control panel shall terminate on numbered terminal strips or power distribution blocks. No other wire connecting devices, such as wirenuts or split bolts, shall be allowed in the control panel. Each starter shall be provided with an individual terminal strip for control wiring. This terminal strip shall be completely accessible from the front.

F. Control panel shall have a single means of disconnecting power to the whole enclosure and a separate 120 V control power circuit breaker.

G. Wire extending from the enclosure to the enclosure door shall be wrapped in expandable wire sleeves.

H. For door-in-door construction enclosures, all devices intended to be visible while outer door is closed shall have devices located on side of enclosures.

I. Controls shall be laid out on a removable backboard and backboard. All external fasteners on the control panel shall be stainless steel.

3.00 EXECUTION

3.01 ENCLOSURE INSTALLATION SCHEDULE

A. Outdoor: Painted steel NEMA 250, Type 1, except use NEMA 250, Type 4X stainless steel.

3.02 PREPARATION

A. Enclosure shall be clean and free of sharp corners. Conductors shall be grouped together and routed in a neat and orderly fashion.

3.03 INSTALLATION

A. Make all electrical connections to all equipment specified. Install equipment in accordance with the manufacturer's recommendations and the Drawings. If neither are available, install the equipment using recognized practices of the electrical industry and trade.

B. The final control schematic shall be printed and placed in a clear plastic sleeve after all the field modifications have been made.

C. Conduit Penetrations:

1. No top entry of conduit into panels shall be permitted , unless located in dry locations.

2. Where top entry of enclosures is allowed, conduit penetrations must not be located directly over devices that conductors are being terminated to. Resting conductors on non-related devices is not permissible.

3. Where conduits enter the top of the enclosure, the must not be terminated or routed directly above or in front of any solid state device. Conductors must not be supported by devices within the enclosure. Conductors routed around in the enclosure, but on the outer edge of the backplane, must be supported by the enclosure and must not restrict access to anything on the enclosure. If the enclosure must be oversized to accommodate the number of conductors to meet this specification, then it must be provided at no additional cost to the Owner.

4. Side entry of conduits is allowed but must not interfere with devices or Panduit mounted to the backplane. Conductors must not rest against devices and routing of conductors must not block maintenance access to any device or terminal blocks.

D. Penetrations must not be made into control panels until raceways systems entering and exiting control panel are watertight.

E. Floor mounted enclosures in conditioned environments shall have 4-inch housekeeping pad.

F. All wire terminals shall be torqued to manufacturer's torque value.

3.04 FIELD QUALITY CONTROL

A. Functional Checkout: Upon completion of the installation, perform continuity tests and functional checkout to ensure the proper operation of all equipment.

B. Acceptance Testing Preparation:

1. Test insulation resistance for each enclosed controller, component, connecting supply, feeder, and control circuit.

2. Test continuity of each circuit.

C. Tests and Inspections:

1. Inspect controllers, wiring, components, connections, and equipment installation. Test and adjust controllers, components, and equipment.
2. Test insulation resistance for each enclosed-controller element, component, connecting motor supply, feeder, and control circuits.
3. Test continuity of each circuit.
4. Verify that voltages at controller locations are within +/- 10 percent of motor nameplate rated voltages. If outside this range for any motor, notify Owner/Engineer before starting the motor(s).
5. Perform each electrical test and visual and mechanical inspection stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
6. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
7. Test and adjust controls, remote monitoring, and safeties. Replace damaged and mal-functioning controls and equipment.

3.05 ADJUSTING

A. Prior to energizing control panel loads, the following adjustments must be made and documented.

1. Set field-adjustable switches, auxiliary relays, time-delay relays, timers, and overload-relay pickup and trip ranges.
2. Adjust overload-relay heaters or settings.
3. Set field-adjustable circuit-breaker trip ranges.

3.06 CLEANING AND TOUCHUP

A. Remove all metal shavings, dirt and dust from panel interior. Do not use compressed air to clean panel interior.

B. Painted steel panels will have any scratches to the paint repaired to factory conditions with manufacturer supplied paint. Any rust developed prior to applying touch up paint will be sanded back to bare metal prior to painting.

3.07 PROTECTION

A. Temporary Heating: Apply temporary heat to maintain temperature according to manufacturer's written instructions until enclosed controllers are ready to be energized and placed into service.

B. Replace controllers whose interiors have been exposed to water or other liquids prior to Substantial Completion.

END OF SECTION

26 29 16 MOTOR OPERATORS FOR VALVES

1.00 GENERAL

1.01 SUMMARY

A. This Section covers the furnishing of the three-phase electric motor operators for valves. Motorized actuators furnished as part of this Section shall comply with AWWA C540.

B. The operators shall include the motor, reversing starter, power disconnect, 4-20 ma positioner, control transformer, relays, power gearing, limit switch gearing, limit switches, phase failure relay, adjustable torque switches, feedback potentiometer for modulating valves, stem nut, auxiliary hand-wheel, local digital display, local control station, switch housings and special brackets to mate with the valve, all as a self-contained unit.

C. The manufacturer of each valve shall work with the actuator manufacturer for the proper sizing of the corresponding motor operator. Complete operator sizing calculations showing required unseating and running torque requirements under actual operating conditions shall be submitted with the Shop Drawings for review. The operator shall develop 150 percent of the required unseating torque and 100 percent of the required running torque under actual operating conditions. Operating conditions shall take into consideration the pressure differential across the valve and shutoff heads. Operators shall be capable of operating over an ambient temperature range of -20 to 150 deg. F.

D. Motor operator for 90-degree rotation valves shall move valve through 90 degrees rotation in not less than 1 minute nor more than 3 minutes, unless specified otherwise. Should motor operator be multi-turn, it shall be sized to operate per the valve manufacturer specs. The motor operator shall be a programmable function, each unit provided with an infrared setting tool, field adjustable and without opening the actuator enclosure or by changing gears within the housing.

1.02 SUBMITTALS

A. Submittals shall be in accordance with Section 01 33 00 “Document Management” and shall include:

1. Product data, including size, dimensions, capacity, settings, and operating characteristics of selected models.

2. Maintenance data for specialties, for inclusion in operation and maintenance manual specified in Division 01.

2.00 PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide motorized valve operators manufactured by Rotork, or pre-approved equivalent.

B. All technologies and devices used in the actuator must have a minimum of 5 years commercial operating experience for that specific manufacturer. This is to include torque and position sensing, lubrication, and electrical compartment design.

2.02 CONSTRUCTION

A. Hand-wheel: Operators shall be equipped with an auxiliary hand-wheel to provide for actuation of the valve in the event of power failure. The hand-wheel shall not turn during normal operation of the valve. The hand/auto selection lever should be pad-lockable in both "Hand" and "Auto" positions. It should be possible to select hand operation while the actuator is running or start the actuator motor while the hand/auto selection lever is locked in "Hand" without damage to the drive train. The hand-wheel drive must be mechanically independent of the motor drive, and any gearing should be such as to permit emergency manual operation in a reasonable time.

B. Drive Bushing: The actuator shall be furnished with a drive bushing easily detachable for machining to suit the valve stem or gearbox input shaft. Normally the drive bush shall be positioned in a detachable base of the actuator. Thrust bearings, when housed in a separate thrust base, should be of the sealed-for-life type.

C. Power Gearing:

1. The actuator gearing shall be totally enclosed in an oil-filled gear-case suitable for operation at any angle. All main drive gearing must be of metal construction. Where the actuator operates gate valves or large diameter ball or plug valves, the drive shall incorporate a lost-motion hammer-blow feature. For rising spindle valves, the output shaft shall be hollow to accept a rising stem and incorporate thrust bearings of the ball or roller type at the base of the actuator, and the design should be such as to permit the gear-case to be opened for inspection or disassembled without releasing the stem thrust or taking the valve out of service.

2. For full Modulating applications, “hammer-blow” feature should be removed to increase accuracy and reduce wear.

D. Motor:

1. The electric motor shall be Class F insulated with a time rating of at least 15 minutes at 104 deg. F (40 deg. C) or twice the valve stroking time, whichever is the longer, at an average load of at least 33 percent of maximum valve torque.

2. Electrical and mechanical disconnection of the motor should be possible without draining the lubricant from the actuator gear case. Plugs and sockets are not acceptable as a means of electrical connection for the motor.

3. Motor enclosures shall be NEMA 4 explosion-proof submersible per IP 68.

4. Motor Protection shall be single phasing protection. The motor shall be de-energized in the event of stall when attempting to unseat a jammed valve. Motor temperature shall be sensed by a thermostat to protect against overheating.

E. Electrical:

1. The actuators shall be suitable for use on a nominal 120V, 2 phase, 60 Hertz power supply and are to incorporate motor, gearbox, integral reversing starter, local control facilities, and terminals for remote control and indication connections.

2. The actuator shall include a phase discriminator: a device to ensure that the motor runs with the correct rotation for the required direction of valve travel with either phase sequence of the three-phase power supply connected to the actuator.

F. Torque and Turns Limitations: Torque and turns limitation to be adjustable as follows:

1. Torque Rating: 3115 ft-lb, minimum or as required by the valve supplier.
2. Position Setting Range: 2.5 to 100,000 turns, with resolution to 15 degrees of actuator output.
3. Torque Setting: 40 to 100 percent rated torque.
4. Torque sensing must be affected purely electrically or electronically. Extrapolating torque from mechanically measured motor speed is not acceptable due to response time; nor shall springs be utilized.
5. “Latching" to be provided for the torque sensing system to inhibit torque off during unseating or during starting in mid-travel against high inertia loads.
6. The electric circuit diagram of the actuator should not vary with valve type remaining identical regardless of whether the valve is to open or close on torque or position limit. An inexpensive setting tool is required for non-intrusive calibration and interrogation of the actuator. This setting tool will provide speedy interrogation capabilities as well as security in a non-intrusive intrinsically safe watertight casing.

G. Controls:

1. Remote Valve position/Actuators Status Indication:
    a. The actuator must provide a local display of the position of the valve via a LCD in percentages, even when the power supply is not present. In the event of a (main) power (supply) loss or failure, the position contacts must continue to be able to supply remote position feedback and maintain interlock capabilities.
    b. Open/Close Operating Actuators:
        1). Four latching volt free contacts shall be provided which can be selected to indicate any position of the valve with each contact selectable as normally open or normally closed. Each contact can be configured to either -normally open- or -normally closed- via the infrared setting tool and rated at 5 mA to 5 amps, 120 VAC, 30 VDC.
        2). Any of the four above contacts shall be independently configurable to signal one of the following:
            a). Valve Position - fully open, fully closed or intermediate positions (0-99 percent open).
            b). Status - Valve opening, closing, moving (continuous or pulsing signal), local stop selected, local selected, remote selected, open or close interlock active, ESD active.
            c). Valve Alarms - Motor tripped on torque in mid travel, motor tripped on torque going open, going closed, valve jammed, actuator being operated by hand-wheel.
    c. Modulating Actuators:
        1). Positioner:

a). Positioner shall balance a 4-20 mA DC input signal and a feedback signal from a precession potentiometer. Relay output from the positioner shall energize the reversing contactors to drive the actuator in either the open of close direction. Positioner shall have separate zero and span settings for calibration of feedback potentiometer. Time delay setting shall be provided to suppress hunting. The time delay setting shall be adjustable from 1.5 to 15 seconds. Dead band adjustment shall be provided to control the amount of error signal that occurs before the motor is energized.

b). All positioners, potentiometer, starters, switches, relays, transformers and related controls shall be mounted within the actuator housing.

2. Local Position Indication: The actuator shall include a digital position indicator with a display from fully open to fully closed in 1 percent increments. Red, green, and yellow lights corresponding to Open, Closed, and Intermediate positions shall be included on the actuator. The digital display shall be maintained even when the power to the actuator is isolated. The local display should be large enough to be viewed from a distance of 6 feet when the actuator is powered up. Provision shall be made in the design for the addition of a transmitter without contacts to give a 4-20 mA analog signal corresponding to valve travel for remote indication when required.

3. Integral Starter and Transformer: The reversing starter, control transformer, and local controls shall be integral with the valve actuator, suitably housed to prevent breathing and condensation buildup. For ON/OFF service, this starter shall be an electromechanical type suitable for 60 starts per hour and of rating appropriate to motor size. For modulating duty, the starter shall be solid state and suitable for up to a maximum of 1200 starts per hour. The controls supply transformer shall be fed from two of the incoming three phases. The transformer shall be furnished with sufficient capacity to operate the contactor. It shall have the necessary tapping and be adequately rated to provide power for the following functions:

   a. 120 VAC energizing of the contactor coils.

   b. 24 VDC output where required for remote controls.

   c. Supply for all the internal electrical circuits.

   d. The primary and secondary windings shall be protected by easily replaceable fuses.

4. Integral Push Buttons and Selector Switches:

   a. Local, Stop, and Remote Selector Switch lockable in the Stop position.

   b. Open/Close selector switch.

5. Controls shall be arranged so that direction of valve travel can be reversed without the necessity of stopping the actuator.

6. Internal Wiring and Terminal:

   a. Internal wiring shall be of tropical grade PVC insulated stranded cable of appropriate size for the control and three- phase power. Each wire shall be clearly identified at each end. The terminals shall be embedded in a terminal block of high tracking resistance compound. The terminal compartment shall be separated from the inner electrical components of the actuator by means of a watertight seal. The terminal

compartment of the actuator shall be provided with a minimum of three threaded cable entries.

b. All wiring supplied as part of the actuator to be contained within the main enclosure for physical and environmental protection. Control logic circuit boards and relay boards must be mounted on plastic mounts to comply with double insulated standards. No more than a single primary size fuse shall be provided to minimize the need to remove single covers for replacement.

c. A durable terminal identification card showing plan of terminals shall be provided attached to the inside of the terminal box cover indicating serial number, external voltage values, wiring diagram and terminal layout.

7. Separate Control Module: There shall be furnished and mounted on each operator a separate control module, submersible, explosion-proof, containing a lockable power disconnect which shall disconnect all power from the operator for servicing. Supply voltage disconnect that meets the rating of the actuator.

8. Reversing Contactors: Each operator shall have an integral three-phase, full-voltage, reversing contactor with mechanical and electrical interlocks and three overload sensing relays. The contactor control voltage shall be 120 VAC. The contactor shall have auxiliary contacts as shown in the schematics.

9. Phase Failure Relay: Each operator shall be protected against loss of any one phase, phase unbalance, and phase rotation reversal.

H. Communications:

1. Monitoring and Diagnostic:

a. Shall provide eight programmable feedback status including:

1). Local-Stop-Remote (remote position status).

2). Open status.

3). Closed status.

4). High Torque alarm.

5). 2 Intermediate position 0-99 percent.

6). Internal failure.

b. Actuators shall include a diagnostic module, which will store and enable download of historical actuator data to permit analysis of changes in actuator or valve performance. A software tool shall be provided to allow configuration and diagnostic information to be reviewed and analyzed and reconfigured.

c. Diagnostic status screens must be provided to show multiple functions simultaneously so troubleshooting can be affected rapidly and efficiently. All diagnostic information should be contained on no more than eight screens so multiple functions can be checked simultaneously.

d. Provision shall be made to graphically display valve torque demand as a percent of rated actuator torque vs. position simultaneously in 1 percent increments so as to facilitate valve troubleshooting and diagnostics.

I. Enclosure:

1. Actuators shall be 'double O' ring sealed, watertight to NEMA 6, IP68 during operation and shall at the same time have an inner watertight and dustproof 'O' ring seal between the terminal compartment and the internal electrical elements of the actuator fully protecting the motor and all other internal electrical elements of the actuator from ingress of moisture and dust when the terminal cover is removed on-site for cabling.
2. Enclosure must allow for temporary site storage without the need for electrical supply connection or require special storage instructions, desiccants shall not be used. A space shall not be required due to the enclosure design.
3. All external fasteners should be of stainless steel.

2.03 PAINTING

A. The operator mechanism shall be supplied with a factory finish consisting of thoroughly cleaning all surfaces, a prime coat, and the manufacturer's standard paint finish.

3.00 EXECUTION

3.01 INSTALLATION

A. The electric motor operators shall be carefully handled and installed in accordance with manufacturer's recommendations.

B. All actuators shall be started in the field by the actuator factory representative.

3.02 MANUFACTURER'S REPRESENTATIVE

A. The services of a factory representative shall be provided for whatever time period is required to ensure proper installation and startup of the motor operators, and for instruction of the Owner's operating personnel in the proper operation and maintenance of the equipment.

B. All startup and commissioning functions shall be provided by the authorized manufacturer's representative.

C. All actuators shall be warranted for a minimum of 3 years.

3.03 PERFORMANCE TEST CERTIFICATE

A. Each actuator must be performance tested and individual test certificates shall be supplied free-of-charge. The test certificate should record details of specification, such as gear ratios for both manual and automatic drive, closing direction, and wiring diagram code number.

B. The test should simulate a typical valve load and the following parameters should be recorded: current at maximum torque setting, torque at maximum torque setting, flash test voltage, actuator output speed or operating time.

C. In addition, the test certificate should record details of specification, such as gear ratios for both manual and automatic drive, closing direction, and wiring diagram code number.

3.04 ACCEPTANCE TEST

A. Upon completion of the installation of the operators, an acceptance test will be conducted to verify the satisfactory operation of the equipment. The test shall be conducted in a manner approved by, and in the presence of the Engineer. The equipment will be checked for general operation, etc. The equipment must perform in a manner acceptable to the Engineer before final acceptance will be made by the Owner.

END OF SECTION

DIVISION 31

EARTHWORK

31 05 13 SOILS FOR EARTHWORK

1.00 GENERAL

1.01 WORK INCLUDED

A. This Section of the specifications describes the various classes of Earth Fill. All of the classes of Earth Fill contained in this specification may not be used on this project. The classes of Earth Fill used on this project are shown on the drawings or specified in other sections of the specifications. This Section does not include specifications for placement and compaction of Earth Fill. Specifications for placement and compaction of Earth Fill are included in other sections of the specifications and/or shown on the drawings.

1.02 STANDARDS

A. Soil materials shall be classified into the appropriate class of Earth Fill shown below according to ASTM D2487 “Standard Classification of Soils for Engineering Purposes (Unified Soil Classification System)” or other appropriate methods as designated by the Engineer.

2.00 PRODUCTS

2.01 MATERIALS; CLASSIFICATIONS

A. Class 1 Earth Fill: Limited to clays and sandy clays classified as CH material with a liquid limit greater than or equal to 50, a plasticity index greater than or equal to 25, and a minimum of 60 percent passing the No. 200 sieve, which are free of organic materials.

B. Class 2 Earth Fill: Limited to clays and sandy clays classified as CH and CL materials with a coefficient of permeability less than or equal to 1.0×10^{-7} cm/sec, a liquid limit greater than or equal to 30, a plasticity index greater than or equal to 15, and more than 50 percent passing the No. 200 sieve, which are free of organic materials.

C. Class 3 Earth Fill: Consist of any materials classified as CH, CL, SM, SP, SP-SM, SC, and GC, which have a minimum plasticity index of 4, which are free of organic materials.

D. Class 4 Earth Fill: Consist of materials which are classified as SP, SM, SC, CL, or dual classifications thereof, which have a liquid limit less than or equal to 35 and a plasticity index of a minimum of 4 and a maximum of 15, which are free of organic materials.

E. Class 5 Earth Fill: Consist of materials classified as SP or SP-SM which have a plasticity index less than or equal to 4 and a maximum of 12 percent passing the No. 200 sieve, which are free of organic materials.

F. Class 12 Earth Fill: Consist of soils suitable for topsoil which are relatively free of stones or other objectionable debris, which have sufficient humus content to readily support vegetative growth. The suitability of soils for topsoil shall be subject to the approval of the Engineer.

3.00 SUBMITTALS

3.01 A. PRODUCT DATA:

A. 1. Material source.

B. 2. Gradation.

C. 3. Testing data.

3.02 B. QUALITY CONTROL FOR AGGREGATE BASE COURSE:

A. 1. Test reports: Reports for tests required by Sections of Standard Specifications.

B. 2. Certificates of Compliance: Certificates as required by Sections of Standard Specifications.

4.00 DELIVERY, STORAGE, AND HANDLING

4.01 Storage and protection: protect from segregation and excessive moisture during delivery, storage, and handling.

5.00 MATERIALS

5.01 GENERAL

A. Provide material having maximum particle size not exceeding 2 inches and that is free of trash, lumber, debris, leaves, grass, roots, stumps, and other organic matter.

B. 2. Materials derived from processing demolished or removed asphalt concrete are not acceptable.

5.02 DRAIN ROCK

A. Durability: Percentage of wear not greater than 40 percent when tested in accordance with ASTM C131.

B. Consists of hard, durable particles of stone or gravel; screened or crushed to specified size and gradation; and free from organic matter, lumps or balls of clay, or other deleterious matter.

C. Crush or waste coarse material and waste fine material as required to meet gradation requirements.

D. Conforms to size and grade within the following limits when tested in accordance with ASTM C117 and C136

5.03 NATIVE MATERIAL:

A. Sound, earthen material passing 1-inch sieve.

B. Percent of material by weight passing Number 200 sieve shall not exceed 30 when tested in accordance with ASTM D422.

C. Expansion index less than 35 when tested in accordance with ASTM D4829.

5.04 SAND:

A. Clean, coarse, natural sand.

B. Non-plastic when tested in accordance with ASTM D4318.

C. 100 percent shall pass a 1/2-inch screen.

D. No more than 20 percent shall pass a Number 200 sieve.

5.05 SELECT MATERIAL:

A. Sound earthen material for which the sum of plasticity index when tested in accordance with ASTM D4318 and the percent of material by weight passing a Number 200 sieve shall not exceed 23 when tested in accordance with ASTM D422.

B. 100 percent shall pass a 1-inch screen.

C. Organic content shall not be greater than 3 percent by volume.

6.00 REFRENCES

A. ASTM International (ASTM):

1. C117 - Standard Test Method for Materials Finer than 75-µm (No. 200) Sieve in Mineral Aggregates by Washing.
2. C131 - Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.
3. C136 - Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
4. D2419 - Standard Test Method for Sand Equivalent Value of Soils and Fine Aggregate.
5. D4318 - Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.
6. D4829 - Standard Test Method for Expansion Index of Soils.

7.00 EXECUTION (NOT APPLICABLE)

END OF SECTION

31 05 16 AGGREGATES FOR EARTHWORK

1.00 GENERAL

1.01 WORK INCLUDED

A. This Section of the specifications describes the various classes of Aggregate Fill. All of the classes of Aggregate Fill contained in this specification may not be used on this project. The classes of Aggregate Fill used on this project are shown on the drawings or specified in other sections of the specifications. This Section does not include installation. Installation of Aggregate Fill is included in other sections of the specifications and/or on the drawings.

1.02 QUALITY ASSURANCE

A. Classification Testing:

1. Contractor Testing:

a. Arrange and pay for the services of an independent testing laboratory to sample and test proposed Aggregate Fill materials.

b. Submit the test results to the Engineer, and obtain approval prior to providing Aggregate Fill.

2. Owner Testing: The Owner shall arrange and pay for additional testing on the Aggregate Fill after delivery to the project site as determined necessary by the Engineer.

B. Contamination Certification:

1. Obtain a written, notarized certification from the Supplier of each proposed Aggregate Fill source stating that to the best of the Supplier's knowledge and belief there has never been contamination of the source with hazardous or toxic materials.

2. Submit these certifications to the Engineer prior to proceeding to furnish Aggregate Fill to the site. The lack of such certification on a potential Aggregate Fill source shall be cause for rejection of that source.

1.03 STANDARDS

A. Aggregate Fill shall be classified into the appropriate class listed below according to ASTM testing procedures as specified for the various classes.

1. American Society for Testing and Materials (ASTM) Standards:

ASTM C33	Specification for Concrete Aggregates
ASTM C88	Test Method for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium sulfate
ASTM C125	Terminology Relating to Concrete and Concrete Aggregates
ASTM C131	Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
ASTM C535	Test Method for Resistance to Degradation of Large-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
ASTM D448	Classification for Sizes of Aggregate for Road and Bridge Construction

2.00 PRODUCTS

2.01 MATERIALS; CLASSIFICATIONS

A. Class 1 Aggregate Fill: Consist of durable particles of crushed stone free of silt, clay, or other unsuitable materials and have a percentage of wear of not more than 40 percent when tested in accordance with ASTM C131 or C535. When material is subjected to five cycles of the sodium sulfate soundness test in accordance with ASTM C88, Sodium Sulfate Solution, the weighted percentage of loss shall not exceed 12 percent. The source of the material shall be approved by the Engineer and meet the following gradation in accordance with ASTM D448, size number 57:

Sieve Size Square Opening	Percent Passing
1-1/2”	100
1”	95-100
1/2”	25-60
No. 4	0-10
No. 8	0-5

B. Class 2 Aggregate Fill: Consist of durable particles of crushed stone free of silt, clay, or other unsuitable materials and have a percentage of wear of not more than 40 percent when tested in accordance with ASTM C131 or C535. When material is subjected to five cycles of the sodium sulfate soundness test in accordance with ASTM C88, Sodium Sulfate Solution, the weighted percentage of loss shall not exceed 12 percent. The source of the material shall be approved by the Engineer and meet the following gradation in accordance with ASTM D448, size number 67:

Sieve Size Square Opening	Percent Passing
1”	100
3/4”	90-100
3/8”	20-55
No. 4	0-10
No. 8	0-5

C. Class 3 Aggregate Fill: Consist of durable particles of crushed stone free of silt, clay, or other unsuitable materials and have a percentage of wear of not more than 40 percent when tested in accordance with ASTM C131 or C535. When material is subjected to five cycles of the sodium sulfate soundness test in accordance with ASTM C88, Sodium Sulfate Solution, the weighted percentage of loss shall not exceed 12 percent. The source of the material shall be approved by the Engineer and meet the following gradation in accordance with ASTM D448, size number 7:

Sieve Size Square Opening	Percent Passing
3/4”	100
1/2”	90-100
3/8”	40-70
No. 4	0-15
No. 8	0-5

D. Class 4 Aggregate Fill: Consist of durable particles of crushed stone free of silt, clay, or other unsuitable materials and have a percentage of wear of not more than 40 percent when tested in accordance with ASTM C131 or C535. When material is subjected to five cycles of the sodium sulfate soundness test in accordance with ASTM C88, Sodium Sulfate Solution, the weighted percentage of loss shall not exceed 12 percent. The source of the material shall be approved by the Engineer and meet the following gradation in accordance with ASTM D448, size number 467:

Sieve Size Square Opening	Percent Passing
2”	100
1-1/2”	95-100
3/4”	35-70
3/8”	10-30
No. 4	0-5

E. Class 5 Aggregate Fill: Consist of durable particles of crushed stone free of silt, clay, or other unsuitable materials and have a percentage of wear of not more than 40 percent when tested in accordance with ASTM C131 or C535. When material is subjected to five cycles of the sodium sulfate soundness test in accordance with ASTM C88, Sodium Sulfate Solution, the weighted percentage of loss shall not exceed 12 percent. The source of the material shall be approved by the Engineer and meet the following gradation in accordance with ASTM D448, size number 357:

Sieve Size Square Opening	Percent Passing
2-1/2”	100
2”	95-100
1”	35-70
1/2”	10-30
No. 4	0-5

F. Class 6 Aggregate Fill: Consist of durable particles of crushed stone free of silt, clay, or other unsuitable materials and have a percentage of wear of not more than 40 percent when tested in accordance with ASTM C131 or C535. When material is subjected to five cycles of the sodium sulfate soundness test in accordance with ASTM C88, Sodium Sulfate Solution, the weighted percentage of loss shall not exceed 12 percent. The source of the material shall be approved by the Engineer and meet the following gradation in accordance with ASTM D448, size number 1:

Sieve Size Square Opening	Percent Passing
4”	100
3-1/2”	90-100
2-1/2”	25-60
1-1/2”	0-15
3/4”	0-5

G. Class 7 Aggregate Fill: Consist of durable particles of crushed stone free of silt, clay, or other unsuitable materials and shall have a percentage of wear of not more than 40 percent when tested in accordance with ASTM C131 or C535. When material is subjected to five cycles of the sodium sulfate soundness test in accordance with ASTM C88, Sodium Sulfate Solution, the weighted percentage of loss shall not exceed 12 percent. The source of the material shall be approved by the Engineer and meet the following gradation in accordance with ASTM D448, size number 6:

Sieve Size Square Opening	Percent Passing
1”	100
3/4”	90-100
1/2”	20-55
3/8”	0-15
No. 4	0-5

H. Class 8 Aggregate Fill: Consist of durable particles of crushed stone free of silt, clay, or other unsuitable materials and shall have a percentage of wear of not more than 40 percent when tested in accordance with ASTM C131 or C535. When material is subjected to five cycles of the sodium sulfate soundness test in accordance with ASTM C88, Sodium Sulfate Solution, the weighted percentage of loss shall not exceed 12 percent. The source of the material shall be approved by the Engineer and meet the following gradation in accordance with ASTM D448, size number 56:

Sieve Size Square Opening	Percent Passing
1-1/2”	100
1”	90-100
3/4”	40-85
1/2”	10-40
3/8”	0-15
No. 4	0-5

I. Class 9 Aggregate Fill:

1. Consist of washed and screened gravel and natural sands or sands manufactured by crushing stones complying with the requirements of ASTM C33, except that the gradation shall be as follows:

Sieve Size Square Opening	Percent Passing
1/2”	100
3/8”	95-100
No. 4	80-95
No. 8	65-85
No. 16	50-75
No. 30	25-60
No. 50	10-30
No. 100	0-10

2. Class 9 Aggregate Fill shall have not more than 45 percent passing any sieve and retained on the next consecutive sieve of those shown above, and its fineness modulus, as defined in ASTM C125, shall be not less than 2.3 nor more than 3.1.

J. Class 10 Aggregate Fill:

1. Consist of washed and screened natural sands or sands manufactured by crushing stones complying with the requirements and tests of ASTM C33. The gradation as included in ASTM C33 is as follows:

Sieve Size Square Opening	Percent Passing
3/8”	100
No. 4	95-100
No. 8	80-100
No. 16	50-85
No. 30	25-60
No. 50	10-30
No. 100	0-10

2. Class 10 Aggregate Fill shall have not more than 45 percent passing any sieve and retained on the next consecutive sieve of those shown above, and its fineness modulus, as defined in ASTM C125, shall be not less than 2.3 nor more than 3.1.

K. Class 11 Aggregate Fill: Consist of durable particles of crushed stone free of silt, clay, or other unsuitable material and have a percentage of wear of not more than 40 percent when tested in accordance with ASTM C131 or C535. When material is subjected to five cycles of the sodium sulfate soundness test in accordance with ASTM C88, Sodium Sulfate Solution, the weighted percentage of loss shall not exceed 12 percent. The source of the material shall be approved by the Engineer and meet the following gradation:

Sieve Size Square Opening	Percent Passing
1-3/4”	100
7/8”	65-90
3/8”	50-70
No. 4	35-55
No. 40	15-30
No. 100	0-12 (Wet Sieve Method)

L. Class 12 Aggregate Fill: Consist of durable particles of crushed stone free of silt, clay, or other unsuitable material and have a percentage of wear of not more than 40 percent when tested in accordance with ASTM C131 or C535. When material is subjected to five cycles of the sodium sulfate soundness test in accordance with ASTM C88, Sodium Sulfate Solution, the weighted percentage of loss shall not exceed 12 percent. The source of the material shall be approved by the Engineer and meet the following gradation:

Sieve Size Square Opening	Percent Passing
1-1/2”	100
1”	85-100
3/4”	60-95
3/8”	50-80
No. 4	40-65
No. 16	20-40
No. 100	0-12 (Wet Sieve Method)

M. Class 13 Aggregate Fill: Consist of durable particles of crushed stone free of silt, clay, or other unsuitable material and have a percentage of wear of not more than 40 percent when tested in accordance with ASTM C131 or C535. When material is subjected to five cycles of the sodium sulfate soundness test in accordance with ASTM C88, Sodium Sulfate Solution, the weighted percentage of loss shall not exceed 12 percent. The source of the material shall be approved by the Engineer and shall meet the following gradation:

Sieve Size Square Opening	Percent Passing
1-3/4”	100
7/8”	65-90
3/8”	50-70
No. 4	35-55
No. 40	15-30
No. 100	0-3 (Wet Sieve Method)

N. Class 14 Aggregate Fill: Consist of durable particles of crushed stone free of silt, clay, or other unsuitable material and have a percentage of wear of not more than 40 percent when tested in accordance with ASTM C131 or C535. When material is subjected to five cycles of the sodium sulfate soundness test in accordance with ASTM C88, Sodium Sulfate Solution, the weighted percentage of loss shall not exceed 12 percent. The source of the material shall be approved by the Engineer and meet the following gradation:

Sieve Size Square Opening	Percent Passing
1-1/2”	100
1”	85-100
3/4”	60-95
3/8”	50-80
No. 4	40-65
No. 16	20-40
No. 100	0-3 (Wet Sieve Method)

O. Class 15 Aggregate Fill: Consist of durable particles of silica sand, washed clean, chemically inert, and packaged by the Supplier. The material shall meet applicable regulatory requirements for monitor well filter pack. The source of the material shall be approved by the Engineer and shall meet the following gradation requirements:

Sieve Size Square Opening	Percent Passing
No. 20	98-100
No. 40	0-2

3.00 EXECUTION (NOT APPLICABLE)

END OF SECTION

31 11 00 CLEARING AND GRUBBING

1.00 GENERAL

1.01 WORK INCLUDED

A. Provide labor, materials, equipment and incidentals necessary to perform operations in connection with clearing, grubbing, and disposal of cleared and grubbed materials.

1.02 QUALITY ASSURANCE; DEFINITIONS

A. Clearing: Clearing is defined as the removal of trees, shrubs, bushes, and other organic matter at or above original ground level.

B. Grubbing: Grubbing is defined as the removal of stumps, roots, boards, logs, and other organic matter found at or below ground level.

C. Stripping: Includes the removal and disposal of all organic sod, topsoil, grass and grass roots, and other objectionable material remaining after clearing and grubbing from the areas designated to be stripped.

2.00 PRODUCTS (NOT APPLICABLE)

3.00 QUALITY ASSURANCE

A. Regulatory requirements: Verify and comply with applicable regulations regarding those governing noise, dust, nuisance, drainage and runoff, fire protection, and disposal.

B. Pre-construction conference: Meet with Engineer to discuss order and method of work.

C. Clearing, stripping and grubbing: Perform in advance of grading operations.

4.00 EXECUTION

4.01 PREPARATION

A. Verification of conditions: Examine site and verify existing conditions for beginning work.

B. Protect existing improvements from damage by site preparation work.

C. Mark areas to be cleared and grubbed prior to commencing clearing operations. The Owner's Representative shall approve clearing and grubbing limits prior to commencement of clearing operations.

D. Trees and shrubs outside of the clearing limits, which are within 10 feet of the clearing limits, shall be clearly marked to avoid damage during clearing and grubbing operations.

E. Remove trees and brush outside the clearing limits, but within the immediate vicinity of the work, upon receipt of approval by the Owner's Representative, when the trees or brush interfere with the progress of construction operations.

F. Clearly mark trees and shrubs within the clearing limits, which are to remain, and protect the trees and shrubs from damage during the clearing and grubbing operations.

G. The clearing limits shall not extend beyond the project limits.

H. Establish the clearing limits as follows:

1. Embankments plus 10 feet beyond the toe of the embankment.
2. Excavations plus 5 feet beyond the top of the excavation.
3. Concrete structures plus 10 feet beyond the edge of the footing.
4. Roadways, runways, taxiways, and parking areas plus 5 feet beyond the edge of pavement or R.O.W. limits.
5. Retaining walls plus 10 feet beyond the edge of the footing.
6. Railroads plus 10 feet beyond the edge of the subgrade.
7. Underground utility trench top width plus 8 feet.
8. 10 feet along the centerline of the overhead utility lines.

I. Establish the grubbing limits as follows:

1. Embankments plus 2 feet beyond the toe of the embankment.
2. Concrete structures plus 2 feet beyond the edge of the footing.
3. Roadways, runways, taxiways, and parking areas plus 1 foot beyond the edge of pavement.
4. Retaining walls plus 2 feet beyond the edge of the footing.
5. Railroads plus 2 feet beyond the edge of the subgrade.

4.02 INSTALLATION

A. Clearing: Clearing shall consist of the felling, cutting up, and the satisfactory disposal of trees and other vegetation, together with the down timber, snags, brush, rubbish, fences, and debris occurring within the area to be cleared.

B. Grubbing:

1. Grubbing shall consist of the removal and disposal of stumps and roots larger than 1 inch in diameter.
2. Extend grubbing to the depth indicated below: In the case of multiple construction items, the greater depth shall apply.
    a. Footings: 18 inches below the bottom of the footing.
    b. Walks: 12 inches below the bottom of the walk.
    c. Roads and Taxiways: 18 inches below the bottom of the subgrade.
    d. Parking Areas: 12 inches below the bottom of the subgrade.
    e. Runways: 24 inches below the bottom of the subgrade.
    f. Embankments: 24 inches below existing ground.
    g. Railroads: 24 inches below the bottom of the subgrade.
    h. Concrete Structures: 18 inches below the bottom of the concrete.
    i. Retaining Walls: 18 inches below the bottom of the footing.

4.03 FIELD QUALITY CONTROL

A. Timber, logs, roots, brush, rotten wood, and other refuse from the clearing and grubbing operations, may be burned or removed at the Contractor's option from the Owner's property. However, when permitted in writing by the Engineer, disposal of material may be done without the burning logs and large stumps, as elected by the Contractor. Such permit shall state the conditions covering the disposal of logs and stumps without burning, including the areas of disposal. Burn timber and other refuse to be disposed of at locations approved by the Owner and in a method that does not damage existing structures, construction in progress, trees, and vegetation.

B. The Contractor shall be responsible for compliance with the federal, state, county, and municipal laws and regulations relative to the building of fires. Constantly monitor the disposal by burning until the fires have burned out or have been extinguished. Disposal of materials in streams shall not be permitted and no materials shall be piled in stream channels or in areas where it might be washed away by floods. Timber within the area to be cleared shall become the property of the Contractor, and the Contractor may cut, trim, hew, saw, or otherwise dress felled timber within the limits of the Owner's property, provided timber and waste material is disposed of in a satisfactory manner.

C. Burn materials weekly during the clearing and grubbing operations, unless permission is granted by the Owner's Representative to store the materials for longer periods.

D. Contractor to check with the owner if burring is permitted. If not, then completely remove timber, logs, roots, brush, rotten wood, and other refuse from the Owner's property. Disposal of materials in streams shall not be permitted and no materials shall be piled in stream channels or in areas where it might be washed away by floods. Timber within the area to be cleared shall become the property of the Contractor, and the Contractor may cut, trim, hew, saw, or otherwise dress felled timber within the limits of the Owner's property, provided timber and waste material is disposed of in a satisfactory manner. Materials shall be removed from the site daily, unless permission is granted by the Engineer to store the materials for longer periods.

END OF SECTION

31 23 23.34 FLOWABLE FILL

1.00 GENERAL

1.01 WORK INCLUDED

A. Furnish labor, materials, equipment, and incidentals necessary to mix and place flowable fill, consisting of Portland cement, fine aggregate, fly ash, and water in the proper proportions as specified hereinafter. Flowable fill (Controlled Low-Strength Material, CLSM) shall be used to bed and backfill around piping, utilities, and structures where indicated.

1.02 QUALITY ASSURANCE

A. Design Criteria – Flowable Fill Proportions and Consistency: Flowable fill shall be proportioned to give the necessary workability, strength, and consistency, and shall conform to the following governing requirements:

1. Permeability: Maximum permeability limit of $1x10^{-6}$ cm/sec. This limit shall apply at all locations where flowable fill is used as a utility trench plug (dam) within trench backfill materials.
2. Subsidence: Evaporation of bleed water shall not result in shrinkage of more than 10.4 mm per m (1/8 inch per ft.) of flowable fill depth. Measurement of a Final Bleeding shall be as measured in Section 10 of ASTM C940.
3. Strength for Excavatable Flowable Fill: Unconfined compressive strength at 28-days when tested in accordance with ASTM D4832: 100 psi (+/- 50 psi).
    a. Long-term strengths (greater than 90 days) shall not exceed 150 psi.
    b. Where indicated provide Excavatable Flowable Fill around utilities, unless noted otherwise.
    c. Excavatable Flowable Fill shall be excavatable with hand tools and conventional machinery such as backhoes.
4. Strength for Non-Excavatable Flowable Fill: Unconfined compressive strength at 28-days when tested in accordance with ASTM D4832: 150 psi minimum.
    a. Where indicated provide Non-Excavatable Flowable Fill below structures and/or around structures, unless noted otherwise.
5. Fluidity: Flowable fill shall be self-consolidating and non-segregating in accordance with ASTM C1611:
    a. Slump Flow Test: Minimum 20-inch mean spread.
    b. Visual Stability Index (VSI) Test: Less than or equal to 1.
6. Density, minimum: 100 pcf.

B. Factory Testing: The Contractor shall be responsible for the design of the material. A trial mix shall be designed by an independent testing laboratory, retained by the Contractor. The testing laboratory shall submit verification that the materials and proportions of the trial mix design meets the requirement of the Specifications. In lieu of trial mix design, Contractor may submit historical data for a mix design used successfully in previous similar

work. The Contractor shall not make changes in materials, either in gradation, source, or brand, or proportions of the mixture after having been approved, except by specific approval of the Engineer.

C. Owner Testing: It is the responsibility of the Contractor to achieve and maintain the quality of material required by this Section. However, the Owner may secure the services of an independent testing laboratory to verify the quality of the flowable fill. The Owner shall have the right to require additional testing, strengthening, or replacement of flowable fill which has failed to meet the minimum requirements of this Section.

1.03 SUBMITTALS

A. Submit mix design on each material required. Provide backup data as required below.

B. Submit historical or trial mix data and test results as a basis for mix design approval. Required data shall include:

1. Permeability test results if plugs are required on Project.
2. Subsidence test results.
3. Strength test results for Excavatable and Non-Excavatable Flowable Fill if used on Project.
4. Fluidity test results.

1.04 STANDARDS AND REFERENCES

A. Materials shall meet recommendation for mix design and placement, as published by National Ready Mixed Concrete Association.

B. The applicable provisions of the following references and standards shall apply to this Section as if written herein in their entirety.

1. ASTM International (ASTM) Standards:

ASTM C33	Specification for Concrete Aggregates
ASTM C40	Test Method for Organic Impurities in Fine Aggregates for Concrete
ASTM C150	Specification for Portland Cement
ASTM C618	Specification for Fly Ash and Raw or Calcined Natural Pozzolan for Use as Mineral Admixture in Portland Cement Concrete
ASTM C 940	Standard Test Method for Expansion and Bleeding of Freshly Mixed Grouts for Preplaced-Aggregate Concrete in the Laboratory
ASTM C 1611	Standard Test Method for Slump flow of Self Consolidating Concrete
ASTM D 4832	Standard Test Method for Preparation and Testing of Controlled Low Strength Material (CLSM) Test Cylinders

2.00 PRODUCTS

2.01 MATERIALS

A. Cement: ASTM C150, Type I or II; or ASTM C595, Type IL.

B. Fly Ash/Pozzolans: ASTM C618, Class F or C.

C. Fine Aggregate: ASTM C33, fine aggregate.

1. ASTM C40: Aggregate shall not contain strong alkali, or organic material which gives a color darker than the standard color.

D. Water: Potable and in conformance with ASTM C1602 and ASTM C1602, Table 2.

E. Performance Additive: As required to meet specification requirements:

1. DaraFill by GCP Applied Technologies.

2. MasterCell 25 by Master Builders Solutions US LLC.

3. Sika Lightcrete Powder by Sika Corporation.

4. Approved equal.

F. Chemical Admixtures for Concrete per ASTM C 494, as required by performance requirements.

2.02 MIXES

A. In the determination of the amount of water required for mix, consideration shall be given to the moisture content of the aggregate. The net amount of water in the mix will be the amount added at the mixer; plus the free water in the aggregate; and minus the absorption of the aggregate, based on a 30 minute absorption period. No water allowance shall be made for evaporation after batching.

B. The methods of measurement of materials shall be such that the proportions of water to cement are closely controlled during the progress of the Work and easily checked at any time by the Owner's representative. To avoid unnecessary or haphazard changes in consistency, the aggregate shall be obtained from sources which will insure a uniform quality and grading during any single day's operation and they shall be delivered to the Work and handled in such a manner that the variation in moisture content will not interfere with the steady production of flowable fill of reasonable degree of uniformity. Sources of supply shall be approved by the Owner's representative.

C. All material shall be separately and accurately measured. All equipment for measurement of materials shall be subject to approval by the Owner's representative.

3.00 EXECUTION

3.01 INSTALLATION

A. Contractor shall give the Owner's representative sufficient advance notice before starting to place material in any area, to permit inspection of the area, and preparation for pouring.

B. Conduct the operation of depositing the material so as to form a well consolidated mass and so as not to develop air pockets in confined spaces.

C. Unless specified otherwise, flowable fill shall be uniformly placed to the depth shown on the Drawings. The fill shall be brought up uniformly to the top of excavation elevation or as otherwise indicated on the Drawings. Placement of flowable fill shall then cease and the fill protected from traffic for a period of not less than 72 hours.

   1. To prevent pipe flotation place material in lifts or provide alternate means.

   2. Around structures, material shall be placed in lifts. Lift depth shall not exceed 4 feet, whichever is less.

   3. When multiple lifts are required, material shall be allowed to harden before placing next lift. Hardening time varies with each mix. Verify flowable fill has reached a penetration number of 1500, in accordance with ASTM C 403, but not less than 3 hours.

D. The material shall be placed against undisturbed trench walls, and shall not be placed on or against frozen ground.

E. At time of placement the ambient temperature shall be 35 F and rising.

3.02 FIELD QUALITY CONTROL

A. An approved testing laboratory shall perform the quality control testing of backfill operations. The testing laboratory shall sample material in accordance with ASTM D5971. The testing laboratory shall monitor backfill operation continuously or at intervals acceptable to the Owner and Engineer at structures. It shall be the responsibility of the Contractor to provide sufficient advance notification to the testing laboratory before backfill operations begin.

   1. Strength: A strength test is the average of two cylinders per ASTM D4832.

   2. Fluidity: A fluidity test is a Slump Flow Test and a VSI Test per ASTM C1611.

   3. For all tests required, at a minimum perform one test per day, but not less than one per 150 cubic yards.

B. Field inspections:

   1. Engineer shall provide on-site inspection for the Work of this Section.

   2. Advise the Engineer of readiness to proceed at least 24 hours prior to each placement of CLSM.

   3. Required inspections:

      a. Engineer will observe the prepared areas. Do not place CLSM until the Engineer has observed and accepted preparations.

   4. Record of inspections.

   5. Field sampling and testing:

      a. During construction, the [Owner][Contractor] shall provide sampling and testing to determine whether the CLSM, as produced and placed, complies with the requirements specified.

b. Sample CLSM for testing in accordance with ASTM D5971.

3.03 NON-CONFORMING WORK

A. When testing or observation indicates CLSM with properties outside the specified and accepted range, the Engineer will issue instructions regarding disposition of non-conforming materials.

B. Engineer may:

1. Reject CLSM represented by those test specimens and require its removal and replacement.

2. Require modification of the mix design to provide CLSM with the properties specified.

C. Make such modifications at no additional expense to the Owner and with no adjustment to the schedule.

END OF SECTION

31 23 33 TRENCHING AND BACKFILL

1.00 GENERAL

1.1 WORK INCLUDED

A. Furnish labor, materials, equipment and incidentals necessary to perform operations in trenching, pipe bedding, backfilling, clearing, grubbing and site preparation; handling, storage, transportation and disposal of excavated material; pumping and dewatering; preparation of subgrades; protection of adjacent property; fills, grading; and other appurtenant work.

B. Trenching, backfilling, and pipe embedment procedures shall be in full compliance with Section 31 23 36 “Trench Safety.”

C. Material sampling and testing roles, responsibilities and procedures shall be in full compliance with Section 01 40 00 “Quality Management.”

D. Earth removed from excavations and which is not required for backfill shall be removed from the Site by the Contractor at its own expense

E. Excavations, other than trench excavation, are not part of this Section.

F. Bidders must satisfy themselves as to the actual existing subsurface conditions prior to the submittal of a proposal to complete the proposed Work. No extra or separate payments shall be made for rock, dewatering, or any other condition.

1.2 QUALITY ASSURANCE

A. Excavations shall include material of whatever nature encountered, including but not limited to clays, sands, gravels, conglomeritic boulders, weathered clay shales, rock, debris and abandoned existing structures. Excavation and trenching shall include the removal and subsequent handling of materials excavated or otherwise handled in the performance of the Work.

B. Trench excavation shall consist of excavation to the lines and grades indicated, required for installation of the pipe, pipe bedding, backfill, and to accommodate trench safety systems.

1.3 SUBMITTALS

A. Submittals shall be in accordance with Section 01 33 00 “Document Management” and shall include:

1. Certified test reports for embedment material, backfill material, and coarse gravel. Certified Test Reports shall be from an independent laboratory. Test reports shall include sieve analysis, Atterburg limits, results of an abrasion test, and other tests as required to demonstrate compliance with Paragraph 2.01.

2. Test results indicating soil resistivity for embedment material used on metal pipe.

3. Field density test reports indicating that the Contractor's method of backfill meets the requirements of the Contract Documents. The field density testing for granular embedment shall be done in a manner approved by the Owner/Engineer by an independent testing lab in accordance with ASTM D4253. The cost of the field testing shall be included in the Bid Price for the Work, with no additional compensation to the Contractor.

1.4 REFERENCE SPECIFICATIONS

A. Section 01 33 00 "Document Management."

B. Section 01 40 00 "Quality Management."

C. Section 03 30 53 "Miscellaneous Cast-In-Place Concrete."

D. Section 31 05 13 "Soils for Earthwork."

E. Section 31 05 16 "Aggregates for Earthwork."

F. Section 31 23 23.34 "Flowable Fill"

G. Section 31 23 36 "Trench Safety."

1.5 STANDARDS

A. The following publications, referred to hereafter by basic designation only, form a part of this Section to the extent indicated by the references thereto:

1. ASTM International (ASTM):

ASTM C33	Standard Specification for Concrete Aggregates
ASTM C88	Standard Test Method for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate
ASTM C125	Standard Terminology Relating to Concrete and Concrete Aggregates
ASTM C131	Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
ASTM C535	Standard Test Method for Resistance to Degradation of Large-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
ASTM D75	Standard Practice for Sampling Aggregates
ASTM D448	Standard Classification for Size of Aggregate for Road Bridge Construction
ASTM D698	Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lb/ft^3 (600 kN-m/m^3)
ASTM D1556	Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method
ASTM D2487	Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System)
ASTM D4253	Standard Test Methods for Maximum Index Density and Unit Weight of Soils Using a Vibratory Table
ASTM D6938	Standard Test Method for In-Place Density and Water Content of Soil and Soil-aggregate by Nuclear Methods (Shallow Depth)
ASTM G57	Standard Test Method for Field Measurement of Soil Resistivity Using the Wenner Four-Electrode Method

B. Any other testing required by these specifications and not specifically referenced to a standard shall be performed under ASTM or other appropriate standards as designated by the Engineer.

C. Reference herein or on the Drawings to soil classifications shall be understood to be according to ASTM D2487, Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System).

1.6 DELIVERY AND STORAGE

A. Excavated materials to be used for backfill may be deposited in stockpiles at points convenient for rehandling the material during the backfilling process. If not indicated on the Drawings, the location of stockpiles shall be within the limits of construction easements or public right-of-way. The location of stockpiles is subject to the approval of the Owner or the Owner's representative. Do not place stockpiles over buried pipelines or utilities unless adequate provisions are made for protection. Roads and driveways must be kept open unless written authorization is granted by Owner. Keep drainage channels clear of stockpiled materials.

B. If more than one material is stockpiled on site, maintain separation and clearly identify stockpiles. Cross-contamination of materials will not be permitted and will serve as grounds for rejection.

1.7 JOB CONDITIONS

A. Classification of Excavation: Excavation shall be "unclassified" and involves the removing of the necessary materials to provide the trench/excavation to the required width and depth. Contractor must satisfy itself as to the actual sub-surface conditions prior to submitting a proposal. No extra or separate payments shall be made for rock, dewatering or any other condition.

B. Road Crossings: Where the Work requires road closure, coordinate with the Owner to obtain written approval detailing the extents of the road closure as well as the duration the road will be out of service. Provide temporary access and detours for roads and driveways as required by the Owner. Provide steel plates to cover trench to allow home owners in and out of their driveways.

C. Place no embedment or backfill material during freezing weather or upon frozen subgrades or previously placed frozen embedment or backfill materials.

2.00 PRODUCTS

2.1 MATERIALS

A. Concrete for Backfill, Blocking, Cradling and Encasement: Unless other strength requirements are designated, concrete used shall be as specified for pipe blocking, lean concrete, in **Section 03 30 53 "Miscellaneous Cast-In-Place Concrete."**

B. Earth Fill: Earth fill materials shall be as specified in Section 31 05 13 "Soils for Earthwork."

C. Granular Embedment and Backfill: Granular embedment material shall be as specified in Section 31 05 16 "Aggregates for Earthwork."

D. Cement: Cement shall be in accordance with **Section 03 30 00.01 "Cast-In-Place Concrete (Limited Applications)."**

E. Coarse Gravel: Where coarse gravel is required for water drainage, restoration of trench foundation, or other uses, it shall be crushed stone or gravel and in compliance with ASTM C33 for Coarse Concrete Aggregate. Gradation shall be ASTM C33 No. 57, No. 67, No. 357, or as follows:

Sieve Size Square Opening	Percent Passing
1"	95-100
3/4"	55-85
1/2"	25-50
No. 4	0-5

F. Flowable Fill: Flowable fill shall be in accordance with Section 31 23 23.34 "Flowable Fill."

G. Modified Flowable Fill: Modified flowable backfill in areas of possible future excavation shall consist of a mixture of native soils or manufactured materials, cement and/or fly ash, air entraining material and water which produces a material with unconfined compressive strength of between 250 and 450 psi after 28 days. Any materials used shall be primarily granular, with a plasticity index less than 12 and with 100 percent passing a 3/4-inch sieve. The flowable mixture shall be mixed in a pug mill, concrete mixer, or transit mixer and shall have a minimum slump of 5 inches. The flowable mixture must be allowed to set prior to the placement of any overlying materials. Modified flowable backfill in permanent areas such as abandoned pipe closures shall contain the same materials and have an unconfined compressive strength greater than 250 psi after 28 days.

H. Embedment Geotextile Material: Embedment geotextile material shall be Mirafi 180N polypropylene or approved equal.

I. Utility Detection Tape: Utility pipe detection tape shall be installed over all PVC pipelines 8 inches and larger. The tape shall be bright-colored, continuous-printed plasticized aluminum tape, intended for direct-burial service, and meet the following requirements:

1. Width: 6 inches.
2. Thickness: 5 mils minimum.
3. Lettering: 1-inch high permanent black, continuously printed.
4. Color: Per APWA Uniform Color Code:
    a. Green - Sanitary Sewer Lines.
    b. Blue - Potable Water.
    c. Purple - Reclaimed Water, Irrigation.
5. Detection tape must be installed above the pipe zone, 12 inches above pipe.

J. Tracer Wire: All piping shall be installed with a continuous, insulated TW, THW, THWN or HMWPE insulated copper, 10 gauge or thicker wire for pipeline location purposes by means of an electronic line tracer. The wire shall be installed along the entire length of pipe. The insulation color shall match the color of the pipe being installed. Sections of wire shall be spliced together using approved splice caps and waterproof seals. Twisting the wires together is not acceptable.

2.2 MIXES; SAND-CEMENT BACKFILL

A. A minimum sand and cement mixture of 25 parts sand and 2 parts cement will be required.

1. Fine Sand: 25 Cubic Feet.
2. Cement: 2 Bags (minimum).
3. Water: Optimum moisture.

B. Sand shall be free of any cohesive material and shall meet the following gradation and plasticity index requirements:

Sieve Size	Percent Passing
1”	100
1/2”	95-100
No. 40	80-100

C. PI and LL Amounts:

1. Plasticity Index: 10 Maximum.
2. Liquid Limit: 25 or less.

3.00 EXECUTION

3.1 PREPARATION

A. Site:

1. Clear sites of logs, trees, roots, brush, tree trimmings and other objectionable materials and debris which are to be occupied by pipe trenches, and grub stumps. Designate material not salvaged for reuse as surface material as spoiled and dispose of material in accordance with Paragraph 3.01.E, Disposal of Spoil Material.
2. Do not remove trees outside of the required working area unless their removal is authorized in writing by the Engineer and with the approval of the local governing authority. Adequately protect the trees left standing from permanent damage by construction operations. Standing trees may be trimmed where necessary to facilitate construction, but only with written authorization from the Engineer.

B. Dewatering:

1. Provide and maintain adequate dewatering equipment to remove and dispose of surface and ground water entering the excavations, trenches, or other parts of the Work. Keep each excavation dry during subgrade preparation and continually thereafter until the proposed pipe is installed. Maintain the proper procedures necessary to

protect against damage to the proposed Work from hydrostatic pressure, flotation, or other water related causes.

2. Dewater excavations which extend down to or below ground water elevation by lowering and keeping the ground water level a minimum of 2 feet below the bottom of the excavation.

3. Divert surface water or otherwise prevent water from entering excavated areas to the fullest extent possible without causing damage to adjacent property.

4. Provide and maintain any piping or conduit necessary to facilitate drainage. Do not alter area drainage patterns to the extent that adjacent property and landowners become threatened with localized flooding and/or water damage. Should such a situation occur, the Contractor shall be responsible for repairing the damage at no additional cost to the Owner.

5. The existing basins and utilities are known to have developed leaks. Trench dewatering efforts due to leaking basins and/or utilities does not constitute as a differing site condition. No additional payment will be made for dewatering efforts due to leaking basins and utilities.

C. Protection of Existing Structures and Utilities:

1. Prior to the start of construction, communicate with the representatives of the local utility companies, including the oil, gas, telephone and communications companies, and local water and sewer utilities operating in the location of the proposed construction area. Seek the utility companies' assistance in locating existing facilities to avoid conflicts during construction. The location, number, depth, and owner of utilities indicated are for information purposes only, and all utilities and structures may not be shown or may not be at the location shown.

2. Where construction endangers adjacent structures, utilities, embankments and/or roadways, the Contractor shall, at his own expense, carefully support and protect such structures so that no damage occurs throughout the construction process. In case damage should occur, the Contractor shall be responsible for restoring the damaged structure to a condition acceptable to the Owner of that structure and shall bear all cost of such reparations.

3. Repair or replace damaged street surfaces, driveways, sidewalks, curbs, gutters, fences, drainage structures, or other such facilities to the satisfaction of the Owner. Structures shall be returned to a condition equal to or better than the original condition and of same or better material and quality.

4. Relocate minor utilities as necessary, at no additional cost to the Owner, in order to resolve conflicts with new Work. Minor utilities shall be defined as conduit less than or equal to 2 inches in diameter and pressure piping less than or equal to 6 inches in diameter. All proposed relocations shall be submitted in writing and approved by Owner or Owner's representative prior to accomplishing the Work.

D. Blasting: Blasting shall not be allowed in any instance.

E. Disposal of Spoil Material:

1. Suitable material from excavations which meets the requirements for pipe backfill material as indicated, except stripping excavation, may be reused. Designate the remaining excavated materials as spoiled material and dispose of material off the Site in accordance with all applicable laws, ordinances, and codes. Contractor shall be responsible for the storage, transportation, and deposition of spoiled material and shall be responsible for acquiring the necessary permits, and the payment of fees and duties at no additional cost to the Owner.

2. No burning of materials shall be permitted on the Site.

3.2 TRENCH EXCAVATION

A. General: The trenches shall be excavated to the alignment and depth indicated or as necessary for the proper installation of the pipe and appurtenances. Brace and dewater the trench if necessary so that the workmen may work therein safely and efficiently. Any specific requirement listed in Paragraph 3.00 Execution, may be modified as necessary to meet OSHA requirements. However, if trench widths are wider than indicated, the Contractor shall be responsible for determining and furnishing the proper class of embedment and piping for the installation with no additional compensation to the Contractor.

B. Trench Width: The trench widths shall be as specified in the following table:

Buried Pipe or Accessory	Minimum Trench Width	Maximum Trench Width
Nominal Pipe Diameter: 4 inch to 24 inch	OD + 18 inches	OD + 24 inches
Nominal Pipe Diameter: Greater than 24 inch	OD + 24 inches	OD + 36 inches
Manholes, vaults, valves, or other accessories	12 inches between outer surface and trench side or shoring	Not applicable

C. Pipe Foundation Subgrade:

1. Excavate the trench to an even grade to permit the installation of the pipe so that the full length of the pipe barrel is supported on the proper depth of bedding material. The entire foundation subgrade area in the bottom of the excavations shall be firm, stable material, and the material shall not be disturbed below required grade except as described in this Section. Where the character of the subgrade material is such that proper subgrade cannot be obtained at the elevation indicated, deepen the excavation to a satisfactory subgrade material.

2. Remove the material until a firm, stable, and uniform bearing is reached and the subgrade brought back to the required grade with coarse gravel thoroughly compacted to 95 percent maximum density as measured by ASTM D4253. The expense of replacing any unsatisfactory subgrade shall be borne by the Contractor.

D. Correcting Faulty Grade: If the trench is excavated to a faulty grade (at a lower elevation than indicated), install pipe foundation material to bring the trench bottom back to the elevation indicated on the drawings. Correct the faulty grade as specified below:

1. In uniform, stable, dry soils, correct the faulty grade with granular embedment material thoroughly compacted to 95 percent of the maximum density measured in accordance with ASTM D4253.
2. In soft spongy disintegrated soils or where necessary to allow proper drainage, correct the faulty grade with coarse gravel in compliance with 2.01 E, compacted to 95 percent of the maximum density measured in accordance with ASTM D4253.
3. If bottom of trench excavation consists of rock or any material that, by reason of its hardness, cannot be excavated to provide uniform bearing surface:
    a. Remove such rock or other material to a depth of not less than 4 inches below pipe embedment zone.
    b. Materials:
        1). Controlled low-strength material (CLSM).
        2). Class C concrete.
4. If bottom of trench excavation consists of mud or other soft unstable material:
    a. Remove such unacceptable material to a depth of not less than 18 inches below pipe embedment zone.
    b. Material and placement:
        1). Lightweight material
        2). Stabilization material: wrap stabilization material as specified in Section 31_32_19.15 - Geotextile
5. Correct faulty grade at no additional cost to Owner.

E. Care of Surface Material for Reuse: If local conditions permit reuse, keep surface material suitable for reuse separate from the general excavation material.

F. Trenching Methods: The use of any suitable trench digging machinery is permitted except in places where such operations may cause damage, above or below ground, in which case, employ hand methods.

G. Pipe Clearance in Rock: Remove ledge rock, rock fragments, shale, or other rock to provide proper clearance for bedding materials. Provide adequate clearance for properly jointing pipe laid in rock trenches at bell holes.

H. Open Trench:

1. Owner shall have the right to limit the amount of trench which may be opened or partially opened at any time in advance of the completed line; and also the amount of trench left not backfilled.
2. Not more than 150 feet of trench shall be left open unless otherwise permitted in writing by the Owner. No trench should be left open overnight. No more trench than what can reasonably be completed in a day should be opened.
3. Backfill and/or protect trenches as necessary to prevent injury to adjacent property, Owner’s personnel, livestock, and the public.

4. Trenches left open at night shall be fenced with adequate construction fencing. No trenches in streets or populated areas shall be left open at night.
5. These requirements are minimum standard for trenching and more stringent construction requirements may be located elsewhere in the Contract Documents. The most restrictive requirements shall apply.

I. Trench excavation at road crossings or existing driveways:

1. Provide notification, vehicular access, and traffic control as required by permits and special conditions.
2. Provide temporary asphalt or plating for traffic or access at the end of each work day unless approved in writing by the Engineer.
3. If unexpected utility conflicts or changed Site conditions require trenchless technologies or temporary bridges, immediately notify the Engineer in writing. Approval is required before proceeding with construction.
4. When trench width at top of pipe is increased beyond width specified in this Section because of soil conditions, safety requirements, or other reasons, Engineer approval for remedy is required without additional cost to the Owner.
5. Remedy may include upgrade laying conditions or install stronger pipe designed in accordance with Specifications.

J. Pipe embedment zone - Depressions for joints or couplings:

1. Excavate holes in the fine grading material at the bottom of the trench.
2. Provide holes of sufficient width to provide ample room for grouting, banding, or welding as necessary for making joints and to ensure that pipe rests upon prepared trench bottom and not supported by any portion of the joint.

3.3 BACKFILL

A. Time of Backfilling: Backfill operations shall immediately follow pipe jointing, joint coating application, and curing.

B. Braced and Sheeted Trenches: Remove sheeting and shoring as backfilling operations progress. Incorporate methods so that a good bond is obtained between the backfill material and the undisturbed trench walls.

C. Protection of Pipe During Backfilling Operations: Take the necessary precautions to protect the pipe during backfilling operations. Take care to prevent damage to the pipe or to the pipe coating, and repair any damaged pipe before it is backfilled. Backfill the trench in a method to prevent the deformation or other deflection of the cylindrical shape of the pipe by more than the allowable pipe deflection as specified elsewhere.

D. Bedding within Pipe Zone:

1. Pipe embedment zone for flexible pipe: compacted to a depth above pipe: 12 inch minimum.
2. Materials and placement: aggregate base course compacted to 95 percent maximum dry density.

3. After the trench has been cut to the depths indicated, bring up the bedding layer to a point slightly above grade in maximum 4-inch lifts and uniformly compact to the density indicated. Form bell holes and scoop out a trough to grade so that the pipe is uniformly supported by the embedment material. Lay and joint the pipe. Bring up the embedment material in maximum 4-inch lifts on either side of the pipe to the elevation above the pipe shown on the Drawings. Uniformly compact the pipe as indicated.
4. After moisture is gone from the embedment material, place utility detection tape and backfill and compact the remaining backfill by tamping or other appropriate methods. Water jetting shall not be permitted.
5. Install utility detection tape and tracer wire.

E. Compaction Requirements:

1. Compact earth fill and cohesive aggregate fill in maximum 4-inch lifts with pneumatic rollers or power hand tampers and make a minimum of eight passes.
2. Compact cohesionless aggregate fill in maximum 4-inch lifts with vibratory rollers or vibratory plate power hand compactors and make a minimum of eight passes.
3. The acceptability of the compaction equipment shall be based upon the results of a test section. Compact earth fill and aggregate fill to a minimum of 95 percent of maximum dry density as determined by ASTM D698, Standard Proctor.
4. Compact Class 1 and 2 earth fill at a moisture content within minus 0 to plus 5 percentage points of the optimum moisture content. Compact the remaining classes of earth fill and cohesive aggregate fill listed in 31 05 16 2.01 at a moisture content within minus 2 to plus 5 percentage points of optimum moisture content. The moisture ranges listed above are minimum and maximum limits. A tighter moisture range within these limits may be required to consistently achieve the specified density.
5. Compact cohesionless aggregate fill at a moisture content within a range that accommodates consistent placement and compaction to achieve the density specified above.
6. Owner will arrange and pay for density and moisture testing. The testing frequency and methods shall be as requested by the Engineer. Engineer may waive testing requirements on cohesionless bedding where testing is not practical because of limited space between the pipe and trench walls, however, the minimum number of passes of the compaction equipment specified above shall be achieved.
7. Contractor responsible for meeting density and moisture requirements. Owner will check density and moisture requirements at their cost. Excess failures may result in the Owner back-charging the contractor for subsequent re-testing.

3.4 FINISHING

A. Grade and rake areas smooth and even which do not receive any type of paved surface, to allow drainage to drain away from the structures and toward the roads and streets or the natural drainage course. Break up large clods of earth and remove rocks, trash or debris near the surface.

B. Finish the top portion of backfill beneath established sodded (lawn) areas with not less than 6 inches of topsoil corresponding to, or better than, that underlying adjoining sodded areas.

C. Contractor should bring in top soil as required.

3.5 FIELD QUALITY CONTROL

A. Compact backfill and appropriate embedment material to a minimum of 95 percent of maximum density at a moisture content of 0 to plus 5 percent of optimum for backfill and at optimum for sand-cement embedment as determined by ASTM D698, Standard Proctor.

B. Make periodic tests of compaction for conformance with this Section by an approved testing laboratory selected and paid for by the Owner. Contractor shall pay for re-testing until acceptable test results are obtained.

C. Perform remedial work if compaction test fails to meet specified requirements using one of the following methods:

1. Remove and replace backfill at the proper density.

2. Other means acceptable to the Engineer.

D. Contractor's confirmation tests during performance of remedial work:

1. Performance: Perform tests in manner acceptable to the Engineer.

2. Frequency: Double amount specified for initial confirmation tests.

3.6 CLEAN AND ADJUST

A. Remove surplus pipeline materials, tools, rubbish and temporary structures and leave the construction site clean, to the satisfaction of the Engineer. Grade the surface and re-establish drainage. Removal of rock and other excess excavated material and general leveling and grading of the Site shall be part of the bid price and no additional payment shall be made.

END OF SECTION

31 23 36 TRENCH SAFETY

1.00 GENERAL

1.01 WORK INCLUDED

A. This specification is for the purpose of providing minimum performance specifications and consists of the basic requirements which the Contractor must comply with in order to provide for the safety and health of workers in a trench.

B. Contractor shall develop, design, and implement the trench safety system and will be solely responsible for the adequacy of the trench safety system and providing “a safe place to work” for the workman.

C. Should the trench safety protection system require wider trenches than specified elsewhere, the Contractor shall be responsible for the costs associated with determining adequacy of pipe bedding and class, including the purchase and installation of alternate materials.

D. Contractor shall comply with all applicable federal, state, and local rules, regulations, and ordinances related to trench excavation and safety.

1.02 STANDARDS

A. The following standard shall be the minimum governing requirement of this specification and is hereby made a part of this specification as if written in its entirety.

1. Occupational Safety and Health Administration (OSHA): 29 CFR Part 1926 - Safety and Health Regulations for Construction, Subpart P – Excavations.

2.00 PRODUCTS (NOT APPLICABLE)

3.00 EXECUTION (NOT APPLICABLE)

END OF SECTION

31 25 13.13 SEEDING FOR EROSION CONTROL

1.00 GENERAL

1.01 WORK INCLUDED

A. Provide labor, materials, equipment and incidentals necessary to seed the slopes and other areas as specified. This specification includes seedbed fertilization, watering, mulching, and emulsifying or tacking the mulch and maintenance until final acceptance by the Owner.

1.02 QUALITY ASSURANCE

A. Soil Testing: Fertilizer requirements for each planting area and for significantly different soil types within planting areas, will be determined by a qualified laboratory by the Owner soil testing laboratory. Representative composite soil samples will be collected from the planting areas and submitted to an approved soil testing laboratory.

1.03 STANDARDS

A. The seed used on this project will conform to ITEM 164.2 Standard Specifications for Construction of Highways, Streets and Bridges, Georgia Department of Transportation.

B. The seed used on this project will conform with Forsyth County Land Development Code.

1.04 DELIVERY AND STORAGE

A. Deliver seed with each variety separately bagged.

1.05 OPTIONS

A. If dry mechanical methods are used, the fertilizer may be spread at the same time as the seed. After sowing, straw mulch will be mechanically spread over the seeded area.

B. When seed and fertilizer are to be distributed as a water slurry, apply the mixture within 30 minutes of mixing.

2.00 PRODUCTS

2.01 MATERIALS

A. Seed: From the previous season's crop, labeled in accordance with the Georgia Seed Law.

1. Seed for Fall planting (temporary) shall be one or more of the following small grains as designated by the Engineer: Wheat, oats, rye, or barley.

2. Seed for spring planting (permanent) shall be Bermuda grass.

B. Fertilizer: Insert requirements.

C. Mulch:

1. Consisting of straw, wood-fiber, mulch nettings, wood chips or other suitable material approved by the Engineer and free of Johnson grass and other noxious weed seeds.

2. Straw mulch shall be oat, wheat or rice straw, prairie hay, Bermuda grass hay, or other hay harvested before seed production and approved by the Engineer. The straw mulch will be kept dry and shall not be rotted or molded. A minimum of 50 percent by weight of the herbage making up the hay shall be 10 inches in length or longer.

D. Topsoil: As specified for Class 12 earth fill in Section 31 05 13 “Soils for Earthwork.”

E. Herbicide: Contractor shall be responsible for using herbicides in a manner consistent with label requirements and precautions. Only registered herbicides having a minimal residual effect shall be used. Contractors shall strictly adhere to all federal, state, and local laws governing herbicide usage.

3.00 EXECUTION

3.01 TOPSOIL PLACEMENT

A. Place topsoil as specified for Class 12 earth fill in Section 31 23 23.16 “Compacted Earth Fill [Landfills and Heavy Earthwork Projects, Excluding Dams].”

3.02 FALL PLANTING

A. Fall planting will be temporary only and will be required if construction is completed between May 15 and November 30. The fall planting is to be followed by a spring planting of perennial vegetation.

B. Seedbed Preparation: Use a one-way plow, tandem disk, bedder, or equipment which will accomplish similar results. Break or mix the surface of the soil with the tillage equipment. Additional tillage operations will be necessary if required so planting can be on a clean, firm seedbed. Chiseling will be necessary on areas which have been severely compacted.

C. Seeding:

1. Seeding will be required on disturbed or excavated areas and on new embankments of whatever nature unless requested otherwise by the Engineer.

2. Optimum fall planting dates are September 1 to November 30. Accomplish the seeding for fall planting within these dates unless approval to do otherwise is obtained from the Engineer. Planting rates when drilled or broadcast are as follows:

Seeding	lb./acre
Wheat	120 lb./acre
Oats	128 lb./acre
Rye	112 lb./acre
Barley	114 lb./acre

3.03 SPRING PLANTING

A. Follow procedures for spring planting if construction is completed between November 30 and May 15, or after a temporary fall planting has been made:

1. Seedbed Preparation: Seedbed preparation for Spring planting is the same as that stated in the Fall planting of temporary cover with one addition: Any temporary cover crop must be top killed using an approved contact herbicide or by mechanically undercutting the growing cover crop, leaving residues on or near the soil surface.
2. Mulching:
    a. Spread mulch material on the area to be planted if construction was completed too late for planting a temporary fall crop or if insufficient residues are produced by the fall planting. Mulch the planting areas to control soil erosion and seed loss by wind and water and to promote grass establishment. Apply Mulch hay at the rate of 2 tons per acre and spread uniformly so that about 25 percent of the ground surface is uniformly visible through the mulch.
    b. Anchor the mulch hay by treading into the soil with a straight disk type mulch tiller. Perform disking across the slope along contours. Other types of mulch such as wood cellulose fiber or cotton bur mulch may be used at recommended rates, if approved by the Engineer. Apply mulch in a manner that will not hinder emergence of seedlings.
    c. Dry mulch: The mulch material used shall normally be dry mulch. Dry mulch shall be straw or hay, consisting of oat, rye, or wheat straw, or of pangola, peanut, coastal bermuda or bahia grass hay. Only undeteriorated mulch which can readily be cut into the soil shall be used. Mulch shall be free of weeds, weed seed and other deleterious material.
3. Other methods of mulch anchoring are available, including mulch netting, peg and twine, pick chain, slit, and asphalt mulch tie-down.
4. Seeding:
    a. Plant Bermuda grass seed between March 1 and May 15. Sow the seed at the rate of 50 pounds of pure live seed (PLS) per acre, or more if required to obtain a complete stand of grass. The PLS content is determined by multiplying the seed package weight by the product of the percent purity and the percent germination, which are contained on the seed label.
    b. Accomplish seeding by mechanical means using either broadcasting or drilling type equipment to provide uniform distribution of the seed in the planting areas. Cover Bermuda grass seed by 1/4 to 1/2 inch of soil. If seed is drilled, the distance between drill rows shall not exceed 12 inches. Hydro seeding may be used to apply seed, fertilizer, and wood-fiber mulch with the approval of the Engineer.

3.04 MAINTENANCE

A. Irrigation: Supply the seeded areas with adequate moisture (3- to 4-inch penetration) at 10-day intervals, if needed, for seed germination and plant growth until acceptance by the Owner. Water the seed in a manner which will prevent erosion of the soil. Furnish all water to be used.

B. Watering: Water shall be free of acid, alkali, or organic materials and shall have a pH of 7.0 to 8.5. Provide all water needed for grassing. Provide permanent or temporary piping and valves, and temporary trucks to convey water from the source to the point of use. Provide

any meters required and pay for water used if the water is taken from a public water system. Water shall be free of petroleum products, pesticides and any other deleterious constituents.

C. Repair: Repair washouts and other bare soil areas in a seeded area either by re-seeding, sprigging, or spot sodding, and perform maintenance as needed to establish grass in the area.

D. Weed Control:

1. Control competitive weed growth during the establishment period by mowing and/or with herbicides. Chemical usage shall be in accordance with the current recommendations of the local Soil Conservation Service Field Office Technical Guides. Strictly adhere to all federal, state, and local laws governing herbicides.

2. Weed control shall be the Contractor's responsibility whether topsoil is from on-site or off-site sources and also for seeded areas which are specified not to receive topsoil.

3.05 SEEDING OF DISTURBED AREAS

A. Disturbed areas will require seeding as specified in this Section unless requested otherwise by the Engineer or shown otherwise on the drawings or in the specifications.

B. Any areas which are disturbed by the Contractor which are not shown on the drawings or specified to require disturbance including any approved areas not shown on the drawings, shall be considered as unauthorized disturbed areas. Any such areas shall be seeded as specified in this Section at the Contractor's expense and shall not be measured or paid under this Section.

C. The types of seed and their mixture shall be as specified herein. Where more than one species of seed is called for in a given seed mix the separate types of seed used shall be thoroughly dry-mixed immediately before sowing.

D. All seed shall meet the requirements of State Department of Agriculture and Consumer Services and all applicable state laws. The seed shall have been harvested from the previous year's crop.

E. Grass Seed: Each of the species or varieties of seed shall be furnished and delivered in separate labeled bags. During handling and storage, the seed shall be cared for in such a manner that it will be protected from damage by heat, moisture, rodents and other causes.

F. All permanent and temporary grass seed shall have been tested within a period of six months of the date of planting.

3.06 FIELD QUALITY CONTROL; OBSERVATION AND ACCEPTANCE

A. Observation: Upon completion of the site preparation, mulching, fertilizing, seeding, and maintenance of seeded areas, the Engineer will observe the seeded areas periodically to determine the establishment success. Engineer will consider soil coverage, purity of the grass stand, and maturity of the plants.

B. Establishment of Stand and Acceptance:

1. The Engineer will determine that a grassed area is established upon fulfillment of the following conditions:

2. The permanent grass stand uniformly covers the planting area, with no exposed soil areas more than 36 inches across in any dimension.

3. The permanent grass stand is free of over-topping weed species which would compete for sunlight, moisture, and nutrients. In addition, no area of pure weed species greater than 36 inches across in any dimension shall occur within a permanent grass stand.

4. The majority of the grass plants in a stand shall have a well-established root system to survive if irrigation is discontinued.

5. Establish the permanent grass stand before October 1 to preclude having to perform a temporary Fall seeding. In the event a fall seeding must be performed, follow-up the temporary seeding with a permanent seeding as specified. Upon final acceptance of the work under this contract, the Owner will assume the responsibility of maintaining the grassed areas.

3.07 CLEANUP AND PROTECTION

A. Promptly remove soil and debris created by turf work from paved areas.

1. Clean wheels of vehicles before leaving the Site to avoid tracking soil onto roads, walks, or other paved areas.

B. Erect temporary fencing or barricades and warning signs as required to protect newly seeded areas from traffic.

1. Maintain fencing and barricades throughout initial seed establishment.

C. Remove nondegradable erosion-control measures after grass establishment period.

D. During landscape installation:

1. Areas shall be reasonably clean at the end of each workday.

2. Sidewalks and other paved areas shall be swept or washed down as needed.

E. Project completion:

1. Debris, soil, and trash resulting from landscape operations shall be removed from the Site.

2. Paved areas shall be washed down.

END OF SECTION

31 32 19.15 GEOTEXTILE

1.00 GENERAL

1.01 WORK INCLUDED

A. Furnish labor, materials, equipment and incidentals necessary to install geotextile. Use geotextile to provide for the following applications:

1. Drainage/Filtration: For lining trenches, pavement edge drains, interceptor drains or blanket drains in subsurface drainage applications.

2. Stabilization:

a. Use in conjunction with aggregate to stabilize soft soils for roads, storage yards, parking areas or other areas as specified; or

b. Under ballast and/or sub ballast for mainlines, secondary rail lines, switches, crossings and retarders as specified.

3. Protection/Erosion Protection:

a. Use as a cushion to protect geomembrane liners;

b. Under bedding stone or riprap along channels, shores and waterways; or

c. Under slope protection along highway cut or fill slopes as specified for erosion control applications.

4. Separation:

a. Use for separation between the Sidewall Trench Backfill Aggregate and the protective soil cover and for separation between the LCR Trench Backfill Aggregate and the protective soil cover in landfill applications;

b. Use as separation between subgrade and aggregate fill layer for athletic fields, roads and ponds.

1.02 QUALITY ASSURANCE

A. Design Criteria:

1. The geotextile fabric shall be inert to commonly encountered chemicals, hydrocarbons, mildew and rot resistant, resistant to ultraviolet light exposure, insect and rodent resistant, and conform to the properties in the following table.

2. The minimum average roll value (MARV) in the weakest principle direction for strength properties of any individual roll tested from the manufacturing lot or lots of a particular shipment shall be in excess of the minimum average roll value (MARV) in the weakest principle direction stipulated herein.

Geotextile			
Property	**Test Method**	**Units**	**MARV**
Grab Tensile Strength	ASTM D4632-91	lb.	
Grab Tensile Elongation	ASTM D4632-91	%	
Trapezoid Tear Strength	ASTM D4533-91	lb.	
CBR Puncture Strength	ASTM D6241	lb.	
AOS	ASTM D4751-87	U.S. Standard Sieve Size	
Permittivity	ASTM D4491-92	Sec-1	
UV Resistance (@ 500 hours)	ASTM D4355	% Retained	

B. Packing and Identification Requirements: Provide the geotextile in rolls wrapped with protective covering to protect the fabric from mud, dirt, dust, and debris. The fabric shall be free of defects or flaws which significantly affect its physical properties. Label each roll of fabric in the shipment with a number or symbol to identify that production run.

C. Sampling and Compliance Requirements: A competent laboratory must be maintained by the producer of the fabric at the point of manufacture to ensure quality control in accordance with ASTM testing procedures. The laboratory shall maintain records of its quality control results and provide a manufacturer's certificate upon request to the Engineer prior to shipment. The certificate shall include:

1. Name of manufacturer.
2. Chemical composition.
3. Product description.
4. Statement of compliance to specification requirements.
5. Signature of legally authorized official attesting to the information required.

1.03 SUBMITTALS

A. Submittals shall be in accordance with Section 01 33 00 "Document Management" and shall include:

1. Submit Manufacturer's certificate as stipulated in Paragraph 1.02.C.
2. Samples.

2.00 PRODUCTS

2.01 MATERIALS

A. Geotextile: Woven geotextile fabric manufactured from polypropylene yarns.

3.00 EXECUTION

3.01 INSTALLATION

A. Drainage/Filtration:

1. Exposure of geotextiles to the elements between laydown and cover shall be a maximum of 14 days to minimize potential damage. Install the geotextile fabric in accordance with the Drawings and manufacturer's recommendations. Construction vehicles will not be allowed to traffic directly on the fabric. In trenches, after placing the backfill material, fold the geotextile over the top of the backfill material to produce a minimum overlap of 12 inches for trenches greater than 12 inches wide. In trenches less than 12 inches in width, the overlap shall be equal to the width of the trench. Cover geotextile with the subsequent course of backfill. Overlap successive sheets of geotextile a minimum of 12 inches in the direction of flow.
2. Where seams are required in the longitudinal trench direction, join them by either sewing or overlapping. Seams shall be subject to the approval of the Engineer. Overlap seams a minimum overlap equal to the width of the trench.
3. Repair damaged geotextile with a geotextile patch placed over the damaged area and extended 3 feet beyond the perimeter of the tear or damage.

B. Stabilization:

1. Install the geotextile on the prepared subgrade in accordance with the Drawings and manufacturer's recommendations. Overlaps when necessary shall be 36 inches minimum. The aggregate should be back dumped onto the fabric and spread in a uniform lift maintaining the design aggregate thickness at all times. Construction vehicles will not be allowed to traffic directly on the fabric.
2. Avoid over-stressing the soil by utilizing equipment in spreading and dumping that exerts only moderate pressures on the soil. Severe rutting at the time of placement is an indication of over-stressing the soil. Such soil over-stressing must be avoided. Increasing aggregate depths and reducing loads are two methods of reducing the pressures on the soil.
3. Fill any ruts which develop during spreading or compacting with additional aggregate rather than blading from surrounding areas.
4. Thoroughly compact the aggregate with vibratory rollers after placement.

C. Protection/Erosion Protection:

1. Install the geotextile fabric in accordance with the Drawings and manufacturer's recommendations. Construction vehicles will not be allowed to traffic directly on the fabric. Individual panels of the geotextile shall be overlapped a minimum of 18 inches or overlapped a minimum of 3 inches and heat bonded. Overlaps shall be oriented in the same direction for all laps in a particular area. Geotextiles may be heat bonded only if the material is 8 ounces per square yard or heavier. Prior to heat bonding, the geotextile installer must demonstrate to the Engineer the ability to perform this type of joining. Areas burned through or damaged by heat bonding shall be repaired. Torn or punctured material shall be patched with sufficient overlap to prevent separation. All geotextile panels shall be temporarily secured from the wind by use of sand bags placed on the overlaps at the perimeters of the geotextile. All geotextiles shall be covered within 1 week with the aggregate or protective cover soil.

2. Aggregate and protective cover soil shall be spread in the direction with the overlaps. Placement of aggregate and protective cover soil on slopes shall begin at the toe and proceed up the slope. Back-dump the aggregate and protective cover soil onto the fabric and spread in a uniform lift maintaining design thickness at all times. Maintain a minimum of 2 feet of aggregate or protective cover soil between the geotextile and the equipment. Avoid over-stressing the soil by utilizing equipment in spreading and dumping that exerts only moderate pressures on the soil. Severe rutting at the time of placement is an indication of over-stressing the soil. Such soil over-stressing must be avoided. Increasing depths and reducing loads are two methods of reducing pressures on the soil. Fill any ruts which develop during spreading or compacting with additional aggregate or soil rather than blading from surrounding areas.

3. Exposure of geotextiles to the elements between laydown and cover shall be a maximum of 14 days to minimize damage potential. Install the geotextile fabric in accordance with the Drawings. Construction vehicles will not be allowed to traffic directly on the fabric. Place and anchor geotextile on a smooth graded surface approved by the Engineer. The geotextile shall be placed so that placement of the overlying materials will not excessively stretch or tear the fabric. Anchoring of the terminal ends of the geotextile shall be accomplished through the use of key trenches or aprons at the crest and the toe of the slope. Successive geotextile sheets shall be overlapped so that the upstream sheet is placed over the downstream sheet and/or upslope over downslope. In underwater applications, the geotextile and required thickness of backfill material shall be placed the same day. The geotextile shall be placed so that placement of the overlying materials will not excessively stretch or tear the fabric. Overlaps when necessary shall be 12 inches minimum except when placed under water where the overlap shall be a minimum of 36 inches. Use securing pins when necessary to ensure proper anchoring of the fabric, with securing pins spaced at 5- to 10-foot centers. Securing pins shall be 3/16-inch steel bars, pointed at one end and fabricated with a head to retain a steel washer having an outside diameter of not less than 1-1/2 inches. The pin length shall not be less than 19 inches. U-shaped pins or special staples shall be an acceptable option, if approved by the Engineer. Damaged geotextile shall be repaired with geotextile patch placed over the damaged area and extended 3 feet beyond the perimeter of the tear or damage.

4. The backfill placement shall begin at the toe and proceed up the slope. Back-dump the aggregate onto the fabric and spread in a uniform lift maintaining design aggregate thickness. Avoid over-stressing the soil by utilizing equipment in spreading and dumping that exerts only moderate pressures on the soil. Severe rutting at the time of placement is an indication of over-stressing the soil. Such soil over-stressing must be avoided. Increasing aggregate depths and reducing loads are two methods of reducing pressures on the soil. Fill any ruts that develop during spreading or compacting with additional aggregate rather than blading from surrounding areas.

D. Separation:

1. Install the geotextile fabric in accordance with the Drawings and manufacturer's recommendation. Construction vehicles will not be allowed to traffic directly on the fabric. Individual panels of the geotextile shall be overlapped a minimum of 18 inches or overlapped a minimum of 3 inches and heat bonded. Overlaps shall be oriented in the same direction for all laps in a particular area. Geotextiles may be heat bonded only if

the material is 8 ounces per square yard or heavier. Prior to heat bonding, the geotextile installer must demonstrate to the Engineer the ability to perform this type of joining. Areas burned through or damaged by heat bonding shall be repaired. Torn or punctured material shall be patched with sufficient overlap to prevent separation. All geotextile panels shall be temporarily secured from the wind by use of sand bags placed on the overlaps at the perimeters of the geotextile. All geotextiles shall be covered within 1 week with the aggregate or protective cover soil.

2. Aggregate and protective cover soil shall be spread in the direction with the overlaps. Placement of aggregate and protective cover soil on slopes shall begin at the toe and proceed up the slope. Back-dump the aggregate and protective cover soil onto the fabric and spread in a uniform lift maintaining design thickness at all times. Maintain a minimum of 2 feet of aggregate or protective cover soil between the geotextile and the equipment. Avoid over-stressing the soil by utilizing equipment in spreading and dumping that exerts only moderate pressures on the soil. Severe rutting at the time of placement is an indication of over-stressing the soil. Such soil over-stressing must be avoided. Increasing depths and reducing loads are two methods of reducing pressures on the soil. Fill any ruts which develop during spreading or compacting with additional aggregate or soil rather than blading from surrounding areas.

3. Exposure of geotextiles to the elements between laydown and cover shall be a maximum of 14 days to minimize potential damage. Install the geotextile on the prepared subgrade in accordance with the Drawings and manufacturer's recommendations. The geotextile shall be placed so that placement of the overlying materials will not excessively stretch or tear the fabric. Successive geotextile sheets shall be overlapped so that the upslope sheet is placed over the downslope sheet. Where seams are required in the longitudinal trench direction, they shall be joined by either sewing or overlapping. Overlaps shall be a minimum of 12 inches. Seams shall be subject to the approval of the Engineer. Damaged geotextile shall be repaired with a geotextile patch placed over the damaged area and extended 3 feet beyond the perimeter of the tear or damage.

4. The aggregate should be back dumped onto the fabric and spread in a uniform lift maintaining the design aggregate thickness. Construction vehicles will not be allowed to traffic directly on the fabric. Avoid over-stressing the soil by utilizing equipment in spreading and dumping that exerts only moderate pressures on the soil. Severe rutting at the time of placement is an indication of over-stressing the soil. Such soil over-stressing must be avoided. Increasing aggregate depths and reducing loads are two methods of reducing the pressures on the soil. Fill any ruts which develop during spreading or compacting with additional aggregate rather than blading from surrounding areas. Thoroughly compact the aggregate with vibratory rollers after placement.

4.00 FIELD QUALITY CONTROL

4.01 INSPECTION: BEFORE COVERING, THE CONDITION OF THE FABRIC WILL BE OBSERVED BY THE ENGINEER TO DETERMINE THAT NO HOLES OR RIPS EXIST IN THE FABRIC. REPAIR ALL HOLES OR RIPS BY PLACING A NEW LAYER OF FABRIC EXTENDING BEYOND THE DEFECT IN ALL DIRECTIONS, A DISTANCE EQUAL TO THE MINIMUM OVERLAP REQUIRED FOR ADJACENT ROLLS.

END OF SECTION

DIVISION 32

EXTERIOR IMPROVEMENTS

32 12 16 ASPHALT PAVING

1.00 GENERAL

1.01 WORK INCLUDED

A. Furnish labor, materials, equipment and incidentals necessary to perform operations in connection with the construction of hot mix asphaltic concrete (HMAC) base course, leveling-up course and surface course or any other combination of these courses. Construct the pavement on the previously completed and approved subgrade, base, or existing pavement.

1.02 QUALITY ASSURANCE

A. Design Criteria: Use the services of an independent testing laboratory to prepare a mix design to comply with Georgia Department of Transportation, Standard Specification Item 340 or may use a previously prepared mix design meeting the specification requirements with satisfactory substantiation of experience with the mix.

B. American Association of State Highway and Transportation Officials (AASHTO): Standard Specifications for Transportation Materials and Methods of Sampling and Testing

1.03 SUBMITTALS

A. Submittals shall be in accordance with Section 01 33 00 “Document Management” and shall include:

1. Mix design as record data.
2. Gradation of materials.
3. Quality Control: Certificate of Compliance.

1.04 STANDARDS

A. Hot mix asphaltic concrete (HMAC) pavement shall conform to the requirements of the current Georgia Department of Transportation (GDOT), Standard Specification for “Dense-Graded Hot Mix Asphaltic “, Item 340.

B. Asphaltic material shall comply with Georgia Department of Transportation (GDOT) Standard Specification Item 300.

1.05 DELIVERY AND STORAGE

A. Haul the asphaltic mixture to the job site in tight vehicles previously cleaned of foreign materials. Arrange the dispatching of vehicles so that all material delivered shall be placed and all rolling shall be completed during daylight hours. In cool weather, or for long hauls, canvas covers may be required. The inside of the truck body may be given a light coating of oil, if necessary, to prevent the asphaltic mixture from adhering to the body.

1.06 JOB CONDITIONS

A. Do not apply prime coat when the air temperature is below 50 F and falling but may be applied when the air temperature is above 40 F and rising, the air temperature being taken in the shade and away from artificial heat. Do not place asphaltic material when general weather conditions, in the opinion of the Owner's Representative are not suitable.

B. The asphaltic mixture shall be at a temperature between 225 and 350 F when dumped from the mixer. The Owner's Representative shall determine the temperature, within the above limitations. The mixture when dumped from the mixer shall not vary from the selected temperature more than 30 F.

2.00 SEQUENCING AND SCHEDULING

2.01 A. PRIME COAT

A. Prior to requesting Engineer's acceptance for application, inspect area to be coated to determine its fitness to receive bituminous priming material.

B. Do not begin application before area to be coated has been accepted for application by the Engineer.

3.00 PRODUCTS

3.01 MATERIALS

A. Aggregate: Conform to GDOT Standard Specification Item 340. The Type "B" mixtures and at least three bins when producing Type "D" mixture. These bins shall contain the following sizes of aggregate, in percentages by weight or by volume, as applicable.

1. Gradation for base course or leveling-up course shall comply with Type B listed as follows:

a. Type "B" (Fine Graded Base Course):

Sieve Size	Percent Passing by Weight or Volume
1"	98-100
3/4"	84-98
5/8"	75-95
3/8"	60-80
No. 4	40-60
No. 8	29-43
No. 30	13-28
No. 50	6-20
No. 200	2-7
VMA percent minimum	12
The asphaltic material shall form from 3.5 to 7 percent of the mixture by weight unless specified otherwise on the plans.	

2. Gradation for surface course shall comply with Type D listed as follows:

   a. Type “D” (Fine-Graded Surface Course):

Sieve Size	Percent Passing by Weight or Volume
1/2”	98-100
3/8”	85-100
No. 4	50-70
No. 8	35-46
No. 30	15-29
No. 50	7-20
No. 200	2-7
VMA percent minimum	14
The asphaltic material shall form from 4 to 8 percent of the mixture by weight unless specified otherwise on the plans.	

B. Asphaltic Materials: Comply with GDOT Standard Specification Item 300. In general, the grade of asphalt shall be AC-10. Other grades of asphalt shall be considered if weather conditions or mixed design appear to warrant a change. Prime coat shall comply with GDOT Standard Specification Item 300, Grade MC-30. Tack coat shall meet the requirements of cutback asphalt RC-250.

3.02 EQUIPMENT

A. The equipment necessary for the construction of the hot mix asphaltic concrete pavement shall be on the project site and shall be approved by the Owner’s Representative as to condition before the Contractor shall be permitted to begin construction operations on which the equipment is to be used. Equipment shall be maintained in good repair and operating condition.

B. Spreading and Finishing Machines:

1. The spreading and finishing machine shall be of a type approved by the Owner’s Representative and capable of producing a surface that shall meet the requirements of the typical cross section and surface test.

2. Rollers:

   a. Pneumatic Tire Roller: The roller shall consist of not less than seven pneumatic tire wheels, running on axles in such a manner that the rear group of tires shall cover the entire gap between adjacent tires of forward group; mounted in a rigid frame; and provided with a loading platform or body suitable for ballast loading. The front axle shall be attached to the frame in such a manner that the roller may be turned within a minimum circle. The tire shall afford surface contact pressures up to 90 pounds per square inch or more. The roller shall be so constructed as to operate in both forward and a reverse direction with suitable provisions for moistening the

surface of the tires while operating; and shall be approved by the Owner's Representative.

b. Two-Axle Tandem Roller: The roller shall be an acceptable power-driven, steel-wheel tandem roller weighing not less than 8 tons. The roller must operate in forward and reverse directions; contain provisions for moistening the surface of the wheels while in motion; and shall be approved by the Owner's Representative.

c. Three-Wheel Roller: The roller shall be an acceptable power-driven, all steel three wheel roller weighing not less than 10 tons. The roller must operate in forward and reverse directions; contain provisions for moistening the surface of the wheels while in motion; and shall be approved by the Owner's Representative.

d. Vibratory Steel Wheel Roller: If approved for use by the Owner's Representative, this roller shall have a minimum weight of 6 tons. The compactor shall be equipped with amplitude and frequency controls and shall be specifically designed to compact the material on which it is used. The roller shall be operated in accordance with the Manufacturer's recommendations.

3. Straightedges: The Contractor shall provide acceptable straightedges for the surface testing. Satisfactory templates shall be provided as required by the Owner's Representative.

4.00 EXECUTION

4.01 PREPARATION

A. Prime Coat: Apply a uniform coat of prime coat asphaltic material to the surface of the prepared subgrade, sub-base, or base, applied at a rate of not less than 0.30 gallons per square yard of surface. Apply a thin uniform coat of the prime coat material to contact surfaces of gutters, manholes, and other structures.

B. Tack Coat: Thoroughly clean the surface of the asphalt base course and apply a uniform coat of tack material meeting the requirements for cutback asphalt RC-250. Apply a tack coat when the surface to be paved is Portland cement concrete, brick, or asphaltic pavement. Apply the tack coat using sprayer at a rate not exceeding 0.05 gallons per square yard surface. Paint contact surfaces of curbs, gutters, vertical faces, and other structures in actual contact with asphaltic mixes with asphaltic material to provide a closely bonded, water-tight joint.

C. Compacted Thickness of Asphaltic Concrete Surface Courses and Base Courses:

1. Surface Course: The compacted thickness or depth of the asphaltic concrete surface shall be as indicated on the plans. Where the plans indicate a depth or thickness of the surface course greater than 2 inches compacted depth, same shall be placed in multiple courses of equal depth, each which shall not exceed 2 inches compacted depth. A tack coat is required between any of the multiple courses, and applied at the rate specified.

2. Base Course: The compacted thickness or depth of each base shall be as indicated. Where the plans indicate a depth or thickness of the course greater than 4 inches, same shall be accomplished by constructing multiple lifts of approximately equal depth, each of which shall not exceed these maximum compacted depths. An additional tack coat is required between any of the multiple lifts and must be applied at the rate specified.

4.02 PLACEMENT

A. Place the asphaltic mixture on an approved base course with the previously specified spreading and finishing machine in such a manner that, when properly compacted, the finished course shall comply with the maximum thickness requirements, shall be smooth, of uniform density and meet the requirements of the typical cross-sections and the surface test. During the placing and spreading of the asphaltic material, take care to prevent the spilling of the material onto adjacent pavement, gutters, or structures.

B. In small areas, which are inaccessible to the spreading and finishing machine, hand spreading may be authorized by the Owner's Representative, provided an acceptable surface can be obtained.

4.03 COMPACTION

A. Rolling with the three-wheel and tandem rollers shall start longitudinally at the sides and proceed toward the center of the surface course, overlapping on successive trips by at least half the width of the rear wheels. Alternate trips of the roller shall be slightly different in length. Rolling with the pneumatic tire roller shall be done as directed by the Owner's Representative. Rolling shall continue until no further compression can be obtained and all roller marks are eliminated. The motion of the rollers shall be slow enough at all times to avoid displacement of the asphaltic surface material. If displacement should occur, correct the situation at once by the use of rakes and fresh asphaltic mixtures. The roller shall not be allowed to stand on the surface course when it has not been fully compacted and allowed to cool. To prevent adhesion of the surface to the roller, the wheels shall be kept thoroughly moistened with water, but an excess of water shall not be permitted. Rollers must be in good mechanical condition. Take the necessary precautions to prevent the dripping of gasoline, oil, grease, or other foreign matter on the surface course while the rollers are in motion or when standing. In areas where surface course cannot be compacted with the roller, hand tamps, lightly oiled, shall be used to secure the required compaction.

B. With approval by the Owner's Representative, the vibratory steel wheel roller may be substituted for the three-wheel roller and tandem roller. Each course, after final compaction, shall contain from 5 to 9 percent air voids determined by GDOT Test Method TEX207-F and TEX-227-F.

4.04 FIELD QUALITY CONTROL

A. Surface Tests: The finished surface of the pavement after compression shall be smooth and true to the established line, grade, and cross-section. When tested with a 16-foot straightedge placed parallel to the centerline of the roadway, the finished surface shall have no deviation in excess of 1/16 inch per foot from the nearest point of contact. The maximum ordinate measured from the face of the straightedge shall not exceed 1/4 inch at any point. Any point in the pavement surface not meeting these requirements shall be immediately corrected.

B. Pavement Thickness Test: Upon completion of the work and before final acceptance and final payment shall be made, pavement thickness test shall be made by the Owner or his authorized representative unless otherwise specified in the special provisions or in the plans. The number and location of tests shall be at the discretion of the Owner's Representative. The cost for the initial pavement thickness test shall be at the expense of

the Owner. In the event a deficiency in the thickness of the pavement is revealed during normal testing operations, subsequent tests necessary to isolate the deficiency shall be at the Contractor's expense. The cost for the additional coring test shall be at the same rate charged by commercial laboratories.

END OF SECTION

32 15 00 AGGREGATE SURFACE AND DRAINAGE COURSE

1.00 GENERAL

1.01 WORK INCLUDED

A. Furnish labor, materials, equipment, and incidentals necessary to complete the surface course and drainage course systems as specified herein in conformance with the typical sections, lines, and grades as indicated on the drawings.

1.02 SUBMITTALS

A. Submittals shall be in accordance with Section 01 33 00 “Submittal Procedures” and shall include a sieve analysis for aggregate fills and record data for the geotextile materials to be used.

1.03 STANDARDS

A. The applicable provisions of the following standards shall apply as if written here in their entirety:

1. ASTM International (ASTM) Standards:

ASTM C131	Test Methods for Resistance to Degradation of Small-Size Course Aggregate by Abrasion and Impact in the Los Angeles Machine
ASTM D2217	Practice of Wet Preparation of Soil Samples for Particle-Size Analysis and Determination of Soil Constants

2.00 PRODUCTS

2.01 MATERIALS

A. Surface Course: The surface course shall consist of Class 11 Aggregate Fill as specified in Section 31 05 16 “Aggregates for Earthwork.”

B. Drainage Course: The drainage course shall consist of Class 2 Aggregate Fill as specified in Section 31 05 16 “Aggregates for Earthwork.”

C. Geotextile: The geotextile shall be as specified in Section 31 32 19.15 “Geotextile.”

3.00 EXECUTION

3.01 PREPARATION OF SUBGRADE

1. Strip maximum depth of 6 inches, as required to remove topsoil, rubbish, and vegetation not removed by clearing and grubbing operations. After excavation or stripping of the subgrades and excavation of the undesirable material to the extent indicated on the drawings or otherwise required, break down the sides of stump holes, test pits, and other similar cavities or depressions to flatten out the slopes to no steeper than five horizontal to one vertical (5:1). Scarify the sides of the cut or hole to provide bond between the subgrade material and the fill. Scarify the slopes and bottom of all excavations. Fill each depression with the appropriate class of earth fill material,

depending upon the type of material which is being placed immediately above the subgrade. Place the fill-in layers, moistened, and compacted in accordance with the applicable provisions. Spread materials which cannot be compacted by roller equipment because of inadequate clearances in 4-inch layers and compact with power tampers to a density and moisture content specified herein for the particular material being placed.

B. After filling of depressions and trenches, and immediately prior to placement of compacted fill in any section of the embankment, loosen the subgrade of such section thoroughly by scarifying, plowing, discing, or harrowing to a minimum depth of 6 inches. The moisture content shall be at or within 2 percentage points dry to 5 percentage points wet of optimum moisture content. After removal of roots or other debris turned up in the process of loosening, compact the entire surface of the subgrade area to 95 percent of maximum dry density as determined by ASTM D698, Standard Proctor.

3.02 INSTALLATION

A. Geotextile: Install the geotextile on the prepared subgrade as indicated and as specified in Section 31 32 19.15 “Geotextile.”

B. Drainage Course:

1. Install the drainage course on the prepared roadway subgrade in conjunction with the geotextile as indicated and as specified in Section 31 32 19.15 “Geotextile.”

C. Surface Course:

1. Compact the crushed stone surface course to a minimum of 95 percent of maximum index density as determined by ASTM D4253 Accomplish compaction with a vibratory roller as specified herein for the drainage course. With approval of the engineer, compaction confirmation and subsequent proof rolling documented by the engineer can suffice as acceptance of the compacted aggregate layer in lieu of meeting the maximum index density requirement listed above.

2. The completed surface of the crushed stone course shall be within the tolerance of +0.00 and -0.04 foot of the lines and grades shown on the drawings. The minimum thickness of the crushed stone surface course at any point in the completed course shall be not less than the thickness shown on the drawings. If regrading or reshaping of the crushed stone surface course is required to meet the specified tolerances, recompact the course to meet specification requirements for moisture and density.

3. Protect the completed crushed stone surface course from traffic or other conditions which might damage the course. Any area of the crushed stone surface course which is damaged by the weather or otherwise shall be reprocessed and re-compacted as required to meet specification requirements.

3.03 FIELD QUALITY CONTROL

A. General: The Owner will arrange and pay for the services of an independent testing laboratory to perform testing of the completed drainage course and surface course.

B. Testing:

1. Thickness Verifications: Thickness verification tests shall be performed on the drainage course and surface course.

2. Gradations: Gradation tests shall be performed on the drainage course and the surface course.
3. Density: Density tests shall be performed on the surface course.
4. Frequency: The testing frequency will be as designated by the Engineer.
5. Contractor Assistance: Assist in testing by curtailing operations in the vicinity of the tests during testing and shall repair areas where thickness verification tests and gradation test samples are taken in the completed drainage course and surface course.

END OF SECTION

32 16 13 CURBS AND GUTTERS

1.00 GENERAL

1.01 WORK INCLUDED

A. Furnish labor, materials, equipment and incidentals necessary to construct reinforced concrete curb and gutter in accordance with the lines, grades, and section indicated on the plans or as directed by the Owner's Representative.

1.02 OPTIONS

A. A curb and gutter laydown machine may be used for placing reinforcing steel and forming and placing concrete.

1.03 REFERENCES

A. Georgia Department of Transportation (GDOT)

1.04 SUBMITTALS

A. Product data: Submit data completely describing products.

B. Samples: Submit samples when requested.

2.00 PRODUCTS

2.01 MATERIALS

A. Concrete: Conforming to the requirements for 3000-psi concrete in Section 03 30 53 "Miscellaneous Cast-In-Place Concrete."

B. Reinforcing Steel: Conforming to the requirements in Section 03 21 00 "Reinforcing Steel."

C. Expansion Joint Material: Conforming to the requirements in Section 03 30 53 "Miscellaneous Cast-In-Place Concrete."

2.02 MIXES

A. Mortar: 1 part Portland cement and 2 parts fine aggregate.

3.00 EXECUTION

3.01 PREPARATION, EXCAVATION AND GRADING

A. Excavate, stabilize and shape the subgrade or foundation to line, grade and section as indicated on the plans or as directed by the Owner's Representative. Lightly sprinkle the subgrade or foundation material immediately before placing concrete.

B. Where curb and gutter are not adjacent to new pavement, use 2 inches of sand cushion. After the fine grading has been completed, evenly spread a 2-inch layer of sand or suitable gravel cushion over the subgrade for curb and gutter. Thoroughly wet and tamp sand cushion into place to the satisfaction of the Owner's Representative. Place the forms upon this sand or gravel base and use a screed to shape the sand cushion to parallel the top of gutter.

3.02 INSTALLATION

A. Forms:

1. Forms shall be made of wood or steel and framed, braced, or staked in a substantial and approved manner so as to insure perfect alignment and grade. Clean and oil the forms immediately before placing concrete. Take care in removing forms to prevent marring or spalling of the concrete. Forms shall be of a depth equal to the depth of the curb and gutter and a minimum of 1-1/2 inches in width when wooden forms are used or a rage that provides equivalent rigidity and strength when metal forms are used.

2. Forms showing a deviation of 1/8 inch in 10 feet from a straight line shall be cause for rejection.

3. For curves with a radius of less than 250 feet, acceptable flexible metal forms or wood forms may be used upon approval by the Owner's Representative.

B. Reinforcing Steel:

1. Accurately place steel reinforcement as indicated and hold in place during progress of placing concrete, and do not allow movement from the true position. Wire the bars at intersections and laps or splices. Lap bars at splices a minimum of 20 diameters of the bar or 12 inches, whichever is greater.

2. Place the reinforcement necessary for a section of concrete and have the Owner's Representative approve the reinforcement before any concrete is deposited in the section. Steel shall be free from paint and oil, and completely remove loose scale, rust, dirt, and other foreign substances before using.

3. Reinforcing steel shall conform to requirements in Section 03 21 00 "Reinforcing Steel."

C. Expansion Joints:

1. Form expansion joints using preformed expansion joint material as specified herein. Place expansion joints in the curb and gutter at 36-foot intervals and at intersection returns or as otherwise shown on the plans or as directed by the Owner's Representative. Place "Flagging" or a tooled joint at 6-foot intervals to provide a plane of weakness, unless otherwise shown on the plans or as directed by the Owner's Representative. Place expansion joints at abutting structures such as concrete driveways, sidewalks, buildings, inlets, etc. Expansion joints shall be 1/2 inch in thickness and shall extend the full depth of the concrete. Neatly trim any expansion material extending above the finished work to the surface of the finished work. The expansion joints in concrete pavement shall coincide with the expansion joints in the curb and gutter. Longitudinal dowels, across the expansion joints in the curb and gutter, shall be required. There shall be three No. 3 round, smooth bars for dowels at each expansion joint spaced in accordance with standard reinforcement steel. The dowel shall be a

minimum of 24 inches in length. Coat one end of the dowel with asphalt and terminated with an expansion cap. The cap shall provide a minimum of 1-inch free expansion. Support dowels by an approved method to provide a true horizontal and longitudinal alignment.

2. Seal joints through the gutter with a joint sealant material as specified herein.

3. Construct joints in a neat and workmanlike manner with edges rounded in conformity with the plans and specifications, and at locations as indicated on the plans or as designated by the Owner's Representative.

3.03 PLACEMENT

A. Deposit concrete so as to maintain a horizontal surface and thoroughly and continuously work into spaces and around all reinforcement to form a dense voidless mass.

B. Work the coarse aggregate away from contact with the forms so as to form a smooth, hard exposed concrete surface.

C. Continuously pour the concrete for curb and gutter between expansion joints. If construction joints are allowed at other locations by the Owner's Representative, properly construct joints with wood bulkheads to completely separate adjacent concrete sections.

3.04 FINISHING

A. After the concrete has been struck off and while still plastic, thoroughly work the exposed surfaces with a wooden float. Round the exposed edges by the use of an edging tool to the radius indicated. Float and trowel exposed surfaces. Brush exposed surfaces of curb and gutter to a smooth and uniform surface. Avoid excess working of the surface. Remove excess water, laitance and inert material from the surface.

3.05 CURING

A. Cure the completed curb and gutter in accordance with the requirements of Membrane Curing, as specified in Section 03 30 53 "Miscellaneous Cast-In-Place Concrete." Other methods of curing as outlined herein shall be acceptable with a required curing period of 72 hours.

3.06 BACKFILLING

A. Backfill the curb and gutter to the full height of the concrete and tamp and slope as indicated or as directed by the Owner's Representative.

3.07 FIELD QUALITY CONTROL

A. The top of the work and the face of the curbs shall be checked for irregularities as soon as the surface is finished, using a 10-foot straightedge. The maximum distance from the straightedges to the concrete shall not exceed 1/4 inch. Variations exceeding 1/4 inch shall be immediately corrected. Immediately chip out and patch honeycombed areas disclosed by removal of forms with mortar as specified.

B. Tests:

1. Curbs and gutters:

a. Test face, top, back, and flow line with 10-foot straightedge or curve template longitudinally along surface.

b. Correct deviations in excess of 1/4 inch.

2. Gutters:

a. Frequency of testing: When required by the Engineer, where gutters have slope of 0.8 foot per 100 feet or less, or where unusual or special conditions cast doubt on capability of gutters to drain.

b. Test method: Establish flow in length of gutter to be tested by supplying water from hydrant, tank truck, or other source.

c. Required results:

a). 1 hour after supply of water is shut off, inspect gutter for evidence of ponding or improper shape.

b). In event water is found ponded in gutter to depth greater than 1/2 inch, or on adjacent asphalt pavement, correct defect or defects in manner acceptable to the Engineer without additional cost to the Contract.

3.08 ADJUSTING

A. Repair portions of concrete damaged while stripping forms or, when damage is severe, replace such work at no additional cost to the Contract. Evidence of repairs shall not be noticeable in the finished product.

B. Remove and replace sections of work deficient in depth or not conforming to requirements indicated on the Drawings and specified in the Specifications at no additional cost to the Contract. Removal and replacement shall be the complete section between 2 joints.

END OF SECTION

32 31 13 CHAIN LINK FENCES AND GATES

1.00 GENERAL

1.01 WORK INCLUDED

A. Furnish labor, materials, equipment, and incidentals necessary to install chain link fences and gates. Chain link fences shall be of the industrial variety and 8-feet high. Gates shall be swing gates or slide gates as indicated on the Drawings.

B. Provide project coordination such that motorized gate controls are compatible with all other gates at the dam site.

C. Provide equipment tags for operators indicated on the Drawings.

1.02 SUBMITTALS

A. Submittals shall be in accordance with Section 01 33 00 “Document Management” and shall include:

1. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for chain-link fences and gates.
    a. Fence and gate posts, rails, and fittings.
    b. Chain-link fabric, reinforcements, and attachments.
    c. Gates and hardware.
    d. Gate operators, including operating instructions.
    e. Motors: Show nameplate data, ratings, characteristics, and mounting arrangements.
2. Shop Drawings: Show locations of fences, gates, posts, rails, tension wires, details of extended posts, extension arms, gate swing, or other operation, hardware, and accessories. Indicate materials, dimensions, sizes, weights, and finishes of components. Include plans, gate elevations, sections, details of post anchorage, attachment, bracing, and other required installation and operational clearances.
    a. Gate Operator: Show locations and details for installing operator components, switches, and controls. Indicate motor size, electrical characteristics, drive arrangement, mounting, and grounding provisions.
    b. Wiring Diagrams: Power and control wiring and access-control features.
3. Field Quality-Control Test Reports.
4. Maintenance Data: For the following to include in maintenance manuals:
    a. Gate operator.

1.03 STANDARDS

A. The applicable provisions of the following references and standards shall apply as if written herein in their entirety:

1. ASTM International (ASTM):

ASTM A36	Specification for Carbon Structural Steel
ASTM A121	Specification for Metallic-Coated Carbon Steel Barbed Wire
ASTM A123	Specification for Zinc (Hot-Dip Galvanized) Coatings in Iron and Steel Products
ASTM A153	Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM A1011	Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength
ASTM F567	Practice for Installation of Chain-Link Fence
ASTM F626	Specification for Fence Fittings
ASTM F668	Specification for Polyvinyl Chloride (PVC), Polyolefin and Other Polymer-Coated Steel Chain Link Fence Fabric
ASTM F1184	Specification for Industrial and Commercial Horizontal Slide Gates

2. Chain Link Fence Manufacturers Institute (CLFMI):

CLF-PM0610	Product Manual

1.04 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who has completed chain-link fences and gates similar in material, design, and extent to those indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.

B. Manufacturer shall be a company engaged in the manufacturing of chain link fencing and shall be in compliance with the CLFMI.

C. The chain link fencing shall be Standard 6 Gauge Industrial grade and shall meet the requirements of that grade, according to the CLFMI “PRODUCT MANUAL”.

1.05 PROJECT CONDITIONS

A. Field Measurements: Verify layout information for chain-link fences and gates shown on the Drawings in relation to property survey and existing structures. Verify dimensions by field measurements.

B. Refer to Section 03 30 53 “Miscellaneous Cast-In-Place Concrete” for concrete post concrete fill.

1.06 DELIVERY AND STORAGE

A. Products shall be stored at the Site on wood platforms raised above the surrounding grade and covered with weather-resistant coverings.

1.07 JOB CONDITIONS

A. Contractor shall visit the Site and determine the conditions which must be taken into consideration in the installation of the fencing. Report any condition which could affect the quality of installation.

B. Ascertain subsurface condition at the Site and provide drilling equipment suitable for boring to the required depth.

2.00 PRODUCTS

2.01 MATERIALS

A. Chain Link Fabric: 9-gauge galvanized steel wire fabric, Class 2, having a coating weight of 1.2 ounces per cubic feet, and a 2-inch mesh. Top edge of mesh shall have selvage edge and bottom of fabric shall be twisted.

B. Top Rail: 1-5/8-inch O.D. galvanized pipe, weighing not less than 2.27 pounds per foot, with outside sleeve-type couplings at least 6 inches long.

1. Coating: Use type A, consisting of not less than minimum 2-ounce per square foot average zinc coating per ASTM A123.

C. Line Posts: Line posts shall be galvanized 2-inch H-column, weighing not less than 2.72 pounds per foot, or 2.375-inch O.D. schedule 40 pipe, weighing not less than 3.65 lb/ft. Spacing not to exceed 10 feet. Fabric shall be tied to columns with 6-gauge galvanized clips on 14-inch centers and to pipe with 11 gauge galvanized steel tie wire.

1. Coating: Use type A, consisting of not less than minimum 2-ounce per square foot average zinc coating per ASTM A123.

D. Terminal Posts: Terminal posts shall be 2.875-inch O.D. diameter, weighing 5.79 lb/ft. Posts shall be equipped with 1/4-inch by 3/4-inch tension bars, 121 gauge by 1-inch wide tension bands, and 3/8-inch carriage bolts, bands on approximately 14-inch centers.

1. Coating: Use type A, consisting of not less than minimum 2-ounce per square foot average zinc coating per ASTM A123.

E. Gate Posts: Posts shall be 4-inch O.D. minimum weighing not less than 9.11 lb/lf. Coating: Use type A, consisting of not less than minimum 2-ounce per square foot average zinc coating per ASTM A123.

F. Bottom Tension Wire: No. 7 galvanized or aluminum-coating spring coil or tension wire which shall hold fabric in proper alignment and be resilient so as to restore alignment when fabric is deflected.

G. Wire Ties: 9-gauge aluminum.

H. Post Tops: Pressed steel or malleable iron, galvanized. Top posts shall be designed to permit passage of the top rail.

I. Stretcher Bars: One-piece galvanized steel having a minimum size of 3/16 inch by 3/4 inch.

J. Stretcher Bar Bands: Galvanized steel or aluminum alloy conforming to ASTM F626. Tension bars shall be formed from flat or beveled steel and shall have a minimum thickness after galvanizing of 0.078 inches by 3/4 inch for posts 4-inch O.D. or less, and 0.18 inches by 7/8 inch for posts larger than 4-inch O.D.

K. Tension Rod: 3/8-inch steel rod, hot-dip galvanized after threading, with turnbuckle or other means of adjustment.

L. Bolts: 5/16-inch by 1-1/4-inch galvanized steel carriage bolts with nuts, or other appropriate fasteners according to the application.

M. Structural and Miscellaneous Steel: Rolled steel shapes conforming to ASTM A36, galvanized according to ASTM A123.

N. Swing Gate Frames: Gates shall be fabricated of 2-inch O.D. pipe, weighing not less than 2.72 lb/ft. Gates shall be welded construction, galvanized after fabrication. Gates shall have 180-degree swing hinges, positive latching devices with provision for padlock, and adequate bracing, center rest, and semi-automatic catch to secure gate in open position.

O. Gates: Gates shall be covered with same fabric as fence. Double gates shall be supplied with positive center stop.

P. Gate Diagonal Bracing: 3/8-inch diameter galvanized steel rod with turnbuckle or truss tightener. Weight of galvanizing: 2 ounces per square foot, minimum.

Q. Miscellaneous Gate Hardware: Stretcher bands and bars, bolts, and nuts: steel, galvanized in accordance with ASTM A153. Clips: 6-gauge steel, galvanized in accordance with ASTM A153.

2.02 CAST-IN-PLACE CONCRETE

A. Concrete used for setting posts and other accessories shall be Class A concrete and shall meet the requirements of Section 03 30 53“Miscellaneous Cast-In-Place Concrete.”

2.03 INDUSTRIAL HORIZONTAL-SLIDE GATES

A. General: Comply with ASTM F1184 for single slide gate types.

1. Classification: Type II Cantilever Slide, Class 1 with external roller assemblies.

2. Metal Pipe and Tubing: Galvanized steel. Comply with ASTM F1184 for materials and protective coatings.

B. Frames and Bracing: Fabricate members from square, galvanized steel tubing with outside dimension and weight according to ASTM F1184 and the following:

1. Gate Fabric Height: As indicated.

2. Gate Opening Width: As indicated.

3. Frame Members:

a. Tubular Steel: 2 inches (50 mm) rectangular.

4. Bracing Members:

a. Tubular Steel: 2 inches (50 mm) rectangular.

C. Frame Corner Construction: Welded frame with panels assembled with bolted or riveted corner fittings and 5/16-inch (7.9-mm) diameter, adjustable truss rods for panels 5 feet (1.52 m) wide or wider.

D. Roller Guards: As required per ASTM F1184 for Type II, Class 1 gates.

E. Hardware: Latches permitting operation from both sides of gate, locking devices, hangers, roller assemblies and stops fabricated from galvanized malleable iron. Fabricate latches with integral eye openings for padlocking; padlock accessible from both sides of gate.

2.04 GATE OPERATORS

A. Gate Operators:

1. Basis-of-Design Product: Subject to compliance with requirements, provide Chamberlain Liftmaster commercial operator; or comparable product by one of the following:

a. Amazing Gates of America LLC.

b. Apollo Gate Operators.

c. AutoGate, Inc.

d. Begley Automated Gate Systems.

e. Byan Systems, Inc.

f. CAME Americas Automation LLC.

g. Chamberlain Group, Inc. (The).

h. DoorKing, Inc.

i. Eagle Access Control Systems, Inc.

j. FAAC USA.

k. Gates That Open, LLC.

l. HySecurity.

m. Tymetal Corp.

n. USAutomatic Inc.

o. Viking Access Systems.

B. Provide factory-assembled automatic operating system designed for gate size, type, weight, and operation frequency. Provide operation control system with characteristics suitable for Project conditions, with remote-control stations, safety devices, and weatherproof enclosures; coordinate electrical requirements with electrical system.

1. Provide operator designed so motor may be removed without disturbing limit-switch adjustment and without affecting auxiliary emergency operator.

2. Provide operator with UL approval.

3. Provide electronic components with built-in troubleshooting diagnostic feature.

4. Provide unit designed and wired for both right-hand/left-hand opening, permitting universal installation.

C. Comply with NFPA 70.

D. UL Standard: Manufacturer and label gate operators to comply with UL 325.

E. Emergency Access Requirements: Comply with requirements of authorities having jurisdiction for automatic gate operators on gates that must provide emergency access.

F. Motor Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, within installed environment, with indicated operating sequence, and without exceeding nameplate rating or considering service factor. Comply with NEMA MG 1 and the following:

1. Voltage: 480 V, Three Phase, 60 Hz.
2. Horsepower: Maximum of 3 HP.
3. Enclosure: Totally enclosed.
4. Duty: Continuous duty at ambient temperature of 105 F (40 C) and at altitude of 3300 feet (1005 m) above sea level.
5. Service Factor: 1.0 for totally enclosed motors.

G. Gate Operators: Concrete base mounted and as follows:

1. Hydraulic Rolling Gate Operators:
    a. Duty: Commercial/industrial.
    b. Gate Speed: Minimum 45 feet per minute.
    c. Frequency of Use: 10 cycles per hour.
    d. Operating Type: Wheel-and-rail drive with manual release.
    e. Hydraulic Fluid: Viscosity required for gate operation at ambient temperature range for Project.
    f. Locking: Hydraulic in both directions.
    g. Heater: Manufacturer's standard track and roller heater with thermostatic control.

H. Remote Controls: Provide the following remote-control device(s):

1. Card Reader: Gate to be opened via card reader.
2. Digital Keypad Entry Unit: Gate to be opened via digital keypad.
3. Remote Switch: Remote open command switches hard-wired from control room to gate allowing operator to open the gate.
4. Emergency Access: As required by authority having jurisdiction.

I. Vehicle Loop Detector: System includes automatic closing timer with adjustable time delay and loop detector designed to hold gate open until traffic clears, reverse gate, and open gate for exit. System includes electronic detector with adjustable detection patterns, adjustable sensitivity and frequency settings, and panel indicator light designed to detect presence or transit of a vehicle over an embedded loop of wire and to emit a signal activating the gate operator. System includes number of loops consisting of multiple strands of wire, number of turns, loop size, and method of placement, as recommended in writing

by detection system manufacturer for function indicated, at location shown on the Drawings.

J. Obstruction Detection Devices: Provide each motorized gate with automatic safety sensor(s). Activation of sensor(s) causes operator to immediately function as follows:

1. Action: Reverse gate in both opening and closing cycles, and hold until clear of obstruction.
2. Action: Stop gate in opening cycle and reverse gate in closing cycle, and hold until clear of obstruction.
3. Internal Sensor: Built-in torque or current monitor senses gate is obstructed.
4. Sensor Edge: Contact-pressure-sensitive safety edge, profile, and sensitivity designed for type of gate and component indicated, in locations as follows:
    a. Along entire gate leaf leading edge.
    b. Along entire gate leaf trailing edge.
    c. Along entire length of gate posts.
    d. Along entire length of gate guide posts.
5. Photoelectric/Infrared Sensor System: Designed to detect an obstruction in gate's path when infrared beam in the zone pattern is interrupted.

K. Limit Switches: Adjustable switches, interlocked with motor controls and set to automatically stop gate at fully retracted and fully extended positions.

L. Emergency Release Mechanism: Quick-disconnect release of operator drive system of the following type, permitting manual operation if operator fails. Design system so control-circuit power is disconnected during manual operation.

1. Type: Integral fail-safe release, allowing gate to be pushed open without mechanical devices, keys, cranks, or special knowledge or as required by authority having jurisdiction.

M. Operating Features:

1. Digital Microprocessor Control: Electronic programmable means for setting, changing, and adjusting control features with capability for monitoring and auditing gate activity. Provide unit that is isolated from voltage spikes and surges.
2. System Integration: With controlling circuit board capable of accepting any type of input from external devices.
3. Automatic Closing Timer: With adjustable time delay before closing and timer cutoff switch.
4. Open Override Circuit: Designed to override closing commands.
5. Reversal Time Delay: Designed to protect gate system from shock load on reversal in both directions.
6. Maximum Run Timer: Designed to prevent damage to gate system by shutting down system if normal time to open gate is exceeded.

7. Clock Timer: 24-hour programmable for regular events.
8. Override to allow gate to remain open for up to 12 hours with equipment at rest.

N. Accessories:

1. Battery Backup System: Battery-powered drive and access-control system, independent of primary drive system:
    a. Fail-Safe: Gate closes and remains closed until power is restored.
    b. Fail-Secure: Gate cycles on battery power, then fail-safe when battery is discharged.
2. Fire box, as required by authority having jurisdiction.
3. Instructional, Safety, and Warning Labels and Signs: According to UL 325.
4. Equipment Bases/Pads: Precast concrete, depth not less than 12 inches, dimensioned and reinforced according to gate operator component manufacturer's written instructions.

2.05 FENCE GROUNDING

A. Conductors: Bare, solid wire for No. 6 AWG and smaller; stranded wire for No. 4 AWG and larger.

1. Material Above Finished Grade: Copper.
2. Material On or Below Finished Grade: Copper.
3. Bonding Jumpers: Braided copper tape, 1 inch (25 mm) wide, woven of No. 30 AWG bare copper wire, terminated with copper ferrules.

B. Connectors and Grounding Rods: Comply with UL 467.

1. Connectors for Below-Grade Use: Exothermic welded type.
2. Grounding Rods: Copper-clad steel.
3. Size: 3/4 inch by 120 inches.

3.00 EXECUTION

3.01 EXAMINATION

A. Examine areas and conditions, with the installer present, for compliance with requirements for a verified survey of property lines and legal boundaries, site clearing, earthwork, pavement work, and other conditions affecting performance.

1. Do not begin installation before final grading is completed, unless otherwise permitted by the Engineer.
2. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Stake locations of fence lines, gates, and terminal posts. Do not exceed intervals of 500 feet (152.5 m) or line of sight between stakes. Indicate locations of utilities, underground structures, benchmarks, and property monuments.

3.03 INSTALLATION, GENERAL

A. Install chain-link fencing to comply with ASTM F567 and more stringent requirements specified.

1. Install fencing on established boundary lines inside property line.

3.04 CHAIN-LINK FENCE INSTALLATION

A. Post Excavation: Drill or hand-excavate holes for posts to diameters and spacings indicated, in firm, undisturbed soil.

B. Post Setting: Set posts in concrete at indicated spacing into firm, undisturbed soil.

1. Verify that posts are set plumb, aligned, and at correct height and spacing, and hold in position during setting with concrete or mechanical devices.

2. Concrete Fill: Place concrete around posts to dimensions indicated and vibrate or tamp for consolidation. Protect aboveground portion of posts from concrete splatter.

a. Exposed Concrete: Extend 1 inch (25 mm) above grade; shape and smooth to shed water.

C. Terminal Posts: Locate terminal end, corner, and gate posts per ASTM F567 and terminal pull posts at changes in horizontal or vertical alignment of 15 degrees or more.

D. Line Posts: Space line posts uniformly at 10 feet (3 m) center to center.

E. Post Bracing and Intermediate Rails: Install according to ASTM F567, maintaining plumb position and alignment of fencing. Install braces at end and gate posts and at both sides of corner and pull posts.

1. Locate horizontal braces at mid-height of fabric 5 feet (1.52 m). Install so posts are plumb when diagonal rod is under proper tension.

F. Tension Wire: Install according to ASTM F567, maintaining plumb position and alignment of fencing. Pull wire taut, without sags. Fasten fabric to tension wire with 0.120-inch (3.05-mm) diameter hog rings of same material and finish as fabric wire, spaced a maximum of 24 inches (610 mm) o.c. Install tension wire in locations indicated before stretching fabric.

1. Bottom Tension Wire: Install tension wire within 6 inches (150 mm) of bottom of fabric and tie to each post with not less than same diameter and type of wire.

G. Top Rail: Install according to ASTM F567, maintaining plumb position and alignment of fencing. Run rail continuously through line post caps, bending to radius for curved runs and terminating into rail end attached to posts or post caps fabricated to receive rail at terminal posts. Provide expansion couplings as recommended in writing by fencing manufacturer.

H. Chain-Link Fabric: Apply fabric to outside of enclosing framework. Leave 2 inches (50 mm) between finish grade or surface and bottom selvage, unless otherwise indicated. Pull fabric taut and tie to posts, rails, and tension wires. Anchor to framework so fabric remains under tension after pulling force is released.

I. Tension or Stretcher Bars: Thread through fabric and secure to end, corner, pull, and gate posts with tension bands spaced not more than 15 inches (380 mm) o.c.

J. Tie Wires: Use wire of proper length to firmly secure fabric to line posts and rails. Attach wire at one end to chain-link fabric, wrap wire around post a minimum of 180 degrees, and attach other end to chain-link fabric per ASTM F626. Bend ends of wire to minimize hazard to individuals and clothing.

1. Maximum Spacing: Tie fabric to line posts at 15 inches O.C. and to braces at 24 inches (610 mm) o.c.

K. Fasteners: Install nuts for tension bands and carriage bolts on the side of the fence opposite the fabric side.

3.05 GATE INSTALLATION

A. Install gates according to manufacturer's written instructions, level, plumb, and secure for full opening without interference. Attach fabric as for fencing. Attach hardware using tamper-resistant or concealed means. Install ground-set items in concrete for anchorage. Adjust hardware for smooth operation and lubricate where necessary.

3.06 GATE OPERATOR INSTALLATION

A. General: Install gate operators according to manufacturer's written instructions, aligned and true to fence line and grade.

B. Excavation for Concrete Bases/Pads: Hand-excavate holes for bases/pads, in firm, undisturbed soil to dimensions and depths and at locations as required by gate-operator component manufacturer's written instructions and as indicated.

C. Concrete Bases/Pads: Cast-in-place or precast concrete, depth not less than 12 inches (300 mm), dimensioned and reinforced according to gate-operator component manufacturer's written instructions and as indicated on the Drawings.

D. Vehicle Loop Detector System: Cut grooves in pavement and bury and seal wire loop according to manufacturer's written instructions. Connect to equipment operated by detector.

E. Comply with NFPA 70 and manufacturer's written instructions for grounding of electric-powered motors, controls, and other devices.

3.07 GROUNDING AND BONDING

A. Fence Grounding: Install at gates, corners and every other post as shown on the Drawings and Division 26.

B. Fences Enclosing Electrical Power Distribution Equipment: Ground as required by IEEE C2, unless otherwise indicated.

C. Grounding Method: At each grounding location, drive a grounding rod vertically and connect as shown on the Drawings. Connect conductor to each fence component at the grounding location.

D. Bonding Method for Gates: Connect bonding jumper between gate post and gate frame.

E. Connections: Make connections so possibility of galvanic action or electrolysis is minimized. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact will be galvanically compatible.

1. Use electroplated or hot-tin-coated materials to ensure high conductivity and to make contact points closer in order of galvanic series.
2. Make connections with clean, bare metal at points of contact.
3. Make aluminum-to-steel connections with stainless-steel separators and mechanical clamps.
4. Make aluminum-to-galvanized-steel connections with tin-plated copper jumpers and mechanical clamps.
5. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.

F. Bonding to Lightning Protection System: If fence terminates at lightning-protected building or structure, ground the fence and bond the fence grounding conductor to lightning protection down conductor or lightning protection grounding conductor complying with NFPA 780.

3.08 FIELD QUALITY CONTROL

A. Gate posts shall be accurately located to within 2 inches.

B. Intermediate posts shall not deviate from perfect alignment in a run by more than 1/2 inch.

C. Variation in spacings between intermediate posts between corner and terminal post shall not exceed 3 inches.

D. Grounding-Resistance Testing: Contractor to perform field quality-control testing.

1. Grounding-Resistance Tests: Subject completed grounding system to a megger test at each grounding location. Measure grounding resistance not less than 2 full days after last trace of precipitation, without soil having been moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural grounding resistance. Perform tests by two-point method according to IEEE 81.
2. Excessive Grounding Resistance: If resistance to grounding exceeds specified value, notify the Engineer promptly. Include recommendations for reducing grounding resistance and a proposal to accomplish recommended work.
3. Report: Prepare test reports certified by a testing agency of grounding resistance at each test location. Include observations of weather and other phenomena that may affect test results.

3.09 ADJUSTING

A. Gate: Adjust gate to operate smoothly, easily, and quietly, free of binding, warp, excessive deflection, distortion, nonalignment, misplacement, disruption, or malfunction, throughout entire operational range. Confirm that latches and locks engage accurately and securely without forcing or binding.

B. Automatic Gate Operator: Energize circuits to electrical equipment and devices. Adjust operators, controls, safety devices, alarms, and limit switches.

1. Hydraulic Operator: Purge operating system, adjust pressure and fluid levels, and check for leaks.
2. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
3. Test and adjust controls, alarms, and safeties. Replace damaged and malfunctioning controls and equipment.

C. Lubricate hardware, gate operator, and other moving parts.

3.10 DEMONSTRATION

A. Engage a factory-authorized service representative to train the Owner's personnel to adjust, operate, and maintain gates. Refer to Section 01 70 00 "Execution and Closeout Requirements."

END OF SECTION

32 31 29 WOOD FENCES AND GATES

1.00 GENERAL

1.01 WORK INCLUDED

A. Furnish labor, materials, equipment, and incidentals necessary to install wooden fences and gates. Wooden fences shall be of the treated lumber and 6-feet high. Gates shall be swing gates as indicated on the Drawings.

1.02 REFERENCES

A. ASTM International (ASTM):

1. A 121 - Standard Specification for Metallic-Coated Carbon Steel Barbed Wire.
2. A 123 - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
3. A 153 - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Seel Hardware.
4. A 385 - Standard Practice for Providing High-Quality Zinc Coatings (Hot-Dip).
5. A 392 - Standard Specification for Zinc-Coated Steel Chain-Link Fence Fabric.
6. A 702 - Standard Specification for Steel Fence Posts and Assemblies, Hot-Wrought.
7. F 626 - Standard Specification for Fence Fittings.
8. F 668 - Standard Specification for Polyvinyl Chloride (PVC) and Other Organic. Polymer-Coated Steel Chain-Link Fence Fabric.
9. F 1043 - Standard Specification for Strength and Protective Coatings on Steel Industrial Chain Link Fence Framework.
10. 10. F 1184 - Standard Specification for Industrial and Commercial Horizontal Slide.
    i. Gates.

1.03 SUBMITTALS

A. Submittals shall be in accordance with Section 01 33 00 “Document Management” and shall include:

1. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for wooden fences and gates.
    a. Fence and gate posts, rails, and fittings.
    b. Wooden pickets, bracing, and attachments.
    c. Gates and hardware.
2. Shop Drawings: Show locations of fences, gates, posts, rails, details of extended posts, extension arms, gate swing, hardware, and accessories. Indicate materials, dimensions, sizes, weights, and finishes of components. Include plans, gate elevations, sections, details of post anchorage, attachment, bracing, and other required installation and operational clearances.

3. Field Quality-Control Test Reports.

1.04 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who has completed wooden fences and gates similar in material, design, and extent to those indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.

1.05 PROJECT CONDITIONS

A. Field Measurements: Verify layout information for wooden fences and gates shown on the Drawings in relation to property survey and existing structures. Verify dimensions by field measurements.

B. Refer to Section 03 30 53 “Miscellaneous Cast-In-Place Concrete” for concrete post concrete fill.

1.06 DELIVERY AND STORAGE

A. Products shall be stored at the Site on wood platforms raised above the surrounding grade and covered with weather-resistant coverings.

1.07 JOB CONDITIONS

A. Contractor shall visit the Site and determine the conditions which must be taken into consideration in the installation of the fencing. Report any condition which could affect the quality of installation.

B. Ascertain subsurface condition at the Site and provide drilling equipment suitable for boring to the required depth.

2.00 PRODUCTS

2.01 MATERIALS

A. Pickets: Pickets shall be pressure-treated pine commercial lumber with dog-ear top measuring 5/8 inch x 5 ½ inch x 6 feet.

B. Backer Rails: Backer Rails shall be pressure-treated commercial pine lumber measuring at least 2 inch x 4 inch and of appropriate length to be attached to the Posts.

C. Line Posts: Line posts shall be pressure-treated commercial pine lumber measuring 4 ft x 4ft, and of sufficient length to be set in ground. Spacing between not to exceed 10 feet.

D. Terminal Posts: Terminal posts shall be pressure-treated commercial pine lumber measuring 6 inch x 6 inch and of sufficient length to be set in ground.

E. Gate Posts: Posts shall be pressure-treated commercial pine lumber measuring 6 inch x 6 inch and of sufficient length to be set in ground.

F. Post Tops: Posts shall be cut plumb after setting.

G. Screws: 3 ½ or 4 inch, coated, for attaching Backer Rails to Posts. 1 ¼ to 1 ¾ inch, coated, for attaching Pickets to Backer Rails and Posts.

H. Swing Gate Frames: Gates shall be fabricated per the Contract Documents with adequate bracing. Gates shall have 180-degree swing hinges, positive latching devices with provision for padlock, and adequate bracing, center rest, and semi-automatic catch to secure gate in open position. Double gates shall be supplied with positive center stop.

I. Miscellaneous Gate Hardware: Latch, bolts, and nuts: steel, galvanized in accordance with ASTM A153.

J. Gravel: Gravel shall be 57-stone or equivalent.

2.02 CAST-IN-PLACE CONCRETE

A. Concrete used for setting posts and other accessories shall be Class A concrete and shall meet the requirements of Section 03 30 53 “Miscellaneous Cast-In-Place Concrete.”

3.00 EXECUTION

3.01 EXAMINATION

A. Examine areas and conditions, with the installer present, for compliance with requirements for a verified survey of property lines and legal boundaries, site clearing, earthwork, pavement work, and other conditions affecting performance.

1. Do not begin installation before final grading is completed, unless otherwise permitted by the Engineer.

2. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Stake locations of fence lines, gates, and posts. Do not exceed intervals of 500 feet (152.5 m) or line of sight between stakes. Indicate locations of utilities, underground structures, benchmarks, and property monuments.

3.03 INSTALLATION, GENERAL

A. Install wood fencing to comply with Contract Documents.

B. Install wood fencing on established boundary lines inside property line.

3.04 WOOD FENCE INSTALLATION

A. Post Excavation: Drill or hand-excavate holes for posts to diameters and spacings indicated in the Contract Documents, in firm, undisturbed soil.

B. Post Setting: Set posts in concrete at indicated spacing into firm, undisturbed soil, backfilled with adequate gravel.

1. Verify that posts are set plumb, aligned, and at correct spacing. Hold in position during setting.

C. Concrete Fill: Place concrete around posts to dimensions indicated and vibrate or tamp for consolidation. Protect aboveground portion of posts from concrete splatter.

    a. Exposed Concrete: Extend 1 inch (25 mm) above grade; shape and smooth to shed water.

D. Terminal Posts: Locate terminal end, corner, gate posts at changes in horizontal or vertical alignment of 15 degrees or more.

E. Line Posts: Space line posts uniformly at 10 feet (3 m) center to center.

F. Backer Rails: Attach to posts while maintaining plumb position and alignment of fencing. Install braces at end and gate posts and at both sides of corner posts. Locate Backer Rails at top, middle, and lower height of fence. Install so bracing is plumb to the posts.

G. Pickets: Attach to Backer Rails and Posts while maintaining plumb position and alignment of fencing.

3.05 GATE INSTALLATION

A. Install gates according to Contract Documents, level, plumb, and secure for full opening without interference. Attach hardware using tamper-resistant or concealed means. Adjust hardware for smooth operation and lubricate where necessary.

3.06 FIELD QUALITY CONTROL

A. Gate posts shall be accurately located to within 2 inches.

B. Intermediate posts shall not deviate from perfect alignment in a run by more than 1/2 inch.

C. Variation in spacings between intermediate posts between corner and terminal post shall not exceed 3 inches.

3.07 ADJUSTING

A. Gate: Adjust gate to operate smoothly, easily, and quietly, free of binding, warp, excessive deflection, distortion, nonalignment, misplacement, disruption, or malfunction, throughout entire operational range. Confirm that latches and locks engage accurately and securely without forcing or binding.

B. Lubricate hardware, gate operator, and other moving parts.

3.08 FINISHING

A. Apply protective finish, as selected by Owner, to wooden fence and gates during Warranty Period, approximately 6 months after installation, or as directed by Owner.

END OF SECTION

32 91 19.13 TOPSOIL PLACEMENT AND GRADING

1.00 GENERAL

1.01 WORK INCLUDED

A. Furnish labor, materials, equipment and incidentals necessary to place topsoil, free from rock and foreign material in areas designated to receive sodding or seeding.

2.00 PRODUCTS

2.01 TOPSOIL

A. General: The topsoil shall be fertile loam, easily cultivated and free from objectionable material, and shall have a relatively high erosion resistance and be readily able to support the growth of the planting, seeding, or sodding specified on the plans.

B. Sources:

1. The topsoil may be obtained from the right-of-way at sites of proposed excavation, or it may be obtained from sources outside the right-of-way, secured by the Contractor, and meeting the approval of the Engineer.

2. Topsoil required in addition to salvaged topsoil from the project shall be secured from approved off-site borrow sources. Excavated material from construction which is suitable for topsoil shall be salvaged and used before any topsoil is obtained from borrow source.

3.00 EXECUTION

3.01 INSTALLATION

A. Stockpile topsoil material at locations approved by the Owner's Representative. Remove any trash, wood, brush, stumps or other objectionable materials prior to placement. The source and stockpile areas shall be kept drained and in a neat and presentable condition. Place and spread topsoil to a uniform depth to provide 6-inch compacted depth, while maintaining drainage in areas to be seeded or sodded.

END OF SECTION

32 92 13 HYDRO-MULCHING

1.00 GENERAL

1.01 WORK INCLUDED

A. Furnish labor, material, equipment and incidentals necessary to prepare the ground, furnish and install fertilizer and hydro-mulching seed or a mixture of seed of the kind specified in areas disturbed by the construction operations.

1.02 SUBMITTALS

A. Submittals shall be in accordance with Section 01 33 00 “Document Management” and shall include:

1. Georgia Testing Seed Label.
2. Specification of fertilizer to be used.

1.03 STANDARDS

A. The applicable provision of the following standard shall apply as if written here in its entirety:

1. Georgia Seed Law.

1.04 GUARANTEES

A. Contractor shall fertilize and reseed any area which fails to survive for a period of 1 year from the date the project is accepted by the Owner.

2.00 PRODUCTS

2.01 MATERIALS

A. General: Seed used must carry a Georgia Testing Seed label showing purity and germination, name, type of seed, and that the seed meets all requirements of the Georgia Seed Law. Seed furnished shall be of the previous season’s crop and the date of analysis shown on each tag shall be within 9 months of the time of delivery to the Project. Each variety of seed shall be furnished and delivered in separate bags or containers.

B. Seed: The specified seed shall equal or exceed the following percentages of purity and germination:

Common Name	Purity	Germination
Common Bermuda Grass	95%	90%
Gulf Coast Annual Rye	95%	90%

C. Mulch: The mulch shall be natural cellulose fiber mulch produced from grinding clean, whole wood chips, or fiber produced from ground newsprint with a labeled ash content not to exceed 7 percent. The mulch shall be designed for use in conventional mechanical planting,

hydraulic planting of seed or hydraulic mulching of grass seed, either alone or with fertilizers and other additives. The mulch shall be such that, when applied, the material shall form a strong, moisture-retaining mat without the need of an asphalt binder.

D. Fertilizer: Pelleted or granulated type fertilizer of the composition for the season of the year at which applied shall be used:

   1. Early season (April 1-June 1) 21-0-0.

   2. Normal season (June 1-Sept 1) 10-10-5.

   3. Late season (Sept 1-Nov 1) 6-12-12.

3.00 EXECUTION

3.01 PREPARATION

A. After the areas disturbed by construction operations have been backfilled and completed to the original pre-construction lines and grades shown on the Drawings and as provided for in other items of this Contract, perform hydro-mulch seeding in accordance with the requirements hereinafter described.

3.02 INSTALLATION

A. Cultivation: Cultivate areas to be seeded to a depth of at least 4 inches. Cultivate the seedbed sufficiently to reduce the soil to a state of good tilth when the soil particles on the surface are small enough and lie closely enough together to prevent the seed from being covered too deep for optimum germination. Cultivation of seedbed will not be required in loose sand where depth of sand is 4 inches or more. Maintain the cross-section previously established throughout the process of cultivation and any necessary reshaping shall be done prior to any planting of seed.

B. Planting Season and Application Rates: Perform planting between the dates specified for each type except when specifically authorized in writing. The seeds planted per acre shall be of the type specified with the mixture, rate, and planting dates as follows:

   1. Common Bermuda Grass - hulled, 20 pounds per acre - February through August; or

   2. Combination of Common Bermuda Grass - unhulled, 15 pounds per acre and Gulf Coast Annual Rye - unhulled, 15 pounds per acre - August through February.

   3. Apply fertilizer uniformly at the average rate of 400 pounds per acre.

C. Hydro-Mulch (Cellulose Fiber) Seeding: Uniformly distribute the fertilizer, seed or seed mixture, in the quantity specified over the areas to be seeded. Mechanical equipment shall be such that all varieties of seed as well as fertilizer may be distributed at the same time, provided that each component is uniformly applied at the specified rate. When seed and fertilizer are to be distributed as a water-slurry, apply the mixture to that area to be seeded within 30 minutes after all components are placed in the equipment. Upon completion of planting the seed, spread cellulose fiber mulch uniformly over the area at the following rates:

   1. Sandy soils with 3:1 slope or less: Min. 2000 lb. per acre.

   2. Sandy soils with greater than 3:1 slope: Min. 2300 lb. per acre.

3. Clay soils with 3:1 slope or less: Min. 2500 lb. per acre.
4. Clay soils with greater than 3:1 slope: Min. 3000 lb. per acre.
5. The rates are given in dry weight of mulch per acre. A mulching machine, approved by the Owner's representative, shall be equipped to eject the thoroughly wet mulch material at a uniform rate to provide the mulch coverage specified.

D. Maintenance:

1. Water the planted area at such times as necessary for a period of 1 year after final acceptance of the Project by the Owner or until seeding is accepted per Paragraph 3.02.D.3.
2. Fertilize and reseed any area which fails to survive for a period of 1 year from the date the Project is accepted by the Owner or until seeding is accepted per Paragraph 3.02.D.3.
3. Disturbed areas with slopes less than or equal to 4:1 slopes will be accepted when there is a minimum of 70 percent established coverage. Any slopes or grades exceeding a 4:1 must have a minimum of 90 percent established coverage to be accepted.

END OF SECTION

DIVISION 33

UTILITIES

33 05 01.02 DUCTILE IRON PIPE & FITTINGS

1.00 GENERAL

1.01 WORK INCLUDED

A. Furnish labor, materials, equipment and incidentals necessary to install ductile iron pipe and fittings, including taps, connections, and appurtenances as required for a functional system as indicated herein. Unless otherwise noted, all above grade exposed pipe, fittings, and appurtenances shall be flanged while below grade piping, fittings and appurtenances shall be mechanical joint or push on joints. Trenching, backfilling, and pipe embedment shall be as shown on the Drawings and in accordance with Section 31 23 33 “Trenching and Backfill.”

1.02 QUALITY ASSURANCE

A. Factory Testing: The manufacturer shall perform all tests as required by AWWA C151. Welded outlets shall be hydrostatically tested at a pressure of 250 psi for a period of 1 hour. No leakage shall be allowed.

B. Experience Requirements: Pipe shall be the product of a manufacturer who has a minimum of 10 years’ successful experience manufacturing pipe of the particular type specified and the total pipeline shall be the product of one pipe manufacturer. The manufacturer shall have a minimum of 10 years’ successful experience in the design and manufacturing of pipe joints of similar design, working pressure, pipe diameter and wall thickness as specified.

C. Owner Testing and Inspection:

1. Pipe may be subject to inspection by an independent testing laboratory, which laboratory will be selected and retained by the Owner. Representatives of the laboratory or the Engineer shall have access to the Work whenever it is in preparation or progress, and the pipe manufacturer shall provide proper facilities for access and for inspection. The pipe manufacturer shall notify the Owner in writing, at least 2 weeks prior to the pipe manufacture so that the Owner may advise the manufacturer as to the Owner's decision regarding tests to be performed. Material and pipe which are discovered to be defective, or which do not conform to the requirements of this Section shall be subject to rejection at any time prior to final acceptance of the pipe. After final acceptance, each joint of pipe shall be stamped as approved by the laboratory.

2. It is anticipated that production of pipe shall be done over a normal period of time and without "slow-downs" or other abnormal delays. In the event that an abnormal production time is required, and the Owner is required to pay excessive costs for inspection, then the Contractor shall be required to reimburse the Owner for such laboratory costs over and above those which would have been incurred under a normal schedule of production.

D. Pipe Classification: Pipe manufacturer shall manufacture the pipe to meet the installation conditions, cover depth, and bedding and backfill requirements as shown on the Drawings or specified and furnish the correct class of pipe to meet these conditions. If additional requirements are required, pipe manufacturer shall coordinate their requirements with the Contractor.

1.03 SUBMITTALS

A. Submittals shall be in accordance with Section 01 33 00 “Document Management” and shall include:

1. Record Data: Catalog data, including dimensions of new pipe and fittings and recommendations for handling and storage; details of lining and coating; thrust restraint provisions; hydrostatic pressure test plan and results; affidavit stating the pipe furnished complies with AWWA C151, AWWA C104, AWWA C110, AWWA C111, and these specifications; mill certificates, including chemical and physical test results for each heat of metal, if requested during pipe manufacturing operations; record drawings, including a schematic location-profile and a tabulated layout schedule, referenced to the pipeline stationing.

2. Shop Drawings: Mechanical joint connections; connections to differing pipe materials.

3. Certified Test Data: Certified Test Reports from the manufacturer’s testing facility or an Owner approved testing laboratory; results of factory hydrostatic tests; pipe and fitting certification for conformance to ANSI/NSF 61.

1.04 REFERENCE SPECIFICATIONS

A. Section 09 96 00.01 “High-Performance Coatings.”

B. Section 31 23 33 “Trenching and Backfill.”

C. Section 33 05 05.31 “Hydrostatic Testing.”

D. Section 33 10 13 "Disinfecting of Water Utility Distribution.”

1.05 STANDARDS

A. Except as modified herein, the applicable provisions of the following standards shall apply as if written here in their entirety:

1. American Water Works Association (AWWA) Standards:

AWWA C104	Standard for Cement Mortar Lining for Ductile Iron Pipe and Fittings
AWWA C105	Standard for Polyethylene Encasement for Ductile Iron Piping
AWWA C110	Standard for Ductile Iron and Gray Iron Fittings
AWWA C111	Standard for Rubber Gasket Joints for Ductile Iron Pipe and Fittings
AWWA C150	Standard for Thickness Design of Ductile Iron Pipe
AWWA C151	Standard for Ductile Iron Pipe
AWWA C153	Standard for Ductile-Iron Compact Fittings for Water Service
AWWA C600	Standard for Installation of Ductile Iron Water Mains and Appurtenances
AWWA C606	Grooved and Shouldered Joints

2. Steel Structures Painting Council (SSPC) Standard: SSPC SP6, Commercial Blast Cleaning.

1.06 DELIVERY AND STORAGE

A. Handling and storage of pipe and fittings shall comply with AWWA C600 and the manufacturer's recommendations.

1.07 GUARANTEES

A. The product shall be warranted and guaranteed per the General Conditions of the Specifications.

2.00 PRODUCTS

2.01 MATERIALS

A. Ductile Iron Pipe:

1. Ductile iron pipe shall be made of ductile iron in accordance with AWWA C151. All ductile iron pipe shall have a minimum working pressure as indicated on the Drawings. Pipe shall be rated for pressure in accordance with AWWA C151 for pressure class of pipe as indicated. Standard joint length shall be 18 to 20 feet. Flanged ductile iron pipe shall be in accordance with AWWA C115.

2. Pipe manufacturer shall manufacture the pipe to meet the installation conditions, cover depth, and bedding and backfill requirements as shown on the Drawings or specified and furnish the correct class of pipe to meet these conditions.

3. Manufacturers:

a. ACIPCO.

b. US Pipe.

B. Fittings: Fittings shall be ASTM A536 ductile iron or ASTM A48 cast iron in accordance with AWWA C110 . Fittings shall be rated for a minimum working pressure of 250 psi, unless specified otherwise. Factory welded outlets may be used in lieu of tee fittings for 18-inch and larger tee fittings. Factory welded outlets shall have a minimum pressure rating of 250 psi. Factory welded outlets may not be used near sources of vibration, such as pump stations or roads.

C. Joints for Pipe and Fittings:

1. Joints shall be in accordance with AWWA C110, AWWA C111, and AWWA C151. Standard joints for ductile iron pipe and fittings shall be push-on. Where indicated, joints shall be mechanical joint, flanged, or grooved.

2. Flanged joints shall have pressure ratings equal to or greater than adjacent pipe. Flange pattern shall match pattern of valve, fitting, or appurtenance to be attached. Flanges on ductile iron pipe shall be ductile iron.

3. Grooved joints may be used in lieu of flanged. Where used in lieu of flanges, grooved joints shall be of the rigid type, in accordance with AWWA C606.

4. Where indicated, grooved joints in accordance with AWWA C606 shall be used. Grooved joints shall be flexible unless indicated otherwise. All grooved joint couplings and fittings shall be of a single domestic manufacturer.

D. Provisions for Thrust:

1. Thrust at bends, tees, plugs, or other fittings shall be resisted by restrained joints. If thrust cannot be accommodated using restrained joints, thrust blocking or concrete anchors to restrain thrust may be used on a case-by-case basis when approved by the Engineer.

2. Restrained joints shall be used for a sufficient distance from each bend, tee, plug, or other fitting to resist thrust which will be developed at the design pressure of the pipe. For the purpose of thrust restraint, design pressure shall be 1.5 times the design working pressure class indicated.

3. The length of pipe with restrained joints to resist thrust forces shall be determined by the pipe manufacturer in accordance with Thrust Restraint Design for Ductile Iron Pipe, Ductile Iron Pipe Research Association using the following parameters:

   a. Laying condition equal AWWA C600 Type 4 bedding.

   b. If polyethylene encasement is used, restrained length shall be doubled to account for reduced soil to pipe friction resistance.

4. Where indicated and where required for thrust restraint, joints shall be restrained. Restrained joints shall be mechanically interlocking joints. Restrained joints shall be U.S. Pipe "TR Flex", American Ductile Iron Pipe "Flex Ring", or Clow Corporation "Super-Lock". Restraining fittings using set screws, restraining gaskets, gripper type glands, and field-cuts of restrained joints shall be Mega-Lug, or approved equal. Field welding shall not be allowed. Restrained joints shall be capable of sustaining the design pressure as specified herein.

E. Coating:

1. Coat the exterior of the pipe and fittings with a 1 mil bituminous coating in accordance with AWWA C110 and AWWA C151, unless specified otherwise.

F. In addition to the factory applied asphaltic coating, all buried ductile iron pipe and fittings shall have a tube-type polyethylene encasement in accordance with AWWA C105. Polyethylene encasement shall be 8 mils thick. Both ends of the pipe shall be thoroughly sealed with adhesive tape or plastic tie straps at the joint overlap. Place circumferential wraps of tape at 2-foot intervals along the barrel of the pipe to minimize the space between the encasement and the pipe.

G. Lining: Ductile iron pipe and fittings shall be lined with factory installed Protecto 401 Ceramic Epoxy Lining by Induron or American Polybond Plus (fusion bonded epoxy and fusion bonded polyethylene) or an approved equal. Lining primers, applications, and thicknesses shall be in accordance with manufacturer’s recommendations for sanitary sewer applications, but shall not be less than 40 mils.

H. Flexible Joint Couplings:

1. Flexible joint couplings shall be Dresser Style 38, Rockwell Style 411, Victaulic Depend-O-Lok - E x E, Type II or approved equal, unless otherwise shown.

2. Provide restrained flexible joint couplings or restrained flexible joints on all pipes connecting to concrete structures and at other locations shown on the Drawings. Restrained flexible couplings shall be Victaulic Depend-O-Lok F x F Type II **[** or approved equal. Restrained flexible joints shall be U.S. Pipe "TR Flex", American Ductile Iron Pipe "Flex Ring", Clow Corporation "Super-Lock", or approved equal.

I. Gaskets: Gaskets for air piping, fittings, valves, etc. shall be high temperature resistant type, suitable for a temperature of 350 F or higher if required by the equipment and/or service application.

J. Insulated Connections: Where insulated connections are indicated, the pipe manufacturer shall furnish dielectric insulation gaskets, sleeves, and two plastic washers for each bolt. Insulating kits shall be Insulket or approved equal.

K. Bonding Wires and Welding Cartridges: Bonding wire and thermite welding cartridges shall be furnished by the pipe manufacturer. Bonding wires shall consist of two insulated No. 4 copper wires.

3.00 EXECUTION

3.01 INSTALLATION

A. General: Install ductile iron pipe, fittings, specials, valves, and hydrants in accordance with AWWA C600 and the Specifications. Trenching and backfilling shall be in accordance with Section 31 23 33 **"**Trenching and Backfill." Before lowering into the trench, inspect each joint of pipe. Pipe will then be accepted, rejected, or repaired.

B. Pipe Laying: Lower pipe, fittings, and special castings into trench by crane or other suitable method. Do not roll in or "dump" into the trench. Handle pipe and fittings with belts, slings, or other equipment designed to prevent damage to the pipe and coating. Remove dirt and trash that may be in the barrel of the pipe, on the spigot or in the bell while the pipe is suspended. Keep the pipe clean during the laying operation and free of sticks, dirt, and trash, and at the close of each operating day seal the open end of the pipe with a gasketed night cap. Do not lay pipe in water.

C. Pipe Alignment: Install pipe and fittings to the line and grade indicated. In areas where the line and grade indicated cannot be achieved using standard manufactured bends and fittings, make slight adjustments by deflecting joints. Joint deflections may not exceed the lesser of the maximum deflections stipulated in AWWA C600 or 75 percent of the manufacturer's maximum recommended deflection. Resolve any conflicts with existing utilities and structures.

D. Joint Making:

1. Jointing Mechanical Joint Pipe:

a. Joint this type of pipe in accordance with the manufacturer's recommendations, with uniform torque on bolts.

b. After carefully cleaning both spigot and bell and after slipping the follower ring and gasket over the spigot end, slip the spigot into the bell. Apply a lubricant to the spigot to assist in assembly.

c. Carefully seat the gaskets by hand to be even in the bell at all points.

d. After drawing up the follower ring to uniform bearing against the gasket, insert the bolts and tighten by hand in pairs using bolts opposite each other.

e. Tighten the nuts to hold the required pressure. Extension wrenches or pipes over wrench handles shall not be permitted. Use 10-inch ratchet wrenches to tighten the nuts to a uniform torque.

f. The finished joint shall be watertight.

2. Making Flanged Joints: Erect flanged pipe in accordance with the controlling dimension as specified. Thoroughly clean each piece of flanged pipe to remove dirt, rust, grease, and other foreign matter. Thoroughly wire brush flanged faces to ensure even bearing for gaskets and mating flanges. Place full face gasket, use drift pins to align holes, and tighten flange bolts, each in turn, at a uniform torque around the joint. Finished joints shall be watertight.

3. Making Push-On Joints:

a. The jointing of this type of joint shall be as recommended by the manufacturer. The procedure for jointing shall be generally as follows:

1). Thoroughly clean and dry the spigot and bell before starting the assembly of the joint. Wipe the gasket clean with a cloth.

2). Place the gasket into the gasket seat in the bell.

3). Apply a thin film of lubricant to the surface of the gasket that will come in contact with the entering pipe spigot. If necessary, also apply lubricant to the spigot.

4). Make the joint by exerting sufficient force on the entering pipe so that its plain end will move past the gasket to the seat of the bell.

5). If restrained joints are used, orient pipe to permit ease of assembly. Place locking device after installation of spigot into bell.

4. Making Split-Sleeve Coupling Joints:

a. Exterior surfaces of the pipe shall be clean, smooth and free from weld beads, seams, scars, indentations, roll marks, exterior coatings and flat spots.

b. Install split-sleeve couplings in accordance with the manufacturer's latest installation instructions.

5. Bonding: Bond all pipe joints except where insulated connections are indicated. Clean pipe ends to bare metal and file or grind to prepare surface for cadwelding copper leads. After leads are attached, repair coating or complete field coating of joint.

E. Polyethylene Encasement: Wrap bituminous coated ductile iron pipe in polyethylene encasement in accordance with AWWA C105. Repair or replace encasements which have tears, rips, or punctures in the polyethylene wrap.

F. Painting: Paint piping which is submerged or exposed to the atmosphere in accordance with Section 09 96 00.01 "High-Performance Coatings."

3.02 FIELD QUALITY CONTROL

A. Perform a hydrostatic test as specified in Section 33 05 05.31 “Hydrostatic Testing.”

END OF SECTION

33 05 01.13 SANITARY SEWER PIPE (PVC)

1.00 GENERAL

1.01 WORK INCLUDED

A. Furnish labor, materials, equipment, and incidentals necessary to install 4- through 48-inch gravity flow PVC pipe. Trenching, backfilling, and pipe embedment shall be in accordance with Section 31 23 33 “Trenching and Backfill.”

1.02 QUALITY ASSURANCE

A. Certification: The sewer pipe manufacturer shall provide certification that the pipe supplied conforms to these specifications and shall include laboratory tests results that support such certification. If the manufacturer is unable to provide the certification, an independent testing facility shall be utilized and retained at no cost to the Owner. The pipe supplied shall be permanently marked with the manufacturer’s name, the date of manufacture, and identification with the tests performed to warrant its certification as being in conformance with this standard.

B. Testing:

1. At a minimum, actual test results shall be required as follows:

a. Load bearing tests.

b. Material tests.

c. Hydrostatic tests.

2. Tests on PVC pipe 4 through 48 inches shall be made in accordance with appropriate ASTM standard testing procedures and shall be performed on a minimum of 1 percent of the pipe purchased.

C. Inspection: An inspection of the pipe after delivery to the Project shall be made by a representative of the Owner. Pipe with visible defects which are indicative of poor structural condition or poor workmanship shall be rejected and replaced without cost to the Owner. Visible defects shall include cracks of any type, honeycombs, or any other defects of poor workmanship. Any pipe rejected shall not be returned under any condition to the Project.

1.03 SUBMITTALS

A. Submittals shall be in accordance with Section 01 33 00 “Document Management” and shall include:

1. Shop Drawing including the following information:

a. Product data sheet.

b. Manufacturer.

c. Nominal pipe diameter.

d. Standard dimension ratio (SDR).

e. Cell classification.

f. Laying lengths.

g. Joint methods.

h. Manufacturers minimum radii for horizontal deflection.

1.04 REFERENCE SPECIFICATIONS

A. Section 01 33 00 “Document Management.”

B. Section 01 40 00 “Quality Management.”

C. Section 31 23 33 “Trenching and Backfill.”

1.05 STANDARDS

A. The applicable provisions of the following standards shall apply as if written here in their entirety:

1. ASTM International (ASTM) Standards:

ASTM D1784	Standard Specification for Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds
ASTM D2241	Standard Specification for Poly (Vinyl Chloride) PVC Pressure Rated Pipe (SDR Series)
ASTM D2412	Standard Test Method for determination of External Loading Characteristics of Plastic Pipe by Parallel-Plate Loading
ASTM D3034	Standard Specification for Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings
ASTM D3212	“Standard Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals”
ASTM F477	Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe
ASTM F679 & Annex	Standard Specification for Poly(Vinyl Chloride) (PVC) Large Diameter Plastic Gravity Sewer Pipe and Fittings
ASTM F794	Standard Specification for Poly(Vinyl Chloride) (PVC) Profile Wall Gravity Sewer Pipe and Fittings Based on Controlled Inside Diameter
ASTM F1803	Standard Specification for Poly(Vinyl Chloride) (PVC) Closed Profile Wall Gravity Sewer Pipe and Fittings Based on Controlled Inside Diameter

2. American Water Works Association (AWWA) Standards:

AWWA C900	Standard for Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4 In. through 60 In. (100 mm Through 1,500 mm)

2.00 PRODUCTS

2.01 MATERIALS

A. Gravity Pipe: ASTM D3034 4- to 15-inch SDR 35 (26) or ASTM F679 18- to 48-inch PS46 (115) Polyvinyl chloride pipe with bell and spigot compression joints. Pipe shall have a home mark on the spigot to indicate proper penetration when the joint is made.

1. Use green coloring for ground identification as sanitary sewer pipe.
2. PVC meeting the requirements of ASTM D1784, with a cell classification of 12454 or 12364.

B. Gaskets: Conform to ASTM F477.

C. Joints: Tested in accordance with ASTM D3212.

D. Services: Where pressure rated piping is called for on the Drawings, PVC service laterals shall be pressure rated.

E. Detectable Warning Tape:

1. Provide detectable warning tape as follows:
   a. Thickness: 5.0 mil overall thickness.
   b. Width: 3-inch minimum.
   c. Weight: 27.5 pounds per inch per 1000 square feet.
   d. Triple Layer with:
      1). Minimum thickness 0.35 mils solid aluminum foil encased in a protective inert plastic jacket.
      2). 100 percent virgin low density polyethylene.
      3). Impervious to all known alkalis, acids, chemical reagents and solvents within soil.
      4). Aluminum foil visible to both sides.
   e. Locatable by conductive and inductive methods.
   f. Printing encased to avoid ink rub-off.
   g. Color and Legends:
      1). Sewer Line:
         a). Color: Green (in accordance with APWA Uniform Color Code).
         b). Legend: Caution Sewer Line Below (repeated every 24 inches).

3.00 EXECUTION

3.01 INSTALLATION

A. Install pipe to the lines and grades indicated. Begin installation at the downstream discharge connection point and make connections where indicated.

B. Carefully lower sanitary sewage pipe into the trench to avoid damage to the pipe. Remove dirt and trash from the pipe while suspended. Keep pipe clean during laying operations, and seal the pipe against entrance of objects at the close of each operating day.

C. Install PVC piping in accordance with ASTM F679 & Annex, ASTM F794 and manufacturer's or pipe supplier's published installation instructions.

D. Trenching and backfill as specified in Section 31_23_33 – Trenching and Section 31 23 36 – Trench Safety.

E. Minimum horizontal deflection shall be 133 percent of manufacturers minimum radius or 75 percent of the manufacturer's maximum recommended joint deflection.

3.02 FIELD QUALITY CONTROL

A. Pressure testing shall be as specified in Section 33 05 05.31 "Hydrostatic Testing."

B. Hydrostatic leak test gravity flow sewer lines shall be in accordance with the following:

1. Perform hydrostatic leak tests after backfilling.
2. The length of the pipe to be tested shall be such that the head over the crown of the upstream end is not less than 2 feet or 2 feet above the ground water level whichever is higher and the head over the downstream crown is not more than 6 feet.
3. Plug the pipe by pneumatic bags or mechanical plugs so that the air can be released from the pipe while it is being filled with water.
4. Make provisions for measuring the amount of water required to maintain the water at a constant level during this period.
5. The maximum allowable leakage is 10 gallons per inch of diameter per mile of pipe per 24 hours.
6. Remove the jointing material and remake the joint if any joint shows any visible leakage or infiltration.
7. Remove and replace any defective or broken pipes.
8. Determine the rates of infiltration by means of V-Notch weirs, pipe spigot, or plugs in the end of the pipe. Methods, times, and locations are subject to the Engineer's approval.
9. Pipe with visible leaks or infiltration or exceeds the maximum allowable leakage or infiltration is considered defective and must be corrected.

C. Low Pressure Air Test- Gravity Flow Sewer Lines:

1. Use air test in lieu of the hydrostatic test if desired, or if pipeline grades do not allow filling the entire pipeline segment or manhole to the indicated depth.

2. Perform low-pressure air tests, using equipment specifically designed and manufactured for the purpose of testing sewer pipelines using low-pressure air. Test is to conform to procedure described in ASTM F1417 except for testing times. The following test times are required:

Pipe Diameter (inches)	Minimum Time (seconds)	Length for Minimum Time (feet)	Time for Long Length (sec./ft.)
6	340	398	0.855
8	454	298	1.520
10	567	239	2.374
12	680	199	3.419
15	850	159	5.342
18	1020	133	7.693
21	1190	114	10.471
24	1360	100	13.676
27	1530	88	17.309
30	1700	80	21.369
33	1870	72	25.856

   a. Provide the equipment with an air regulator valve or air safety valve set to an internal air pressure in the pipeline that cannot exceed 6 psig.

   b. Pass air through a single control panel.

   c. Provide pneumatic plugs that have a sealing length equal to or greater than the circumference of the pipe to be tested.

   d. Provide pneumatic plugs that resist internal test pressures without requiring external bracing or blocking.

   e. Provide an air compressor of adequate capacity for charging the system.

3. Perform air test only on lines 33 inches in diameter or smaller. Air tests for pipes larger than 27 inches may be air tested at each joint.

4. Check connections for leakage with a soap solution. Release the air pressure, repair the leak, and retest with soap solution until results are satisfactory, before resuming air test if leaks are found.

5. Determine the shortest allowable time for the pressure to drop from 3.5 pounds per square inch to 2.5 pounds per square inch by the following formula:

$$T = \frac{0.085 * D * K}{Q}$$

Equation Term	Represents	Measure
T	Time for the pressure to drop 1.0 pound per square inch gauge	Seconds
K	Factor equal to 0.000419*D*L, but not less than 1.0	
D	Average inside diameter of the pipe	Inches
L	Length of line of the same pipe size	Feet
Q	Rate of loss. Use 0.0015 cubic feet per minute per square foot of internal surface	

D. Air Test for Individual Joints:

1. Lines 27 inches and larger may be tested at individual joints.
2. The shortest allowable time for the pressure to drop from 3.5 pounds per square inch gauge to 2.5 pounds per square inch gauge is 10 seconds for all pipe sizes.

END OF SECTION

33 05 05.31 HYDROSTATIC TESTING

1.00 GENERAL

1.01 WORK INCLUDED

A. Hydrostatically test new pipe between valves or plugs at the pressure and for the duration specified.

B. Additional plugs may be installed to reduce the length of each test section. No additional compensation will be paid if additional plugs are used.

C. Provide a pressure reducing backflow preventer and all temporary piping, pumping, fittings and gauges required to fill, test and then drain the pipe.

D. Do not begin test until pipe has been backfilled for at least 7 days.

1.02 SUBMITTALS

A. Submit detailed hydrostatic test procedure 10 days prior to conducting the test.

B. Submit Hydrostatic Pipe Test Reports per Section 01 33 00 “Document Management.” At a minimum, the test report shall include the following information:

1. Description of piping being tested:

a. Pipe material.

b. Section of piping being tested:

1). Date and time of pipe test.

2). Name of person performing the pipe test.

3). Specified test method and testing requirements.

4). Initial test pressure and time of pressure.

5). Final test pressure and time of pressure.

6). Status of test: Pass or fail.

7). Signature of the Contractor and Owner’s representative that witnessed the pipe test.

1.03 STANDARDS

A. The applicable provisions of the following standards shall apply as if written here in their entirety:

1. ASTM International (ASTM):

ASTM F2164	Standard Practice for Field Leak Testing of Polyethylene (PE) Pressure Piping Systems Using Hydrostatic Pressure

2. American Water Works Association (AWWA):

AWWA C200	Steel Water Pipe, 6 In (150 mm) and Larger
AWWA C600	Installation of Ductile-Iron Mains and Their Appurtenances
AWWA C604	Installation of Buried Steel Water Pipe – 4 In. (100 mm) and Larger
AWWA C605	Underground Installation of Polyvinyl Chloride (PVC) and Molecularly Oriented Polyvinyl Chloride (PVCO) Pressure Pipe and Fittings
AWWA M9	Concrete Pressure Pipe
AWWA M11	Steel Pipe – A Guide for Design and Installation
AWWA M23	PVC Pipe – Design and Installation
AWWA M41	Ductile-Iron Pipe and Fittings
AWWA M55	PE Pipe – Design and Installation

2.00 PRODUCTS

2.01 WATER FOR TESTING

A. Obtain water for filling and testing the pipeline and provide all temporary pumps and piping necessary to fill the pipeline.

B. Test water disposal:

1. Dispose test water in accordance with requirements of federal, state, county, and city regulations governing disposal of wastes in the location of the Project and disposal site.

2. Requirements and costs associated with notifications and obtaining any discharge permit or approvals shall be the responsibility of the Contractor.

C. If chlorinated water is used, then dechlorinate it before disposal per all regulations.

2.02 TEST PLUGS

A. Design plugs or blind flanges to withstand the test pressure on either side with only atmospheric pressure on the opposite side.

B. Do not use installed valves for shutoff when the specified test pressure exceeds the valve's maximum allowable seat differential pressure. Provide blinds or other means to isolate test sections.

C. Provide a 30-inch access manhole in one side of the plug and a 12-inch flanged outlet on the other side of the plug unless shown differently on the Drawings.

3.00 EXECUTION

3.01 GENERAL

A. Perform hydrostatic test in accordance with this Section, AWWA Standards, AWWA Manuals, and the supplier's recommendations.

3.02 TEST PRESSURE

A. 1.25 to 1.5 of the working pressure for Ductile Iron Pipe.

3.03 TEST PREPARATION

A. Fill pipe at 0.5 feet per second in the main pipe.

B. Verify all air valves are working and air is vented from temporary taps. Plug taps after test.

C. Examine bulkheads, valves, manholes, flanges, and connections for leaks during this period. Stop any leaks before continuing.

D. If an existing valve is in the test section, then coordinate with the Construction Manager to determine an approved method for measuring any leakage past the valve. Furnish all necessary equipment and include the cost for this effort in the Contract Price.

3.04 TEST DURATION

A. Perform pressure testing after completion of visible leaks test and after any leaks have been fixed.

B. After the expansion phase, test the section for 2 hours.

C. The test is acceptable if the pressure drops no more than 5 percent during the test phase. Retest the pipeline, after allowing it to relax for 8 hours, if the pressure drops more than 5 percent during the test.

D. When test results indicate failure of selected sections, limit tests to piping:

1. Between valves.

2. Between a valve and the end of the piping.

3. Less than 500 feet long.

E. Test the test section for 8 hours.

3.05 EXAMINATION UNDER PRESSURE

A. Decrease the pressure by 10 psi.

B. Protect the gauge from direct sunlight during the test.

C. Inspect the pipe during the test to locate any leaks or breaks, defective joints, cracked or defective pipe, fittings, or valves. Correct defective Work identified during the pressure test.

D. Correct all identified leaks

E. Test the pipe again after defective Work has been corrected. If HDPE pipe has been under test pressure for 8 hours, then allow it to relax for 8 hours before retesting it. Repeat the test and correction of defective Work until satisfactory test results are obtained.

3.06 PERMISSIBLE MAKEUP WATER

A. Make up water is the amount of water added to the test section to maintain the pressure within 5 psi of the specified test pressure.

B. Makeup water is not allowed for HDPE.

C. No makeup water is allowed for welded steel pipe.

3.07 CORRECTIONS OF DEFECTS

A. Repair any defective joints, cracked or defective pipe, fittings, or valves discovered in performance of this pressure test with sound material meeting the requirements of the Contract Documents and repeat the test until satisfactory results are obtained. Repair all noticeable leaks even if the actual leakage is within the allowable limits.

3.08 REMOVAL OF TEST PLUGS

A. Remove test plugs once both sides of the pipeline have been tested. If another contractor may need the plug, then coordinate with them – the last contractor to need the plug shall remove it and repair the mortar lining.

B. Leave the pipeline full of water upon completion of the hydrostatic test, except where internal test plugs must be removed to allow construction to continue.

END OF SECTION

33 39 13 SANITARY UTILITY SEWAGE MANHOLES, FRAMES AND COVERS

1.00 GENERAL

1.01 WORK INCLUDED

A. Provide labor, materials, equipment and incidentals necessary to construct manholes and cleanouts complete with covers, fittings, and other appurtenances, in accordance with the details and/or called out in the Drawings.

1.02 QUALITY ASSURANCE

A. Polymer Concrete Manholes:

1. Certification from manufacturer that polymer concrete manhole design meets or exceeds the load and strength requirements of ASTM C478 and ASTM C857, reinforced in accordance with ASTM C478 or ACI 440.1R.
2. Proof of independent chemical resistance testing conducted in accordance with ASTM C267.
3. Manufacturer must provide references of 10 previous polymer concrete projects including scope in the last 5 years performed with both the owner and contractor for reference and review.

1.03 SUBMITTALS

A. Submittals must be in accordance with Section 01 33 00 “Document Management” and must include:

1. Shop Drawings:
    a. Drawings and data covering manhole sections. These drawings must include manhole designation matching the plans, invert elevations and diameters for each manhole.
    b. Concrete batch mix for cast-in-place sections must be submitted as a Shop Drawing.
2. Product Data:
    a. Manhole cover and ring.
    b. Engineer to include other products as specified.
3. Polymer Concrete Manholes:
    a. Certification from the manufacturer that polymer concrete manhole design meets or exceeds the load and strength requirements of ASTM C478 and ASTM C857, reinforced in accordance with ASTM C478 or ACI 440.1R.

1.04 STANDARDS

A. Applicable provisions of the following standards apply as if written here in their entirety:

1. ASTM International (ASTM) Standards:

ASTM A48	Specification for Gray Iron Castings
ASTM C267	Test Methods for Chemical Resistance of Mortars, Grouts, and Monolithic Surfacings and Polymer Concretes
ASTM C443	Standard Specification for Joints for Concrete Pipe and Manholes using Rubber Gaskets
ASTM C478	Specification for Precast Reinforced Concrete Manhole Sections
ASTM C497	Test Methods for Concrete Pipe, Manhole Sections, or Tile
ASTM C579	Test Methods for Compressive Strength of Chemical-Resistant Mortars, Grouts, Monolithic, Surfacing, and Polymer Concretes
ASTM C857	Test Method for Flexural Strength and Modulus of Elasticity of Chemical-Resistant Mortars, Grouts, Monolithic Surfacings, and Polymer Concretes
ASTM D2240	Test Method for Rubber Property - Durometer Hardness
ASTM C76	Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe
ASTM C33	Concrete Aggregates
ASTM C990	Specification for Joints for Concrete Pipe, Manholes and Precast Box Sections using Preformed Flexible Joint Sealants
ASTM C923	Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes, and Laterals
ASTM D6783	Specification for Polymer Concrete Pipe

2. American Concrete Institute (ACI) Standards:

ACI 440-1R-15	Guide for the Design and Construction of Structural Concrete Reinforced with Fiber-Reinforced Polymer (FRP) Bars

3. American National Standards Institute (ANSI) Standards:

ANSI A21.10	American National Standard for Gray Iron and Ductile Iron Fittings, 3 through 48 Inches for Water and Other Liquids

1.05 DELIVERY AND STORAGE

A. Do not deliver precast concrete section to the Site until representative concrete control cylinders have attained a strength of at least 80 percent of the specified minimum.

B. Inspect precast concrete sections upon delivery and reject any cracked or otherwise visibly defective units.

2.00 PRODUCTS

2.01 MANUFACTURED PRODUCTS

A. Precast Concrete Manholes:

1. Above the manhole base, manholes must be constructed with precast concrete rubber gasket sections in accordance with ASTM C478 pipe as detailed in the Drawings using materials as specified below.
2. Material must be a non-shrink, non-metallic cement-based grout.
3. Rubber Gaskets: Neoprene or other synthetic, 40 plus or minus 5 hardness when measured by ASTM D2240, Type A durometer.
4. Precast Cone: Precast cone must be concentric.
5. Manhole steps must not be furnished for wastewater manholes.
6. All ASTM C478 pipe must be machine made by a process that must provide for uniform placement of zero slump concrete in the form and compaction by mechanical devices which must assure a dense concrete in the finished product, except that reducer cones may be wet-cast.
7. Aggregates for the concrete must comply with the requirements of ASTM C33, with the additional requirement that the aggregate must have a minimum of 50 percent of calcium carbonate equivalent.
8. Minimum wall thicknesses for the manhole risers must be as listed under Wall “B” in the ASTM C76 “Class Tables.”
9. Approved Manufacturers:
    a. Forterra Pipe and Products.
    b. CSR Hydroconduit.
    c. Approved equal.

B. Polymer Concrete Manholes:

1. Riser Sections:
    a. Provide base riser section with monolithic floors, unless shown otherwise in the Drawings.
    b. Provide riser sections joined with bell and spigot/ship-lap design seamed with butyl mastic (ASTM C990) and or rubber gaskets (ASTM C443) so that on assembly, manhole base, riser and top section make a continuous and uniform manhole structure. Joints shall meet the testing requirements without the use of an external joint wrap.
    c. Construct riser sections for polymer concrete manholes from standard polymer concrete manhole sections of the diameter indicated in the Drawings. Use various lengths of polymer concrete manhole sections in combination to provide the correct height with the fewest joints. Lifting inserts shall not fully penetrate the wall.

2. Resin: The manufacturer must use only polyester or vinyl ester resin systems designed for use with this particular application. Resin additives such as curing agents, pigments, dyes, fillers and thixotropic agents, when used, must not be detrimental to the manhole. Minimum resin content shall not be less than 7 percent by weight.
3. Aggregate: All aggregate, sand and quartz powder must meet the requirement of ASTM C33, where applicable. Limestone aggregates shall not be used.
4. Polymer concrete must have a minimum compressive strength of 9000 psi when measured in accordance with ASTM C497.
5. Elastomeric Gaskets: Gaskets must be suitable for the service intended and must meet the requirements of ASTM C443. Assembled joints shall meet the testing requirements of ASTM C443 without the use of an external joint wrap. Pipe to manhole connections shall be accomplished with connectors meeting ASTM C923 for both materials and performance requirements. Proof of connector testing can be requested from connector manufacturer.
6. Marking and Identification: Each manhole must be marked with the manufacturer's name and production date.
7. Invert Channel: Construct invert channels to provide smooth flow transition with minimal disruption of flow at pipe to manhole connections. Polymer bench and channel are to be constructed with all polymer concrete material. Extended ballast slab for buoyancy concerns can be addressed with cementitious concrete material.
8. Manholes must be reinforced per ASTM C478 or ACI 440.1R and designed to withstand all live loads and dead loads as described in the Drawings. Manhole wall thickness must be designed to resist hydrostatic pressures with a minimum safety factor of 2.0 for full depth conditions from grade to invert.
9. Materials needed for grouting and patching must be a polyester mortar compound provided by the manufacturer or as approved by the manufacturer.
10. Approved Manufacturers:
    a. Armorock Polymer Concrete.
    b. U.S. Composite Pipe, Inc. (a division of Thompson Pipe Group).
    c. Approved equal.

C. Metallic Manhole Rings and Covers:

1. Manhole rings and covers must be made of gray iron castings, ASTM A48, Class No. 30.
2. A minimum of four 316 stainless steel anchor bolts for the ring are required for the connection to manholes. A minimum of five stud bolts for anchoring of the waterproof lid must be of 316 stainless steel.
3. Castings must be clean, sound, and free of blow or sand holes or other defects.
4. Lids must have pick slots.
5. Minimum manhole ring and cover inside diameter (clear opening) is 30 inches.
6. Ring depth must be a minimum of 6 inches.

7. Lid and ring must be designed for HS-20 traffic loading.
8. Water-tight lids must be bolted using 316 stainless steel bolts to ring with neoprene gaskets within flood plain areas and as indicated in the Drawings.
9. Approved Manufacturers:
    a. EJ.
    b. Neenah Foundry, Co.
    c. Calcutta Foundry, Ltd.
    d. Shree Ram Foundry.
    e. SIP Industrial Products, Ltd.
    f. Victory Iron Works, Ltd.
    g. Approved equal.

D. Non-Metallic Manhole Rings and Covers:

1. All rings and covers must be made from high strength nonmetallic fiber reinforced polymer/composite materials. The material must be a resin thermoset matrix that can be reinforced with continuous filament engineered fabrics, fiber rovings, short fiber filaments, or equivalent nonmetallic reinforcing structure(s). Sealing gaskets must be bonded to the frame continuously at the interface with the cover to reduce wear, shock, noise, malodors and infiltration.
2. Rings and covers intended for traffic service must be capable of withstanding AASHTO M306: Proof Testing (includes items such as frames, covers, etc.).
3. Fabricate rings and covers to conform to shapes, dimensions, and with wording or logos shown in the Drawings.
4. Molding Process:
    a. Before the moldings are removed from the molding operation, they must be thoroughly de-flashed and cleaned at the parting lines, holes, notches and all exposed edges.
    b. If using a lock or latch, these must be independent of the method used to open the cover to ensure the cover can be opened in the event of lock or latch failure.
    c. Covers and frames must be compression molded under high pressures (>0.5 tons/sq. inch of x-y surface area) and high temperatures (>200 deg F).
    d. Metal reinforcements or metal hinges molded within the composite will not be permitted. Small non-stress bearing pieces of metal may be encapsulated or attached.
5. All rings and covers must be molded and assembled in the United States in accordance with the requirements of AASHTO M306.
6. Covers must be provided with a positive sealing mechanism utilizing 316 stainless steel hardware with nuts molded in or attached at pre-molded designated points of the frame and must be Teflon coated. Other equivalent locking mechanisms must be approved by the Engineer.

7. Composite covers must be detectable by metal detectors.
8. Composite covers must be furnished with two concealed pick holes molded with 316 stainless steel inserts. An additional 316 stainless steel lifting clip must be molded into the top of the cover to facilitate removal and replacement.
9. Composite covers must have provisions for 316 stainless steel threaded inserts molded into the bottom surface to accommodate monitoring and remote transmission sensors and antenna utilized by the utility. Antenna placed on the bottom side must have the capability to transmit through the cover without the need to drill and install antenna on the upper surface.
10. Markings: Covers and frames must have the following molded into the substrate of the cover:
    a. Name (or abbreviation) of molder.
    b. Country of origin.
    c. Molding date.
    d. Indication that material is non-metallic.
11. Approved Manufacturers:
    a. Composite Access Products, L.P.
    b. Approved equal.

E. Manhole Grade Adjustment Rings:
1. Concrete Manhole Grade Rings:
    a. Grade adjustment rings must be pre-cast, reinforced concrete in conformance to ASTM C478.
    b. Mortar concrete grade rings using 1 part Portland cement and 2 parts sand and sufficient potable water to produce a working mixture.
    c. Coat all exposed concrete surfaces per 09 96 01 “Concrete Protective Coatings.”

F. Wastewater Manhole Internal Drop:
1. Internal drop for wastewater manholes must consist of a fiberglass reinforced resin bowl in combination with a PVC drop pipe.
2. Bowl and pipe must be attached to manhole using manufacturer provided 316 stainless steel hardware with epoxy anchors.
3. Drop pipe must be ASTM D3034, SDR35 PVC pipe.
4. Provide 316 stainless steel bracket extensions as required for manhole ID changes.
5. Approved Manufacturers:
    a. Duran, Inc. – Reliner Drop Bowl.
    b. Approved equal.

G. Cleanout Fittings:

1. Pipe fittings must be ductile iron and must conform to ANSI A21.10 with a minimum pressure rating of 250 psi.
2. The cleanout casting must conform to ASTM A48, Class 30.
3. Ductile iron fittings must be lined with factory installed Protecto 401 Ceramic Epoxy Lining by Induron or American Polybond Plus (fusion bonded epoxy and fusion bonded polyethylene) or an approved equal. Lining primers, applications and thicknesses must be in accordance with manufacturer's recommendations for sanitary sewer applications.

H. Pipe Connections:

1. Field connections to FRP manholes to pipe penetration must use a compression fit into the cored wall of the RFP liner and use stainless steel bands to secure the gasketed connection to the pipe.
2. Approved Manufacturers:
    a. ADS – Insert-a-Tee.
    b. Trelleborg – Kor-N-Seal.
    c. Approved equal.

I. Manhole Cover Infiltration Insert:

1. The insert must be constructed of an HDPE or 316 stainless steel body with a neoprene gasket.
2. Insert must be equipped with a manufacturer installed gas relief valve designed to release pressure within the manhole, with minimal water inflow back into the manhole.
3. Insert must be equipped with a handle to allow for easy removal of the insert. All hardware must be 316 stainless steel.
4. Approved Manufacturers:
    a. Rainstopper.
    b. Approved equal.

J. Chimney Seals:

1. Chimney seals consist of a flexible internal or external rubber sleeve, interlocking extensions and stainless steel expansion bands.
2. The seal must remain flexible, allowing repeated vertical movement of the frame of not less than 2 inches and/or repeated horizontal movements of not less than 1/2 inch.
3. The sleeve portion of the seal must be either double or triple pleated with a minimum unexpanded vertical height of either 8 or 10 inches respectively. The sleeve and extension must have a minimum thickness of 3/16 inch and must be made from a high-quality rubber compound conforming to the applicable requirements of ASTM C923, with a minimum 1500-psi tensile strength, a maximum 18 percent compression set and a hardness (durometer) or 48 plus or minus 5.

4. The bands must be integrally formed from 16-gauge stainless steel conforming to ASTM A240, Type 316, with no welded attachments, and must have a minimum adjustment range of 2 diameter inches and a positive locking mechanism.
5. All hardware used for this mechanism must be 316 stainless steel.
6. Product must have a minimum 25-year manufacturer's warranty.
7. Approved Manufacturers:
    a. Cretex Specialty Products.
    b. Approved Equal.

3.00 EXECUTION

3.01 INSTALLATION

A. Manhole Sizing: Manhole diameters are to be as indicated in the Drawings and as indicated below. If there is a conflict between the Drawings and these requirements, the larger manhole diameter will be required.
    1. Pipe Diameters 18 Inches and Smaller: Provide 48-inch inside diameter manholes.
    2. Pipe Diameters greater than 18 inches and less than 30 Inches: Provide 60-inch inside diameter manholes.
    3. Pipe Diameters 30 Inches and Larger: Provide 72-inch inside diameter manholes.

B. Foundation Support: Manholes must be founded on stable subgrade. Precast base units must be founded on a minimum 6-inch-thick layer of compacted course aggregate bedding. A pipe section with a prefabricated tee manhole and half the length of the adjoining pipe sections on each side must be founded on a minimum 6-inch layer of Class A concrete. The cradle is to extend to the trench walls and to the spring line of the pipe.

C. Manhole Base:
    1. Tee Manhole Base: The applicable details as indicated in the Drawings apply. Form and place the base of the manholes under and around the existing carrier pipe to form a flat platform above the top of the pipe to receive the pre-cast circular manhole sections. After the manhole has been completed, entry to the pipe area must be made by saw-cutting a section from the top of the pipe. Any debris resulting from this operation must be completely removed from the interior of the pipe.
    2. Precast Manhole Base: The applicable details as indicated in the Drawings apply. Place the manhole base at an elevation that allows the invert to match the pipe flowline.
        a. The precast manhole base must form a watertight seal with the bottom of the manhole. This may be accomplished by placing a continuous 1-inch ring of epoxy grout or using a rubber gasket at the joint of the manhole and manhole base or other pre-approved methods.
    3. Give the concrete portion of all inverts within the manholes a smooth steel trowel finish.
    4. The first section of pipe extending out a minimum of 24 inches from each side of the manhole base must be supported by lean concrete as part of the manhole base. No

additional payment will be made for this concrete cradle; the sum must be included in the bid price for the manhole.

D. For precast manholes, the tops of the manholes will be set to proper elevation by using a predetermined length of the bottom section of the manhole riser and using standard lengths for the other sections of the riser pipe.

E. Monolithic Manholes: Pour monolithic concrete manholes on the Site using specifically designed, re-usable plastic or metal forms. Pour manholes using 3000-psi concrete to provide a formed wall thickness of at least 8 inches. Monolithic manholes must be substantially water-tight when completed. Bases or footing for these manholes must be as described above.

F. Inverts: Construct invert channels to provide a smooth waterway with no disruption of flow at the connection between the pipe and manhole. The channel depth at the point where a pipe connects to the manhole wall, for pipes 24 inches in diameter and smaller, must be a minimum of 3/4 of the diameter of the pipe, with the top of the channel being a smooth transition between the inlet and outlet pipe connections. For manholes connecting to larger pipe diameters, the channel depth must be equal to the full pipe diameter. Changes in flow direction must be constructed using smooth, long radius sweeps. Inlet and outlet pipe grades must be carried through the centerline of the manhole with a minimum slope of 2.5 percent between the inlet and outlet pipe inverts or 0.10 feet, whichever is greater. Where wastewater lines enter the manhole above the outlet flowline, the invert must be filleted to the flowline of the manhole.

G. Manhole Rings and Covers: Securely anchor the base of the manhole ring into a 6-inch minimum thick precast concrete ring as indicated and set on top of concentric manhole cone as a unit.

H. Non-Metallic Manhole Rings and Covers: Install composite frames and covers according to approved Shop Drawings, instructions in related specifications and details, and written installation instructions from manufacturer. Set units accurately at required locations to proper alignment and elevation. Keep units plumb, level, true, and free of trash. Measure location accurately from established lines and grades. Brace or anchor frames temporarily in form work until permanently set.

I. All adjustments to the manhole lid and cover must be completed prior to the placement of final roadway surface and/or final grading.

J. Cleanouts: Provide a cleanout at the ends of all sewer lines unless a manhole is provided at that point. Construct cleanouts in accordance with the details shown in the Drawings.

K. Drop Manholes: Install a drop manhole piping assembly in all cases where the distance between the incoming pipe and the floor of the manhole is 2 feet or more. External drop assemblies must be encased in concrete as indicated in the Drawings.

3.02 GROUTING

A. Use the mortar for grouting within 40 minutes after mixing. Discard mortar which has begun to take an initial set. Do not mix mortar with additional cement or new mortar.

3.03 CORROSION PROTECTION

A. All exposed concrete surfaces on the interior of the manhole, including concrete grade rings must be coated as indicated in section 09 96 01 “Concrete Protective Coatings”.

B. If the manhole is to be in an area where water infiltration through the concrete is expected and/or if required by the interior lining being provided, install an exterior waterproofing coating.

3.04 FIELD QUALITY CONTROL

A. Manhole Testing:

1. Test manholes for leakage separately and independently of the wastewater lines by hydrostatic exfiltration testing, vacuum testing or other approved methods. Test manholes after installation with all connections (existing and /or proposed) in place. Plug lift holes with an approved non-shrink grout prior to testing. Install drop-connections and gas sealing connections prior to testing.

2. Vacuum Test: Temporarily plug lines entering the manhole with the plugs braced to prevent them from being drawn into the manhole. Install plugs in the lines beyond drop-connections, gas sealing connections, etc. Place the test head inside the frame at the top of the manhole and inflate in accordance with the manufacturer’s recommendations. Draw a vacuum of 10 inches of mercury, then turn off the vacuum pump. Read the level of vacuum after the required test time with the valve closed. The manhole will pass the test if the drop in the level is less than 1 inch of mercury (final vacuum greater than 9 inches of mercury). The required test time for 48-, 60-, and 72-inch manholes with depths up to 30 feet is 2 minutes. Test times for manholes of greater size and depths will be determined by the Engineer.

3. Manhole Repairs: Manholes will be accepted in accordance with the criteria above. Repair any manhole which fails the initial test with non-shrink grout or other suitable material as determined for the material from which the manhole is constructed. Retest the manhole as described above until a successful test is achieved. Remove all temporary plugs and grout after a successful test.

4. Repair all hydrostatic leaks in the structure prior to applying the liner system.

END OF SECTION

DIVISION 40

PROCESS INTERCONNECTIONS

40 05 00 COMMON WORK RESULTS FOR PROCESS INTERCONNECTIONS

1.00 GENERAL

1.1 WORK INCLUDED

A. Furnish all labor, materials, equipment, appurtenances, and incidentals required to furnish and install, complete, the process piping specified herein as further specified in the detailed piping specifications provided in Division 33 “Utilities” and Division 40 “Process Integration” of the Specifications.

1.2 RELATED WORK

A. Piping materials and installation methods peculiar to individual piping systems are specified within the respective system specifications provided in Division 33 “Utilities” and Division 40 “Process Integration” of the Specifications.

1.3 DEFINITIONS

A. Buried Pipe: Piping that is installed below buildings, foundations, or finish grade, either in soil or encased in concrete in soil.

B. Exposed Pipe: Piping that is located above ground, in pipe chases, or located inside of a structure, supported by a structure, or cast into a concrete structure.

C. Underground Pipe: Refer to Paragraph 1.3A.

D. Submerged or Wetted Pipe: Piping that is within an area described below:

1. Top face of channel walls and cover slabs.
2. Top face of tank or basin walls and walkways.
3. Under tank or basin cover.
4. Liquid surface or within 2 feet above the top of the liquid surface.

E. Wet Wall: A wall with water on at least one side.

1.4 STANDARDS

A. The applicable provisions of the following standards must apply as if written here in their entirety:

1. American Society of Mechanical Engineers (ASME):

ASME B16.5	Pipe Flanges and Flanged Fittings: NPS 1/2 through 24
ASME B16.47	Large Diameter Steel Flanges: NPS 26 Through NPS 60 Metric/Inch Standard

2. American Water Works Association (AWWA):

AWWA C107	Standard for Polyethylene Encasement for Ductile-Iron Pipe Systems
AWWA C207	Standard for Steel Pipe Flanges for Waterworks Services – Sizes 4 In. Through 144 In.

3. ASTM International (ASTM):

ASTM A193	Standard Specification for Alloy-Steel and Stainless Steel Bolting for High Temperature or High Pressure Service and Other Special Purpose Applications
ASTM A194	Standard Specification for Carbon Steel, Alloy Steel, and Stainless Steel Nuts for Bolts for High Pressure or High Temperature Service, or Both
ASTM A307	Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60,000 PSI Tensile Strength
ASTM A563	Standard Specification for Carbon and Alloy Steel Nuts
ASTM F37	Standard Test Methods for Sealability of Gasket Materials
ASTM F2329	Standard Specification for Zinc Coating, Hot-Dip, Requirements of Application to Carbon and Alloy Steel Bolts, Screws, Washers, Nuts, and Special Threaded Fasteners

4. NSF International (NSF):

NSF/ANSI 61	Drinking Water System Components – Health Effects
NSF/ANSI 372	Drinking Water System Components – Lead Content

1.5 DESIGN REQUIREMENTS AND PROJECT CONDITIONS

A. Design Requirements:

1. Where pipe diameter, thickness, pressure class, pressure rating, or thrust restraint is not shown or specified, design piping systems in accordance with the following:
    a. Process Piping: ASME B31.3, normal fluid service unless otherwise specified.
    b. Building Service Piping: ASME 31.9, as applicable for sanitary building drainage and vent systems.
    c. Buried Piping: H20-S16 traffic load with 1.5 impact factor, AASHTO HB-17, as applicable.
    d. Thrust Restraints:
        d. Design for test pressures shown in the Contract Documents.
        d. Restrained joint pipe shall be used for thrust restraint.
        d. All equipment, supports, anchors, and fasteners must be of adequate strength to withstand loads associated with pumping, turbulence, thrusts from liquid movement, thermal expansion and contraction, and other loads encountered under normal operating conditions.
2. The components, materials, and arrangements described in this Section are typically based on equipment manufacturers' recommendations and are considered minimum limits of acceptability.

B. Project Conditions:

1. All components specified herein must be specifically designed for the specified service and the environment encountered in this installation.

2. When installed in wastewater treatment areas, the environment will be moist and corrosive, exhibiting hydrogen sulfide and other corrosive gases encountered in municipal water resource recovery facilities.

3. NSF/ANSI 61 and 372 Certifications: All components in contact with water being treated for potable use, potable water, and chemicals used in the treatment of water for potable use must comply with the requirements of the Safe Drinking Water Act and must be certified to meet the requirements of NSF/ANSI 61 and NSF/ANSI 372. An accredited testing laboratory or facility must provide the certification as required by the NSF/ANSI certification process. The products must bear the mark or seal of the accredited testing laboratory and the NSF seal.

1.6 QUALITY ASSURANCE

A. Quality Assurance: Provide the services of an independent inspection and testing agency for welding operations.

1. The presence of an Owner's quality control and quality assurance inspector does not relieve the Contractor from performing its own quality control, including 100 percent visual inspection of welds.

B. Source Limitation: Material of each type specified in this Section must be supplied by a single manufacturer.

C. The manufacturer must be fully experienced, reputable, qualified, and regularly engaged for at least the last 5 years in the manufacture of the materials to be furnished.

D. All pipes and fittings must be new and must be designed, constructed, and installed in accordance with the best practices and methods and must comply with this Section.

1.7 SUBMITTALS

A. Submittals must be in accordance with Section 01 33 00 "Document Management" and must include the following:

1. Items specifically called out in the individual piping systems within the respective system specifications provided in Division 33 "Utilities" and Division 40 "Process Integration" of the Specifications.

2. Shop Fabricated Piping:

a. Detailed pipe fabrication or spool drawings showing special fittings, bends, dimensions, coatings, and other pertinent information.

b. Layout drawings showing the location of each pipe section and each special length and number or otherwise designate laying sequence on each piece.

3. Identify the wall thickness and rational method or standard applied to determine the wall thickness for each size of each difference service including exposed, submerged, buried, and concrete-encased installations.

4. Dissimilar pipe joint types and assembly drawings.
5. Gasket material, temperate rating, and pressure rating for each type of pipe and each type of service.
6. Manufacturer's data on materials, construction, end connections, ratings, and overall lengths.
7. Product data on materials specified in this Section.

1.8 DELIVERY, STORAGE, AND HANDLING

A. The pipe must be prepared for shipment to afford the maximum protection from normal hazards of transportation and allow the pipe to reach the Project Site in an undamaged condition. Pipes must be carefully supported during shipment and storage. Pipe, fittings, and specials must be separated so that they do not bear against each other, and the whole load must be securely fastened to prevent movement in transit. Ship pipe on padded bunks with tie-down straps. Store pipes on padded skids, sand or soil berms, tires, or other suitable means to protect the pipe from damage, based on the manufacturer's instructions and recommendations.

B. Care must be taken in loading, transporting, and unloading the materials to prevent damage to the pipe, fittings, and specials. Pipe, fittings, and specials must not be dropped. Pipe, fittings and specials must be examined before installation and no piece shall be installed that is found to be defective.

C. Upon delivery, Contractor must off-load, store, and handle the materials in full compliance with the manufacturer's written instructions and guidelines.

D. In handling the pipe, wide cushioned slings or other devices and methods acceptable to the Engineer must be used. No uncushioned ropes, chairs, wedges, or levers shall be used in handling the pipe, fittings, or couplings. Stainless steel components must be handled with materials dedicated to stainless steel in order to minimize cross contamination and surface corrosion.

E. If any defective pipe is discovered after it has been delivered, stored, and handled, it must be removed and replaced with sound pipe by the Contractor, at the Contractor's own expense prior to installation. All pipes, fittings, specials, and couplings must be thoroughly cleaned before installation and must be kept clean until they are put into service.

1.9 WARRANTY

A. All materials furnished in this Section must be guaranteed against defects in materials and workmanship for a period of 1 year from the date of Substantial Completion of the Project. Cost for the removal, shipment, repair, and installation by the Contractor must be included in the warranty, as well as correction of defective Work.

2.00 PRODUCTS

2.1 PIPE AND FITTINGS

A. Refer to the individual piping specification sections in Division 33 "Utilities" and Division 40 "Process Interconnections" for specifications on piping and fittings relative to that system.

2.2 JOINING MATERIALS

A. Welding Materials: Comply with Section II, Part C, ASME Boiler and Pressure Vessel Code for welding materials appropriate for the wall thickness and chemical analysis of the pipe being welded.

B. Brazing Materials: Comply with SFA-5.8, Section II, ASME Boiler and Pressure Vessel Code for brazing filter metal materials appropriate for the materials being joined.

C. Soldering Materials: Refer to the individual piping system specifications for solder appropriate for each respective system.

D. Flange Bolts and Nuts:

1. General:

a. Washer:

a). Provide a washer for each nut.

b). Washer must be of the same material as the nut.

b. Nuts: Heavy hex-head.

c. Cut and finish flange bolts to project a maximum of 1/4-inch beyond outside face of nut after assembly.

d. Tap holes for cap screws or stud bolts when used.

e. Lubricant for stainless steel bolts and nuts:

a). Chloride-free.

e. Manufacturers: Subject to compliance with requirements of this Section, available manufacturers offering products that may be incorporated into the Work include the following specific manufacturers:

a). Huskey FG-1800 Anti-Seize.

b). Welcon Anti-Seize High-Tech.

2. Ductile Iron Pipe:

a. Aboveground with pressures equal to or less than 150 pounds per square inch gauge (psig):

a). Bolts: ASTM A307, Grade B (carbon steel).

b). Nuts: ASTM A563, Grade A (carbon steel).

c). Washers: Washer shall be of the same material as the nut.

b. Buried, Wetted, or Submerged:

a). Bolts: ASTM A193, Grade B8M Stainless Steel, ASME B1.1 Class 2A threads, with dimensions in accordance with ASME B18.2.1.

b). Nuts: ASTM A194, Grade 8M Stainless Steel, ASME B1.1 Class 2A Fit, with square or heavy hex dimensions in accordance with ASME B18.2.2.

c). Washers: Washer shall be of the same material as the nut.

d). All buried ductile pipes and fittings shall have a tube-type polyethylene encasement in accordance with AWWA C105. Polyethylene encasement shall be 8 mils thick. Both ends of the pipe must be thoroughly sealed with adhesive tape or plastic tie straps at the joint overlap and in accordance with the manufacturer's instructions and recommendations. Place circumferential wraps of tape at 2-foot intervals along the pipe length to minimize the space between the wrap and pipe. Pipe must be wrapped with a V-BIO Enhanced Polyethylene Encasement in accordance with the manufacturer's recommendations and instructions.

3. Thermoplastic Pipe:
    a. Bolts: ASTM A193, Grade B8M Class 2 (316SS).
    b. Nuts: ASTM A194, Grade 8M (316SS).
    c. Washers: Stainless steel, type 316.

E. Mechanical Joint Bolts and Nuts:
1. Bolts including T-Bolts:
    a. High strength low alloy steel in accordance with AWWA C111 (Fluoropolymer coated).
    b. Type 304 stainless steel in accordance with ASTM F593.
    c. Type 316 stainless steel in accordance with ASTM F593.
2. Heavy Hex Nuts:
    a. High strength low alloy steel in accordance with AWWA C111 (Fluoropolymer coated).
    b. Type 304 stainless steel in accordance with ASTM F594.
    c. Type 316 stainless steel in accordance with ASTM F594.

F. Gaskets:
1. General:
    a. Gaskets must be suitable for the specific fluids, pressures, and temperature conditions.
    b. Capable of being applied on the surface of the piping with cavities to provide for an improved seal with the internal pressure.
    c. Contractor is responsible for coordinating gaskets for full-faced and raised face flanges.
2. Ductile Iron and Steel Piping Flanged Joints:
    a. Not meeting NSF/ANSI 61 Requirements:
        a). Suitable for pressures equal to or less than 150 psi, temperatures equal to and less than 120 deg F, unless noted otherwise.
        b). Material: Neoprene elastomer, compressed, non-asbestos fiber reinforcement.

c). Manufacturers: Subject to compliance with requirements of this Section, available manufacturers offering products that may be incorporated into the Work include the following specific manufacturers:

d). Garlock, Blueguard 3300.

e). Approved equivalent by John Crane.

3. Polyvinyl Chloride (PVC) Flanged Joints:

   a. Suitable for hot or cold water, pressures equal to or less than 150 psi, and temperatures equal to or less than 120 deg F, unless noted otherwise.

   b. Material: EPDM.

   c. Manufacturers: Subject to compliance with requirements of this Section, available manufacturers offering products that may be incorporated into the Work include the following specific manufacturers:

      c. Garlock.

      c. John Crane.

2.3 INSULATING FLANGES, COUPLINGS, AND UNIONS

A. Dielectric Insulating Gasket Kits for Flanges:

1. Dielectric insulating flange gasket kits must be installed at all the following locations whether shown on the Drawings or not:

   a. Dissimilar metal pipe connections.

   b. Stainless steel pipe flanges connected to flanges constructed of bronze alloys, carbon steel alloys, or nickel alloys (Monel, Hastelloy, and Inconel).

   c. Process piping connecting with valves and other equipment and appurtenances of dissimilar metals.

   d. Exposed piping making a vertical transition to buried piping.

   e. Locations shown on the Drawings.

2. Insulating flange gaskets must be furnished as a kit including the dielectric gasket, bolt sleeves, and washers in accordance with the nominal flange size.

3. Each dielectric insulating gasket must be a full-face isolation and sealing gasket, Type" E", 1/8-inch thick, epoxy-glass retainer with bolt holes cut to match the mating flange drilling. The retain must contain a precision tapered groove to accommodate the controlled compression of an FPM/FKM (Viton) sealing element. The quad-ring seal must be pressure energized. The epoxy-glass retainer must have 550-volt/mil dielectric strength and a minimum 50,000 psi compression strength.

4. Insulating bolt-sleeves must be manufactured of Mylar having a dielectric strength of not less than 4000-volt/mil.

5. Insulating washers must be manufactured of G-10 epoxy-glass having a dielectric strength of 400 to 500 volts/mil. Insulating washers must be installed with metallic backing washers to prevent damage to the epoxy-glass washers during bolting. The metallic washers must be as specified in this Section.
6. Manufacturers: Subject to compliance with requirements of this Section, available manufacturers offering products that may be incorporated into the Work include the following specific manufacturers:
    a. CALPICO, Inc.
    b. GPT (EnPro Industries) – LineBacker® Isolating Gasket/Kits and LineBacker® 61™ NSF Certified Isolation Gaskets/Kits.
    c. Advance Products & Systems, LLC – Trojan Duplex Seal.

B. Insulating Coupling:
1. Insulating couplings must be installed at all the following locations whether shown on the Drawings or not:
    a. Dissimilar metal pipe connections.
    b. Stainless steel pipe flanges connected to flanges constructed of bronze alloys, carbon steel alloys, or nickel alloys (Monel, Hastelloy, and Inconel).
    c. Process piping connecting with valves and other equipment and appurtenances of dissimilar metals.
    d. Exposed piping makes a vertical transition to buried piping.
    e. Locations shown on the Drawing.
2. Materials of Construction:
    a. Follower Ring: ASTM A576 or ASTM A36.
    b. Middle Ring: ASTM A36 or ASTM A53
    c. Gasket: Styrene Butadiene Rubber (SBR).
    d. Lining: Fusion bonded epoxy per AWWA C213.
    e. Coating: Fusion bonded epoxy per AWWA C213.
    f. Bolts, Nuts, and Washers: stainless steel, type 316 (ASTM A193/A194).
    g. Insulation Boot: Styrene Butadiene Rubber (SBR).
3. Manufacturers: Subject to compliance with requirements of this Section, available manufacturers offering products that may be incorporated into the Work include the following specific manufacturers:
    a. Dresser Utility Solutions – Series 39 Insulating Couplings.
    b. Baker Coupling, LLC – Series 216 Insulating Flex Couplings.

C. Dielectric Couplings and Unions:

1. Provide dielectric coupling and unions with appropriate end connections for the pipe materials installed (threaded, soldered, or flanged), which effectively isolate dissimilar metals, prevent galvanic action, and stop corrosion.

2. The dielectric coupling and union must be factory fabricated with a pressure rating of 150 psi at 180 deg F.

3. Manufacturers: Subject to compliance with requirements of this Section, available manufacturers offering products that may be incorporated into the Work include the following specific manufacturers:

a. CALPICO, Inc.

b. Capital Group, Inc.

c. HART Industrial Unions, LLC.

d. Watts.

2.4 IDENTIFICATION

A. Provide identification as specified in Section 40 05 97 “Identification for Process Piping and Equipment.”

3.00 EXECUTION

3.1 EXAMINATION

A. Verify the size, material, joint types, elevations, horizontal location, and pipe service of existing pipelines to be connected to new pipelines or new equipment.

B. Inspect size and location of structure penetrations to verify the adequacy of wall pipes, sleeves, and other openings.

3.2 PREPARATION

A. Refer to the specific pipe system Sections in Division 33 “Utilities” and Division 40 “Process Integration”, Piping Schedule as shown on the Drawings and Section 09 96 00.01 “High-Performance Coatings” for additional requirements.

B. Inspect the pipe and fittings before installation, clean ends thoroughly, and remove foreign matter and soil from inside.

C. Damaged Coatings and Linings: Repair using the original coating and lining materials in accordance with the manufacturer’s instructions except for glass-lined pipe or PVDF-lined pipe. Glass-lined pipe or PVDF-lined pipe with a damaged coating and lining must be promptly removed from the Site and replaced at no additional cost to the Owner.

3.3 WELDING

A. Perform welding in accordance with Section IX, ASME Boiler and Pressure Vessel Code and ASME B31.3 for Pressure Piping, as may be specified in the specific pipe system sections in Division 33 “Utilities” and Division 40 “Process Integration” and if recommended by the piping or fitting manufacturer.

B. Weld Identification: Keep a paper record of which welder welded each joint.

C. Pipe End Preparation:

1. Machine Shaping: Preferred.
2. Oxygen or Arc Cutting: Smooth to the touch, true, and slag removal by chipping or grinding.
3. Beveled Ends for Butt Welding: ASME B16.25.

D. Surfaces:

1. Clean and free of paint, oil, rust, scale, slag, or other material detrimental to welding.
2. Clean stainless steel joints with stainless steel wire brushes or stainless steel wool prior to welding.
3. Thoroughly clean each layer of deposit weld metal, including the final pass, prior to deposition of each additional layer of weld metal with a power-driven wire brush.

E. Alignment and Spacing:

1. Align ends to be joined within existing commercial tolerances on diameters, wall thickness, and out-of-roundness.
2. Root Opening of Joint: As stated in the qualified welding procedure.
3. Minimum Spacing of Circumferential Butt Welds: Minimum four times the pipe wall thickness or 1 inch, whichever is greater.

F. Climatic Conditions:

1. Do not perform welding if there is impingement of any rain, snow, sleet, or wind exceeding 5 mph on the weld area or if the ambient temperature is below 32 deg F.
2. Stainless Steel and Alloy Piping: If the ambient temperature is less than 32 deg F, local preheating to a temperature warm to the hand is required.

G. Tack Welds: Performed by a qualified welder using the same procedure as for completed weld, made with an electrode similar or equivalent to the electrode to be used for the first weld pass and not defective. Remove those not meeting the requirements prior to commencing welding procedures.

H. Surface Defects: Chip or grind out those affecting the soundness of the weld.

I. The weld quality must meet the requirements of the governing welding codes.

3.4 INSTALLATION – GENERAL

A. Piping Drawings:

1. Except in details, piping is indicated diagrammatically. Not every offset and fitting, or structural difficulty that may be encountered has been indicated on the Drawings. Sizes and locations are indicated on the Drawings.

2. Perform minor modifications to piping alignment where necessary to avoid structural, mechanical, or other types of obstructions that cannot be removed or changed. Modifications are intended to be of minor scope, not involving a change to the design concept or a change to the Contract Price or Contract Time.

3. Join pipe and fittings in accordance with the manufacturer's instructions.

B. Piping Alternatives:

1. Provide piping as specified in this Section and specific pipe system sections in Division 33 "Utilities" and Division 40 "Process Integration", unless indicated on the Drawings or specified otherwise.

2. Alternative Pipe Ratings:

a. Piping with a greater pressure rating than specified may be substituted in lieu of specified piping without changes to the Contract Price.

b. Piping of a different material may not be substituted in lieu of specified piping.

3. Valves in piping sections must be capable of withstanding the specified test pressures for piping sections and fabricated with ends to fit piping.

4. Grooved Joints: Use couplings, flange adapters, and fittings of the same manufacturer. The manufacturer's factory trained representative must provide on-site training for the Contractor's field personnel and periodically visit the jobsite to verify that the Contractor is following the manufacturer's best recommended practices. A distributor's representative is not considered qualified to conduct the training or jobsite visits.

5. Flanged Joints: Where one of the joining flanges is raised face type, provide a matching raised face type flange for the other joining flange.

C. Unless noted otherwise on the Drawings, piping at pipe joints, fittings, couplings, and equipment must be installed without rotation, angular deflection, vertical offset, or horizontal offset.

D. Connections to Existing Piping:

1. Expose existing piping to which connections are to be made with sufficient time to permit, where necessary, field adjustments in line, grade, or fittings.

2. Protect potable water supplies from contamination. Make connections between the potable water supply and other water systems in accordance with the requirements of the Forsyth County.

3. Make connections to existing piping and valves after sections of new piping to be connected have been tested and found satisfactory.

4. Provide sleeves, flanges, nipples, couplings, adapters, and other fittings needed to install or attach new fittings to existing piping and to make connections to existing piping.

5. For flanged connections, provide isolating gasket kits as specified in this Section.

E. Refer to Section 01 35 00 “Special Procedures” for work restrictions regarding connections to existing facilities.

F. Connections Between Ferrous and Nonferrous Metals.

1. Connect ferrous and nonferrous metal piping, tubing, and fittings with dielectric couplings especially designed for the prevention of chemical reactions between dissimilar metals.

2. Nonferrous metals include aluminum, copper, and copper alloys.

G. Provide insulating gasket kits at flanged connections between dissimilar metals such as ductile iron pipe and steel pipe. Insulating gasket kits must meet the requirements specified in this Section.

3.5 INSTALLATION OF EXPOSED PIPING

A. Unless shown otherwise, piping must be parallel to building lines. Hangers on adjacent piping must be aligned where possible on common size ranges.

1. Install piping runs plumb and level, unless indicated otherwise on the Drawings. Drain piping must slope with a minimum 1/4-inch per foot downward in the direction of flow.

2. All flanges must be true and perpendicular to the axis of the pipe. All bolt holes in the flanges must straddle vertical centerline of pipes.

B. Install exposed piping after installing equipment and after piping and fitting locations have been determined.

C. Unions, mechanical couplings, or flanged coupling adapters must be installed where required for piping or equipment installation, even though they are not shown on the Drawings. All mechanical couplings and flanged coupling adapters must be anchored with joint harnessed assemblies.

D. Piping must be installed without springing or forcing the pipe in a manner that would set up stresses in the pipe, valves, or connected equipment.

1. Match and properly orient flanges, unions, flexible couplings, and other connections.

2. Do not subject the piping to bending or other undue stresses when fitting the piping.

3. Do not correct defective orientation or alignment by distorting the flanged joints or subjecting flange bolts to bending or other undue stresses.

4. Flange bolts, union halves, flexible connectors, and other connection elements must slip freely into place.

5. Install eccentric reducers or increasers with the top horizontal for pump suction piping.

E. Required straight runs of piping upstream and downstream of flow measuring devices must be smooth.

F. Where valve handwheels or chainwheels are shown, valve orientation must be as shown on the Drawings. Where valve handwheels or chainwheels are not shown on the Drawings, the valves must be oriented to permit easy access to the handwheels or chainwheels and to avoid interferences.

G. Group piping wherever practical at common elevations; install to conserve building space and not interfere with the use of space or other work.

H. Provide a union or flange at each piping connection to equipment or instrumentation on the equipment side of each block valve to facilitate installation and removal of the equipment or instrumentation.

I. Restraining Above Ground Piping:

1. Restrain piping at valves and fittings where piping changes direction, changes sizes, and at ends.

a. When piping is above ground or underwater, use mechanical or structural restraints.

b. Determine the thrust forces by multiplying the nominal cross-sectional area of the piping by the design test pressure of the piping.

J. Piping Clearances, unless noted otherwise on the Drawings:

1. Over Walkways and Stairs: Minimum of 7 feet-6 inches, measured from the walking surface or stair tread to the lowest extremity of the piping system including flanges, valve bodies or mechanisms, insulation, or hanger/support systems.

2. Between Equipment or Equipment Piping and Adjacent Piping: Minimum of 3 feet-0 inches, measured from the equipment extremity and extremity of the piping system including flanges, valve bodies or mechanisms, insulation, or hanger/support systems.

3. From Adjacent Work: Minimum 0 feet-1 inch from the nearest extremity of completed piping system including flanges, valve bodies or mechanisms, insulation, or hanger/support systems.

4. Do not route piping in front of or interfere with accessways, ladders, stairs, platforms, walkways, openings, doors, or windows. Do not route between ladders and the ladder mounting surface.

5. Headroom in front of openings, doors, and windows must not be less than the top of the opening.

6. Do not install piping containing liquids or liquid vapors in transformer vaults or electrical equipment rooms.

7. Do not route piping over, around, in front of, in back of, or below electrical equipment including controls, panels, switches, terminals, boxes, or other similar electrical work.

3.6 INSTALLATION OF BURIED PIPING

A. Bury piping with the minimum cover specified in this Section, unless noted otherwise on the Drawings, and without air traps.

B. Where two similar services run parallel to each other, piping for such services may be laid in the same trench. Lay piping with sufficient room for assembly and disassembly of joints, thrust blocks, other structures, and to meet the separation requirements of Forsyth County.

C. Refer to Section 31 23 33 “Trenching and Backfilling” for additional requirements.

D. Removal of Water:

1. Provide and maintain ample means and devices at all times to remove and dispose of water entering the trench during the process of pipe laying.

2. The Work is being performed at a lift station. Contractor is responsible for the control and removal of water during the Work described in this Section at no additional cost to the Owner.

3. The trench must be kept dry until the pipe laying and jointing are completed. Prevent trench water and animals from entering the pipe:

a. During installation, keep the interior of all pipes, fittings, and other accessories as free as possible from soil and foreign matter at all times.

b. When pipe laying is not in progress, including work breaks, the open ends of the pipe must be sealed by a plug or cap to prevent trench water, animals, or foreign material from entering the pipe. If water has accumulated in the trench, the seal must remain in place until the trench water has been removed to such an extent that it will not enter the pipe.

E. Laying Piping:

1. Lay piping in finished trenches free from water and debris. Begin at the lowest point with bell ends up slope.

2. Place piping with top or bottom markings with markings in the proper position.

3. Lay piping on an unyielding foundation with uniform bearing under the length of the pipe barrels.

4. Where joints require external grouting, banding, or pointing, provide space under and immediately in front of the bell end of each section laid with sufficient shape and size for grouting, banding, or pointing of joints.

5. At the end of each day’s construction, temporarily plug open ends of piping to prevent the entrance of water, debris, or animals.

F. Venting and Draining Piping Under Pressure:

1. Lay piping under pressure flat or at a continuous slope without air traps, unless otherwise indicated on the Drawings.

2. Install vent valves as air vents at high points in the piping. Install drain valves as low points in the piping. Provide additional pipe taps with valves and riser pipes along the piping as required for venting during initial filling, disinfecting, and sampling. Not all vent and drain valves may be shown on the Drawings; however, the Contractor must install vents on high points and drains on low points of pipelines at all low and high point locations.

3. Before the piping is placed into service, close the valves and install plugs. Protect the plugs and valves from corrosion as specified in Section 09 96 00.01 “High-Performance Coatings.”

G. Restraining Buried Piping:

1. Restrain piping at valves and at fittings where piping changes direction, changes sizes, and at ends:

    a. When piping is underground, use concrete thrust blocks, mechanical restraints, or push-on restraints.

    b. Determine the thrust forces by multiplying the nominal cross-sectional area of the piping by the design test pressure of the piping.

2. Provide restraints with ample size to withstand thrust forces resulting from test pressures. During testing, provide suitable temporary restraints where piping does not require permanent restraints.

3. Place concrete thrust blocks against undisturbed soil. Place concrete so that piping joints, fittings, and other appurtenances are accessible for assembly and disassembly.

H. Tolerances:

1. Deflection from Horizontal Line: Maximum 2 inches.

2. Deflection from Vertical Grade: Maximum 1/4 inch.

3. Joint Deflection: Maximum of 75 percent of the manufacturer's recommendations.

4. The horizontal position of the pipe centerline on alignment around curves maximum variation of 1.75 feet from position shown.

5. Pipe Cover: Minimum 4 feet, unless otherwise shown.

3.7 INSTALLATION OF CONCRETE ENCASED PIPE

A. Provide concrete pipe encasement shown on the Drawings and where otherwise required. Some piping may be required to be concrete encased for pipe strength requirements that are included in the Specifications. Piping under and within the influence of buildings, utility trenches, vaults, slabs, and other structures must be concrete encased.

B. Refer to the details in the Drawings for encasement requirements.

C. Where concrete encased piping crosses structure construction and expansion joints, provide flexible piping joints to coincide with the structure joints to prevent excessive pipe stress.

3.8 THRUST RESTRAINT

A. Location:

1. Buried Piping: Where shown and where required to restrain the force developed at pipeline tees, plugs, caps, bends, and other locations where unbalanced forces exist because of hydrostatic testing and normal operating pressure.

2. Exposed Piping: At all joints in piping.

B. Thrust Ties:

1. Steel Pipe: Attach with joint harness.

2. Ductile Iron Pipe: Attached with socket clamps anchored against grooved joint coupling or flange.

3. Flanged Coupling Adapters: For exposed installations, install manufacturer's wedge style anchor flanges or use dismantling joints. Set screw type anchors are not allowed.

C. Mechanical Joint Valve Restraint in Proprietary Restrained Joint Piping: Install pipe joint manufacturer's adapter gland follower and pipe end retainer, or mechanical joint anchor gland follower. Mechanical joint anchor gland followers must use wedge style anchors only. Set screw anchors are not allowed.

3.9 BRANCH CONNECTIONS

A. Do not install connections smaller than 1/2-inch nominal pipe size, including instrumentation connections, unless noted otherwise in the Drawings.

B. When a line of lower pressure connects to a line of high pressure, requirements for the high-pressure rating prevail up to and including the first block valve in the line carrying the lower pressure, unless noted otherwise in the Drawings.

C. Threaded Pipe Connections:

1. Ductile Iron Piping: Connect only with service saddle or at a tapping boss of a fitting, valve body, or equipment casting.

2. Welded Steel or Alloy Piping: Connect only with a welded thread-o-let or half coupling as specified in the applicable piping system technical specification.

3. Limitations: Threaded taps in the pipe barrel are not acceptable.

3.10 VENTS AND DRAINS

A. Vents and drains at high and low points in piping required for completed system may or may not be shown. Install vents on high points and drains on low points of pipelines at all low and high point locations.

3.11 FIELD FINISHING

A. Notify the Owner's Representative 3 days before the start of surface preparation or coating application work.

B. Refer to the Piping Schedule as shown on the Drawings, and Section 09 96 00.01 "High-Performance Coatings" for additional finishing requirements.

3.12 PIPE IDENTIFICATION

A. Refer to Section 40 05 97 "Identification for Process Piping and Equipment" for requirements.

3.13 FINAL CLEANING

A. Following the assembly and testing, and prior to final acceptance, flush expect as stated below with water at 2.5 feet per second (fps) minimum flushing velocity until foreign matter is removed.

B. The following process pipelines must be blown clean of loose debris with compressed air at 4000 feet per minute (fpm); do not flush with water:

   1. Plant process or high-pressure air.

   2. Dry chlorine (gas or liquid). Immediately after cleaning dry chlorine (gas or liquid) service piping, dry to -40 deg F dew point with dry compressed instrument air or compressed commercial grade nitrogen.

C. If it is impractical to flush large diameter piping at 2.5 fps or blow at 4000 fpm velocity, clean in-place from the inside by brushing and sweeping, then flush or blow line at a lower velocity.

D. Insert cone strainers in flushing connections to attached equipment and leave in-place until cleaning is complete.

E. Remove all accumulated debris through drains 2 inches and larger or by removing spools and valves from the piping.

F. Conduct pressure and leak test, as specified.

END OF SECTION

40 05 62 ECCENTRIC PLUG VALVES

1.00 GENERAL

1.1 WORK INCLUDED

A. Furnish labor, power, materials, equipment, supplies, supervisions, tools and incidentals necessary to install eccentric plug valves, all in accordance with the Drawings and Specifications.

B. Travel delivery, testing, and storage shall be covered under this part and be conducted in accordance with the manufacturer's procedures and the Drawings and Specifications.

C. All electric motor operators shall be provided per Division 26. It shall be the responsibility of the Contractor to install all valves, actuators and appurtenances. Both the valve manufacturer and electric motor operator representative shall be responsible for the startup of their respective equipment and a factory certified technician should perform the startup. It is the responsibility of the Contractor to ensure proper communication between the valve manufacturer and actuator manufacturer and they shall provide a letter of conformance with submittal.

1.2 QUALITY ASSURANCE

A. Acceptable Manufacturers:

1. DeZurik

a. Model PEC

2. Approved equal

B. Manufacturer's name, size, and seat end shall be cast on the valve body. Working pressure and size shall be cast on valve body, or shown on the valve identification.

C. All valves under this Section shall be the product of a single manufacturer.

D. Valves shall be the products of a supplier with at least 10 years of successful experience in the design, manufacturing and application of valves of the type, size, and performance capabilities specified. Supplier shall maintain a quality assurance system. If requested, the equipment supplier shall submit a list of operating installations in the United States involving equipment of similar size and application.

E. Test valves with actuators at the valve manufacturer's factory prior to delivery to the Site.

1. Valves and actuators shall be completely assembled at the factory, adjusted for correct seating, and tested as an assembly and in accordance with the AWWA Standards. Factory adjustments and operational tests shall be performed on each valve with the valve oriented in the same position as the installed field position. The valves shall be cycled five times (full open to full close) and successfully seat tested each cycle to certify proper seating. Seat adjustments and manual indicators shall be set and checked at the factory.

2. Manufacturer shall perform all testing in according with AWWA C517, Section 5. No visible leakage allowed.

3. Document the serial number on valve at time of testing and reflect in certified test records furnished to the Owner's representative.
4. Identification plate must be permanently affixed to valve and actuator prior to hydrostatic testing.

F. Factory Inspection and Tests:

1. Provide 30 days' notice to the Engineer and Owner's representative prior to the start of shop testing.
2. Equipment furnished under these specifications shall be subject to inspection during manufacturing and/or testing by a representative of the Owner who shall be afforded proper facilities for determining compliance with the specifications.
3. Owner reserves the right to have the factory test witnessed by the Owner, or a designated representative of the Owner.
4. The manufacturer or supplier shall provide an affidavit attesting that the valves supplied comply with AWWA C517.

1.3 SUBMITTALS

A. Submittals shall be in accordance with Section 01 33 00 "Document Management" and shall include:

1. Shop Drawings.
2. Operation and Maintenance Manuals.
3. Provide torque calculations through the full range of operations for all motor operated valves.
4. Proof-of-design test results per AWWA C517.
5. Furnish certification that each valve has been given a hydrostatic and seat test per AWWA C517. Provide testing certification as Record Data upon completion.

1.4 STANDARDS

A. The applicable provisions of the following standards shall apply as if written here in their entirety:

1. American Water Works Association (AWWA) Standards:

AWWA C111	Rubber-Gasket Joints for Ductile Iron Pressure Pipe and Fittings
AWWA C517	Resilient-Seated Ductile Iron Eccentric Plug Valves
AWWA C606	Grooved and Shouldered Joints

2. ASTM International (ASTM):

ASTM A126 Class B	Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings
ASTM A536	Standard Specification for Ductile Iron Castings

3. American National Standards Institute (ANSI):

ANSI B16.1	Gray Iron Pipe Flanges and Flanged Fittings

B. The publications listed below form part of this Section to the extent referenced. The publications are referred to in the text by basic designation only.

1. American Water Works Association (AWWA).
2. ASTM International (ASTM).
3. Manufacturer's Standardization Society (MSS).
4. American National Standards Institute (ANSI).
5. American Society of Mechanical Engineers (ASME).
6. National Electrical Manufacturer's Association (NEMA).
7. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

1.5 DELIVERY, STORAGE AND HANDLING

A. Delivery, storage, and handling shall include:

1. Ship with flange or body end protectors.
2. Drain and close valves prior to shipment.
3. Valve and operator may be shipped separately.
4. Onsite storage shall be per the manufacturer's recommendations; records of required valve exercise must be maintained.
5. Spare parts (gasket set and packing) shall be packed and shipped in containers bearing labels clearly designating contents and pieces of equipment for which it is intended.

1.6 SYSTEM DESCRIPTION

A. Maximum Operating Pressure: 85 psi

B. Design Working Pressure: 60 psi on valve sizes 6 inches through 8 inches.

1.7 WARRANTY

A. Supplier shall furnish written warranty covering materials and workmanship for all goods provided for the period defined in the General Conditions amended by the Supplementary Conditions and as indicated in the Agreement.

A. In addition an Extended Warranty shall be provided to supplement the base Warranty. Extended Warranty provision shall be as follows:

1. For years 2 through 5 from the date of substantial completion, seller shall repair or replace components of valves, and actuators whose materials or workmanship fail within specified extended warranty period.

2. Failures include, but are not limited to, the following:

a. Structural or mechanical failures.

b. Faulty operation due to manufacturing or installation defects.

c. Deterioration of metals, metal finishes, liner and materials, and seals beyond normal wear.

2.00 PRODUCTS

2.1 ECCENTRIC PLUG VALVES

A. General:

1. Eccentric plug valves, 3 to 12 inches shall be non-lubricated, tight-closing, quarter-turn type with round or rectangular port construction resilient and one piece faced plugs. Plug shall not contact the seat until at least 90 percent closed. Unless otherwise indicated, buried valves shall be furnished with mechanical joint ends and exposed valves shall be furnished with mechanical joint ends. Valves shall have a minimum nominal port area of 80 percent of the pipe for valve sizes up to 20 inches. Port area for valves 24 inches and larger shall be at least 70 percent of full pipe area.

B. Valves less than 6 inches and smaller shall be wrench operated unless otherwise shown or scheduled. Supply a wrench operator for each wrench operated valve. Valves shall have seals on shafts and gaskets on the valve operator covers to prevent the entry of water.

C. Valves larger than 6 inches shall be side-mounted and come complete with a totally enclosed worm gear/rack and pinion operator. Valves shall have seals on all shafts and gasketed valve operator covers to prevent the entry of water.

1. Valves shall provide drip-tight shutoff up to rated pressure.

2. Valves shall be satisfactory for throttling service as well as frequent or infrequent on-off service.

3. The valve closing member shall rotate approximately 90 degrees from the full-open to full-closed condition and vice-versa.

4. Valves shall be bi-directional.

D. Valves:

1. Valve body including bonnets and covers shall be constructed of ductile iron, ASTM A536 Class B, in accordance with AWWA C517.

2. Seats shall be 1/8-inch thick welded overlay of not less than 95 percent pure nickel. Seat shall be at least 1/2-inch wide, 1/8-inch thick through entire width and raised. The raised surface shall be completely covered with nickel to insure that the resilient plug face contacts only the nickel seat.

2. Sprayed, plated or screwed-in seats are not acceptable.

E. Bearings:

1. Shaft bearings, upper and lower, shall be sleeve Type 316 stainless steel bearings, sintered, oil impregnated and permanently lubricated.
2. Thrust bearings shall be PTFE on the upper and lower bearing journals to reduce torque and prevent dirt and grit from entering the bearing and seal area.
3. Bearings are permanently lubricated for ease of operation after long periods of inactivity.
4. Bearings shall be replaceable.

F. Shaft Seals:

1. Shaft seals shall be multiple V-ring (Chevron) or U-cup design and adjustable and repackable without removing the bonnet from the valve.
2. All packing shall be replaceable without removing the actuator and while the valve is in service.
3. Shaft seals shall be made of a Buna-N rubber.
4. The seal between the body shall be an O-ring or a gasket composed of non-asbestos filler in styrene-butadiene rubber binder.

G. Plug:

1. Plug: Shall be ductile iron with a circular or cylindrical seating surface that is offset from the center of the plug shafts. Plug shall not contact seat until at least 90 percent closed.
2. Plug face: Shall be resilient material that operates satisfactorily at a temperature of 180 degrees Fahrenheit continuous and 215 degrees Fahrenheit intermittent.
3. Plug Shafts: shall be integral.
4. Plug: Shall be one piece solid construction.
5. Grit excluders: Provide PTFE grit excluders at upper plug journals to prevent entry of foreign solids in bearing area.
6. The rubber compound shall be approximately 70 (Shore A) durometer hardness.
7. The rubber to metal bond must meet ASTM D 429-73 Method B per AWWA C517-09 Section 4.4.5.1.
8. The CLOSED position travel stop for the plug shall be externally adjustable in the field while the line and valve are under pressure.

H. Hardware:

1. Exposed nuts, bolts, and washers: Zinc plated. Exception: Exposed nuts, bolts, and washers for buried service: Stainless steel.

I. End Connections:

1. Mechanical joint ends for buried service shall be to AWWA Standard C111-92.
2. Mechanical joint ends shall be integrally cast with body.

3. Grooved ends shall not be allowed.
4. Coordinate valve and adjoining pipe ends for compatibility.
5. Nuts, Bolts, Springs, Washers, Etc.: Type 316 Stainless Steel.
6. Resilient Plug Facings: Neoprene, nitrile rubber, BUNA-N, or approved equal.

J. Valve Boxes:

1. Valves for buried service shall be supplied with cast iron valve boxes. The valve box shall be firmly supported, maintained, centered, and plumb over the wrench nut of the plug valve, with box cover flush with the surface of the ground.
2. Three piece cast iron or carbon steel extension type, Dezurik ENK, Mueller No. 103380 or Clow F2450, with No. 6 round base. The three pieces shall consist of the top section, center section, and base plus the cover.
3. Special Tools: For buried service actuators, provide operating nut wrenches suitable for each size of valve to permit manual operation.

2.2 MANUAL OPERATORS

A. Manual valves shall have a buried valve box pad/stack with a 2-inch square nut as indicated on the Drawings.

B. Buried Service:

1. Wrench Actuated Valves: Include valve box, extension rod, couplings, buried construction gear operator, and standard “T” wrench. Extend operating nut to within 6 inches of top of valve box.
2. Extended Actuator Mounting for Handwheel, Cylinder, or Electric Motor Actuated Valves: Include extension column for mounting valve actuator above grade.

C. Worm Gear/Rack & Pinion Actuator:

1. Gear shall be sized such that when equipped with a handwheel the maximum rim pull is 80 pounds, and when drive by a 2-inch square nut the maximum torque required is 150 foot-pounds. Gear actuator shall be designed to mechanically withstand 200 pounds on handwheel input and 300 foot-pounds input on a 2-inch square nut.
2. Housing shall be cast iron. Input shaft shall be connected to a worm gear. Seals shall be provided on all shafts to prevent entry of dirt and water. The output shaft shall have one bronze, permanently lubricated, replaceable bearing above the gear quadrant and one below. The lower bearing shall also function as an axial thrust bearing.
3. Worm gear operators, where required, shall be of the heavy-duty construction with the ductile iron quadrant supported on the top and bottom by oil impregnated bronze bearings. The worm gear and shaft shall be manufactured of hardened steel and run on high efficiency roller bearings.

2.3 ACCESSORIES

A. Floor Stand: Provide floor stands for use with gear actuated valves. Floor stand shall have handwheel and dial position indicator.

B. Extension Rod: Provide shaft extension rod for use with floor stand for electric actuated valves. EXECUTION

2.4 INSTALLATION

A. Comply with manufacturer's written instructions.

B. Carefully handle and lower valves into position in such a manner as to prevent damage to any part of the valves. Place the valve in the proper position with stem truly vertical or horizontal as the case may be. Furnish bolts and gaskets for flange connections. Adjust the valve boxes to the proper length to conform with the ground surface.

C. Install valves so that in the closed position the pressure in the pipeline applies a seating head on the valves.

D. All valves shall be oriented to provide maximum accessibility for operation and maintenance. Any installation that does not comply shall be removed and reinstalled at no cost to the Owner.

E. Protect buried valves with 8-mil polyethylene film brought up and permanently taped to the valve box.

F. Furnish Manufacturer's Certificate of Installation Verification.

2.5 PAINTING

A. Valves to be exposed shall be cleaned to a bright metal and given a shop coat of rust inhibitive primer. Primer shall be coordinated with field painting to ensure compatibility. Final painting shall be in accordance with Section 09 96 00.01 "High-Performance Coatings."

2.6 FIELD QUALITY CONTROL

A. All valves shall be operated through three complete open-close cycles.

B. All automated or remotely controlled valves shall be operated by means of controls in addition to manual operation.

C. After installation, inspect each valve for correct tightness; no leakage allowed.

D. Furnish the services of a factory representative for one 8-hour day that has complete knowledge of proper installation, startup and operation of the plug valves, to inspect the final installation and supervise a test of the units. This day is in addition to the time required for operation and maintenance training. If there are difficulties in operation of the equipment due to the manufacturer's fabrication or Contractor's installation, additional service shall be provided at no additional cost to the Owner.

E. After all plug valves have been completely installed, the Contractor, under the direction of the manufacturer's factory representative, shall conduct in the presence of the Engineer and Owner's representative, such tests as are necessary to ensure that the operation of all equipment conforms to the specifications. Field tests shall include all equipment included under this section.

F. 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.

2.7 SCHEDULES

A. The required valves, 6 inches to 8 inches, and certain pertinent data are given in the table below.

No. Req.	Description	Size	Ends
One (1)	Existing 8-inch Force Main Isolation	8-inch	Restrained Mechanical Joint
One (1)	New 6-inch Force Bypass Isolation	6-inch	Restrained Mechanical Joint
One (1)	New 6-inch Force Main Isolation	6-inch	Restrained Mechanical Joint

END OF SECTION

40 05 78 AIR VALVES

1.00 GENERAL

1.01 WORK INCLUDED

A. Furnish labor, materials, equipment, and incidentals necessary to install combination air valves of the sizes and types indicated. Furnish the necessary isolating valves and piping.

1.02 SUBMITTALS

A. Contractor shall submit Shop Drawings, Certificate of Adequacy of Design, and operation and maintenance manuals for the material included in this Section. Copies of those submittals will be provided to the Owner.

B. Submittals shall be in accordance with Section 01 33 00 “Document Management” and shall include:

1. Product Catalog Data.
2. Shop Drawings.
3. Certificate of Adequacy of Design and Affidavit of Compliance with AWWA C512.
4. Operation and maintenance manuals.
5. Test Data.

1.03 STANDARDS

A. The applicable provisions of the following standards apply as if written here in their entirety:

1. American National Standards Institute (ANSI) / NSF International:

ANSI/NSF 61	Drinking Water System Components – Health Effects

2. American Society of Mechanical Engineers (ASME):

ASME B16.5	Pipe Flanges and Flanged Fittings: NPS 1/2 through NPS 24, Metric/ Inch Standard

3. American Water Works Associations (AWWA):

AWWA C228	Stainless-Steel Pipe Flanges for Water Service (2-Inch Through 72-Inch)
AWWA C512	Air-Release, Air/Vacuum, and Combination Air Valves for Waterworks Service
AWWA C514	Air Valve and Vent Inflow Preventer Assemblies for Potable Water Distribution System and Storage Facilities
AWWA M14	Backflow Prevention and Cross-Connection Control: Recommended Practices
AWWA M51	Air Valves: Air-Release, Air/Vacuum, and Combination

1.04 DELIVERY

A. Marking: Each valve shall be marked by body markings or a corrosion-resistant nameplate that clearly indicate the manufacturer's name or trademark, size of the valve, size of the orifices if different from the valve size, and the designation of the maximum and minimum operating pressure rating of the valve.

B. Preparation for Shipment: Valves shall be complete in all details when shipped. Cavities shall be drained of water to protect from freezing. The openings shall be covered to prevent entry of foreign material, and the threads shall be protected. The manufacturer shall carefully prepare the valves for shipment. Valves shall be fully packaged or attached to pallets at the manufacturer's option.

C. Cover and store valves to prevent corrosion or damage to any valve components.

2.00 PRODUCTS

2.01 MANUFACTURED PRODUCTS (SOLIDS HANDLING - RAW WATER AND WASTEWATER)

A. General:

1. Air valves shall meet AWWA C512 standards.

2. Each air valve shall have a 316 stainless steel body, and 316 stainless steel trim. Float shall be dimensioned or baffled to prevent air from blowing valve closed until air is exhausted. Elastomers shall be EPDM.

3. Valve body, float, and assembly shall be designed for the pipeline's overall maximum working pressure and shall seat at the minimum pressure**.** The minimum operating pressure shown is under steady state conditions and does not include minimum surge pressure. Valve body shall be extended or sized to keep fluid level low in the body and reduce fluid velocity inside the valve. Splash protection should also be provided.

4. Valve shall be designed to open completely and seat completely for solids handling applications.

5. Contractor shall coordinate the threaded connection or flanged drilling patterns between pipe and valves.

6. Valve inlet shall be NPT for 2-inch valves. Valve inlet shall be ANSI Class 150 for 3-inch and larger valves. Valve and flange rating shall equal or exceed the maximum working pressure.

7. Valves 1-inch and larger shall have an outlet at the bottom of the valve housing. The outlet shall be fitted with a 1/2-inch ball valve.

8. Isolation valves on the inlet side of the air valve shall match the inlet diameter of the air valve and shall be plug valves.

9. Interior components that are not stainless steel shall be painted with System No. 8 in accordance with Section 09 96 00.01 "High Performance Coatings."

B. Combination Air Valves (CAV):

1. Combination air valves shall be designed to exhaust large volumes of air as the pipeline is being filled; permit large volumes of air to enter the pipeline during pipeline drainage;

release accumulated pockets of air while the pipeline is in operation and under pressure; and dampen surge pressures caused by water column separation or rapid air discharge.

2. Combination air valve inlet/outlet cross-sectional area shall be equal to the nominal size of the valve. The vent piping shall extend to 4 feet above the ground or as indicated on the Drawings.

C. Manufacturers shall be one of the following:

1. A.R.I.: Model D-26SS
2. H-TEC: Model 986

3.00 EXECUTION

3.01 INSTALLATION AND TESTING

A. Carefully handle and install valves vertically in such a manner as to prevent damage to any part of the valves. Installation shall be in accordance with the manufacturer's instructions. Provide nuts, bolts, and gaskets where applicable with materials of construction in accordance with service type and process flow as required by AWWA C512.

B. Air valve and accompanying isolation valve and drain valve shall be braced adequately to withstand normal pipeline operation pressures and avoid undue stresses on the pipe.

C. Valves shall be installed in such a manner as to provide adequate access and room for valve operation, maintenance, and removal.

D. Conduct testing described in Section 4 and Section 5 of AWWA C512. Provide test results to the Owner or Owner's representative. Tests shall include:

1. Holiday testing to verify interior/exterior coated surfaces are holiday free.
2. Shell hydrostatic test equal to 150 percent of the design pressure. Test shall be at least 1 minute for 8-inch and smaller valves and 3 minutes for 10- through 20-inch valves.
3. Air valve seat leakage test, including hydrostatic and operational testing. Provide testing at 20 psi or the minimum design pressure, whichever is less and demonstrate no leakage. Test duration is to be a minimum of 30 seconds. Outlet of the valve shall be open to the atmosphere.

3.02 TAGGING

A. Valves shall be permanently tagged with a brass tag indicating the model number, working pressure rating, and station location.

3.03 SCHEDULES

A. The required valves and certain pertinent data are included to facilitate description of the various valves and as an aid to plan take-off. Contractor is responsible for verifying size, type, and number of valves required.

No. Req.	Valve Size (in)	Orifice Size (in)	Pipe Diameter (in)	Valve Type	Min. Operating Pressure (psi)	Max. Operating Pressure (psi)	Installation Location	Valve Service
1	2	2	6	CAV	30	50	STA 3+00	Wastewater

END OF SECTION

40 05 97 IDENTIFICATION FOR PROCESS PIPING AND EQUIPMENT

1.00 GENERAL

1.01 WORK INCLUDED

A. Furnish and install identification markings on process piping and equipment as specified in this Section.

B. Provide identifying devices for the following:

1. Process piping.
2. Process equipment.
3. Valves.
4. Electrical equipment.

1.02 RELATED WORK

A. Identification for Non-process Piping Systems and Equipment:

1. Electrical Systems: Refer to Section 26 05 53 “Identification for Electrical Systems.”

B. Process Piping Coatings: Refer to Section 09 96 00.01 “High-Performance Coatings” for information regarding coating systems for process piping. Process piping color selections are provided within this Section.

1.03 REFERENCES

A. The applicable provisions of the following standards apply as if written here in their entirety:

1. American Society of Mechanical Engineers (ASME):

ASME A13.1	Scheme for the Identification of Piping Systems

2. National Electrical Manufacturers Association (NEMA):

NEMA Z535.1	American National Standard for Safey Colors

3. United Nations (UN):

ST/SG/AC.10/30	Globally Harmonized System of Classification and Labeling of Chemicals (GHS)

1.04 DEFINITIONS

A. Combustible: The material classification for fluids that can burn, but that are not flammable.

B. Flammable: The material classification for fluids that, under ambient or expected operating conditions, are a vapor or produce vapors that can be ignited and continue to burn in air. The term may apply, depending on service conditions, to fluids defined for other purposes as flammable or combustible.

C. Oxidizing: The material classification for fluids that may, generally by providing oxygen, cause or contribute to the combustion of other material more than air does.

D. Piping: Conduits used to convey, distribute, mix, separate, discharge, meter, control, or snub fluid flows.

E. Piping Systems: Piping of any kind, including fittings, valves, and pipe coverings.

F. Toxic and Corrosive: The material classification for fluids that are toxic or corrosive, or that will produce toxic or corrosive substances when released.

1.05 PROJECT CONDITIONS

A. All items specified herein shall be specifically suited for the intended service and the environmental conditions encountered in this installation.

1.06 SUBMITTALS

A. Submittals shall be furnished in accordance with Section 01 33 00 “Document Management” and shall include the following items:

1. Product sheets for identifying devices.

2. A list of where devices are to be installed, and the data to be included on each identifying device.

3. Sample valve/gate and equipment tags for general formatting confirmation.

4. Equipment tag schedule including the following items:

a. Equipment tag number.

b. Equipment description.

1.07 DELIVERY, STORAGE, AND HANDLING

A. The Contractor must closely check the materials upon delivery for damage. If damaged, do not accept the materials. Handle the material with care to prevent inadvertent damage during installation.

B. Upon delivery, the Contractor shall off-load, store, handling and install the materials in full conformance with the manufacturer’s written instructions and guidelines.

1.08 WARRANTY

A. The cost for the removal, shipment, replacement, and installation by the Contractor shall be included in the warranty, as well as correction of defective Work.

2.00 PRODUCTS

2.01 EXPOSED PROCESS PIPING IDENTIFICATION

A. Exposed process piping is defined as piping located above ground or within pipe chases, vaults, galleries, etc. where the piping is observed without excavation.

B. Piping Markers:

1. Piping markers must include the process identify wording along with flow direction arrows.

2. Manufacturers: Subject to compliance with the requirements of this Section, available manufacturers offering products that may be incorporated into the Work include the following:
    a. Marking Services, Inc. – MS-970 Coiled Pipe Markers.
    b. Seton – Setmark Snap-Around Pipe Markers.
    c. Brady B-915.
3. Materials:
    a. Piping markers must be indoor/outdoor grade vinyl with ANSI specifications for background and letter colors, length of color field, and letter height.
    b. Marker minimum thickness must be 20 mil.
    c. Markers must be suitable for a service temperature of -40 through 160 deg F.
    d. Strapping shall be nylon for larger diameter pipes.
4. Size of Piping Identification:
    a. The sizing criteria provided below is the minimum acceptable standard:

Pipe Diameter (Including Insulation)	Length of Color Field	Character Height	Marker Type
1/4" to 3/8"	3"	1/4"	Coil-On
1/2" – 1"	8"	1/2"	Coil-On
1-1/8" – 2-1/4"	8"	3/4"	Coil-On
2-3/8" – 3-1/4"	12"	1-1/4"	Coil-On
3-3/8" – 4-1/2"	12"	1-1/4"	Coil-On
4-5/8" – 5-7/8"	12"	1-1/4"	Coil-On
6" – 7-7/8"	12"	1-1/4"	Coil-On
8" – 10"	24"	2-1/2"	Strap-On
> 10"	32"	3-1/2"	Strap-On

5. Marker Colors: The following colors below are based on the ANSI/ASMI A13.1 standard.

Classification	Lettering	Background
Potable water	White	Blue
Reclaimed water, irrigation, and slurry lines	White	Purple
Sewers and drain lines	White	Green
Gas, oil, steam, petroleum, chemicals, or other service	Black	Yellow

C. Piping Coating and Piping Banding Tape:
1. Piping coatings must as be specified in Section 09 96 00.01 "High-Performance Coatings.
    a. For pipes with color bands in addition to the base color, the following spacing criteria should be followed:

1). The sizing criteria provided below is the minimum acceptable standard:

Pipe Diameter (Including Insulation)	Band Color Spacing	Length of Band Color Field
1/4" to 3/8"	3"	1"
1/2" – 1"	8"	3"
1-1/8" – 2-1/4"	8"	3"
2-3/8" – 3-1/4"	12"	4"
3-3/8" – 4-1/2"	12"	4"
4-5/8" – 5-7/8"	12"	4"
6" – 7-7/8"	12"	4"
8" – 10"	24"	8"
> 10"	32"	10"

2. Piping excluded from coatings in Section 09 96 00.01 "High-Performance Coatings must be provided with self-adhesive vinyl pipe banding tape.

   a. Manufacturers: Subject to compliance with the requirements of this Section, available manufacturers offering products that may be incorporated into the Work include the following:

      1). Brady – Solid Color Banding Tape.

      2). Marking Services, Inc. – MS-900 Self-Adhesive Color Banding Tape.

      3). Seton – Piping Banding Tape.

   b. Materials:

      1). Piping banding must be self-adhesive, indoor/outdoor grade vinyl with ANSI/ASME standard colors.

      2). Marker minimum thickness must be 0.004 inches.

      3). Markers must be suitable for a service temperature of -32 through 140 deg F.

   c. Size of Piping Banding Identification:

      1). The sizing criteria provided below is the minimum acceptable standard:

Pipe Diameter (Including Insulation)	Length of Base Color Field	Length of Band Color Field	Spacing of Piping Tape (Edge to Edge)
1/4" to 3/8"	3"	1"	12"
1/2" – 1"	8"	3"	18"
1-1/8" – 2-1/4"	8"	3"	18"
2-3/8" – 3-1/4"	12"	4"	20"
3-3/8" – 4-1/2"	12"	4"	20"
4-5/8" – 5-7/8"	12"	4"	20"

Pipe Diameter (Including Insulation)	Length of Base Color Field	Length of Band Color Field	Spacing of Piping Tape (Edge to Edge)
6” – 7-7/8”	12”	4”	20”
8” – 10”	24”	8”	24”
> 10”	32”	10”	32”

2). Process Piping Coating and Banding Tape Color Schedule:

a). Wastewater Treatment Facilities (Plants, Lift Stations, Storage, Etc.):

Classification	Lettering	Background
Potable water	White	Blue
Reclaimed water, irrigation, and slurry lines	White	Purple
Sewers and drain lines	White	Green
Gas, oil, steam, petroleum, chemicals, or other service	Black	Yellow

2.02 BURIED PIPING IDENTIFICATION

A. Buried Piping Warning Tape:

1. Place continuous run of warning tape in pipe trench, 12 inches above the pipe.
2. Material:
   a. Polyethylene tape for prolonged underground use.
   b. Minimum tape thickness: 4 mils.
   c. Overall tape width: 4 inches.
   d. Message: “CAUTION” with the name of the service followed by “LINE BURIED BELOW.” in black lettering on colored background in accordance with approved APWA colors.
3. Manufacturers: Subject to compliance with the requirements of this Section, available manufacturers offering products that may be incorporated into the Work include the following:
   a. Seton (of Brady Corporation).
   b. T. Christy Enterprises, Inc.
   c. Kris-Tech.
   d. Marking Services, Inc.
   e. Surv-Kap.

4. Materials:

    a. Detectable Underground Warning Tape: Non-adhesive, 4.5-mil (minimum) thick, aluminum detectable warning tape. Tape must have a width of 6 inches.

    b. Message: “CAUTION” with the name of the name of the service, followed by LINE BURIED BELOW” in black letting on colored background in accordance with approved American Public Works Association (APWA) colors:

        1). Potable Water: Blue.

        2). Reuse: Purple.

        3). Sanitary Sewer: Green.

        4). Telephone: Orange.

        5). Gas and Other Services: Yellow.

B. Tracer Wire:

1. Pipe tracer wire shall be installed above all buried piping unless indicated otherwise.

2. Install pipe locating wire by strapping to the top of the pipe with PVC tape, polyethylene-backed tape, or tie locks every 10-ft at a maximum.

3. Pipe tracer wire shall be of a green color polyethylene insulated 30 mils min thickness 10-gauge annealed copper wire or copper clad steel (CCS) wire. Insulation shall conform to ANSI requirements. Bare wire or nylon jacketed wire such as type THHN are not acceptable.

    a. Where a splice is required for the tracer wire, utilize an appropriate size wire nut or compression fitting which shall then be placed inside a 3M brand Direct Bury Splice kit (DBR), or approved equal, of appropriate size. No bare wire shall be left exposed anywhere. Twisting the wires together and wrapping with electrical tape is not allowed. All wires shall be spliced to all other wires for a continuous pipe locating wire system.

    Location and frequency of tracer wire terminals shall be located on project plans. Stub the tracer wire up inside each valve box and splice together. Sufficient excess length shall be provided at terminal connections to allow continuation of the pipe-locating wire to the terminal connection. Tracer wire shall be terminated or dead-end at a ground rod station.

    b. Tracer wire shall pass a continuity/locating test prior to acceptance.

4. Tracing Wire Standards - All tracing wire shall be Copperhead Industries TraceWire or equivalent #12 AWG Copper clad steel unless otherwise approved by Owner.

5. Open Trench –High Strength with a minimum 450Lbs break load, with minimum 30 mil HDPE insulation Thickness.

6. Directional Drilling / Boring – Extra High strength with minimum 1,150 Lbs. break load. With a minimum 30 mil HDPE insulation thickness. Two tracer wires are required.

7. Pipe Bursting / Slip Lining – Trace wire shall be 7x7 stranded Copper Clad Steel, Extreme Strength with a 4,700 Lbs. break load, with a 50 mil HDPE insulation thickness.

8. Splicing Kit: 3M Kit 82-A1 or engineer approved equivalent for direct bury applications.
9. Manufacturers: Subject to compliance with the requirements of this Section, available manufacturers offering products that may be incorporated into the Work include the following:
    a. Republic Wire, Inc.
    b. Copperhead Industries LLC.
    c. EGW Utility Solutions.
    d. Kris-Tech.
    e. Performance Wire and Cable, Inc.
    f. Or Equal.

C. Pipe Utility Markers:
1. Manufacturers: Subject to compliance with the requirements of this Section, available manufacturers offering products that may be incorporated into the Work include the following:
    a. Carsonite (Valmont Composite Solutions) CRM Utility Marker.
    b. Marking Services, Inc. – MSI Flexible Pipeline Marker.
    c. Engineer approved equivalent.
2. Materials: Fiberglass reinforced plastic material with UV inhibitors for outdoor use.
3. Markers must be constructed as a single piece with a pointed bottom end for installation in soil. Dimensions must be at least 3.9 inches W x 66 inches L.
4. Information to be included on the marker:
    a. “CAUTION” (type of service) “PIPELINE”.
    b. Phone number for Owner in case of emergency.
    c. Station number.
    d. Offset information if the marker is not installed directly over the pipeline.
    e. Name of the appurtenance or fitting (e.g., pipe, 45-ree bend, blow off valve assembly, air release valve, etc.).

2.03 VALVE AND GATE IDENTIFICATION

A. Manufacturers: Subject to compliance with the requirements of this Section, available manufacturers offering products that may be incorporated into the Work include the following:
1. Marking Services, Inc. – MS-215R MaxTek Valve and Equipment Tags.
2. Brady B-418 Durable Rigid Plastic Tags.
3. Engineer approved equivalent.

B. Provide an identification tag for the following valves and gates on the Project:

1. All valves and gates equipped with electric or pneumatic valve operators.

C. Valve Tag Size: Tag shall be sized to accommodate the required text, but at a minimum must be 2 inches by 4 inches in size.

D. Materials:

1. Base Material: 0.1-inch (minimum) thick rigid polymer.
2. Total thickness: 0.120-inch (minimum) thickness to accommodate double sided use (2 each base product, labels, protective outer layers).
3. Service Temperature: -40 through 200 deg F.
4. Outdoor Durability: Tested to ASTM D7869 with an expected durability of more than 5 years.
5. UV Resistance: Excellent resistance and UV stable. Product must resist yellowing and hazing.
6. Finish: The tag must be furnished with a matte finish with beveled edges.
7. Tag Color:
   a. The following colors below are based on the ANSI/ASMI A13.1 standard.

Classification	Lettering	Background
Potable water	White	Blue
Reclaimed water, irrigation, and slurry lines	White	Purple
Sewers and drain lines	White	Green
Gas, oil, steam, petroleum, chemicals, or other service	Black	Yellow

   b. The tag color shall match the piping markers specified in Paragraph 2.01 “Exposed Process Piping Identification” of this Section.

E. Mounting:

1. Attach tags in such a way as to allow free and full operation of the valve or gate.
2. Each tag shall be equipped with a pre-installed stainless-steel grommet to accommodate the use of fasteners.
3. Exposed Valves and Gates: Exposed valves and gates shall have the tags connected to the valves and piping using stainless-steel jack chain, or bead chain.
4. Buried Valves and Gates: Buried valves and gates shall have the tags attached to valve box concrete pad with the use of stainless-steel (type 316) fasteners. Contractor must coordinate with the tag manufacturer for fastener type and size.

F. Tag Text:

1. Each valve tag shall be furnished with four lines of text.
2. Each line of text shall accommodate at least 14 characters.
3. The following text must be included on the tag:

a. Identification (tag) number.

b. Description of piping fluid or process.

c. Normal position of valve or gate (open or close).

d. Valve or gate description/function.

4. Contractor shall submit the tag list for review and approval by the Engineer prior to furnishing and installing the valve and gate tags.

2.04 EQUIPMENT NAMEPLATE

A. Manufacturers: Subject to compliance with the requirements of this Section, available manufacturers offering products that may be incorporated into the Work include the following:

1. Marking Services, Inc. – MS-215R MaxTek Valve and Equipment Tags.

2. Engineer approved equivalent.

B. Provide an identification tag for the following equipment:

1. Process Equipment.

2. Electrical and Instrumentation Equipment and Devices.

3. Panelboards.

4. Disconnects.

5. Control Devices.

6. Control Panels.

7. Other equipment as necessary for the Project.

C. Equipment Tag Size: Tag shall be sized to accommodate the required text, but at a minimum must be 1 inch by 3 inches in size.

D. Materials:

1. Base Material: 0.100-inch (minimum) thick rigid polymer.

2. Total thickness: 0.110-inch (minimum) thickness to accommodate single sided use (base, labels, protective outer layers).

3. Service Temperature: -40 through 200 deg F.

4. Outdoor Durability: Tested to ASTM D7869 with an expected durability of more than 5 years.

5. UV Resistance: Excellent resistance and UV stable. Product must resist yellowing and hazing.

6. Finish: The tag must be furnished with a matte finish with beveled edges.

7. Tag Color:

a. The following colors below are based on the ANSI/ASMI A13.1 standard.

Classification	Lettering	Background
Potable water	White	Blue
Reclaimed water, irrigation, and slurry lines	White	Purple
Sewers and drain lines	White	Green
Gas, oil, steam, petroleum, chemicals, or other service	Black	Yellow

b. The tag color shall match the piping markers specified in Paragraph 2.01 “Exposed Process Piping Identification” of this Section.

E. Mounting: Each tag shall be equipped with a pre-drilled holes with washers to support mounting with stainless steel (type 316) fasteners.

F. Tag Text:

1. Each valve tag shall be furnished with two lines of text.
2. Each line of text shall accommodate at least 14 characters.
3. The following text must be included on the tag:
    a. Identification (tag) number.
    b. Equipment description.
4. Contractor shall submit the tag list for review and approval by the Engineer prior to furnishing and installing the equipment tags.

3.00 EXECUTION

3.01 PREPARATION

A. For piping identified in Section 09 96 00.01 “High-Performance Coatings” to be coated, prepare and coat surfaces as specified in Section 09 96 00.01 “High-Performance Coatings” prior to the installation of any identification devices. For piping identified in Section 09 96 00.01 “High-Performance Coatings” to be excluded from coating, prepare surfaces for identification devices.

B. Install piping complete with insulation, valves, and gates in place prior to installing identification devices.

C. Piping shall be dry and free of oil, grease, or other contaminants that will interfere with the installation of the identification devices.

3.02 EXPOSED PROCESS PIPING IDENTIFICATION

A. Identify process piping, valves, and gates that are exposed to view, in any location inside of buildings or structures, in underground valves, pump station, basements, accessible pipe chases, or other exposed locations with lettering or tags designating services of each piping system with flow directional arrows and color code.

B. Install piping labels and process flow arrows on piping exposed to view, in any location inside of buildings or structures, in underground valves, pump station, basements, accessible pipe chases, or other exposed locations.

C. Color Code:

1. Coat or band piping with the colors identified in Piping Coating and Banding Tape Color Schedule of this Section.

2. Piping that is not coated that will receive piping banding tape, must receiving banding tape as identified previously and as follows:

a. At least one label in each area or room.

b. At connection to equipment, basins, and tanks.

c. Adjacent to all valves.

d. At both sides of floor or wall penetrations.

e. Adjacent to changes in directions.

D. Lettering and Flow Direction Arrows:

1. Piping labels and process arrows must be located so that they are visible from the Owner's position in walkway or working platform near piping. Locate markers along the horizontal centerline of piping, unless better visibility is achieved elsewhere. Install labels in rows with uniform spacings where several pipes run parallel to each other.

2. Piping label and process arrows must be installed at the following locations:

a. At least one label in each area or room.

b. At connection to equipment, basins, and tanks.

c. Adjacent to all valves.

d. At both sides of floor or wall penetrations.

e. Adjacent to changes in directions.

f. Every 5 feet in straight runs of pipe.

3.03 BURIED PIPING IDENTIFICATION

A. Underground Warning Tape: Place continuing run of warning tape in pipe trench, 12 inches above the pipe.

B. Tracer Wire:

1. Install on non-metallic pipe.

2. Install an electrically continuous run of tracer wire along the entire length of the pipe with wire terminations in valve boxes, vaults, or structures.

3. Install tracer wire on top of the pipe and secure to pipe with tape a minimum spacing of 10 feet.

4. Where approved by the Engineer, splice sections of wire together using approved splicing system.

C. Pipe Utility Markers:

1. Install over pipe in unpaved open-space areas at intervals not greater than 150 feet and at all changes in direction.

2. Place markers at appurtenances located in unpaved areas.
3. Embed markers at least 18 inches into the soil.

3.04 VALVE AND GATE IDENTIFICATION

A. Install a valve and gate tag on all valves and gages. Attached the tag to the hand wheel of valve and gate stems so that it does not interfere with the operation of valve or gate.

3.05 PROHIBITED PRODUCTS AND METHODS

A. Uninsulated trace wire.
B. Trace wire insulation other than HDPE.
C. Trace wire not domestically manufactured.
D. Non-locking, friction fit, twist on or taped connectors.
E. Brass or copper ground rods.
F. Wire connections utilizing taping or spray-on waterproofing.
G. Looped wire or continuous wire installations that has multiple wires laid side by
H. side or in close proximity to one another.
I. Trace wire wrapped around the pipe or service.
J. Brass fittings with trace wire connection lugs.
K. Wire terminations within the roadway. I.e. valve boxes. Clean-outs, manholes, etc.
L. Connecting trace wire to existing conductive utility

END OF SECTION

40 61 13 PROCESS CONTROL SYSTEM GENERAL PROVISIONS

1.00 GENERAL

1.01 SUMMARY

A. Section Includes:

1. General requirements for a complete process control system.

B. Related Sections:

1. Section 01 33 04, “Operation and Maintenance Data”
2. Section 01 78 36, “Warranties and Service Agreements”
3. Section 01 79 00, “Training of Operation and Maintenance Personnel”
4. Section 40 61 21, “Process Control System Testing”
5. Section 40 61 26, “Process Control System Training”
6. Section 40 61 93, “Process Control System IO List”
7. Section 40 61 96, “Process Control Descriptions”
8. Section 40 61 96.01, “Kentmere Lift Station”
9. Section 40 67 00, “Control System Equipment Panels and Racks”
10. Section 40 71 13, “Magnetic Flow Meters”
11. Section 40 72 76, “Level Switches”

1.02 SCOPE

A. General Requirements for Instrumentation and Control.

1. Process Control System Integrator (PCSI):

a. The PCSI shall provide all hardware, software, and configuration and integration associated with the PLC-based Process Control system. Provide a complete and operational system in accordance with these Contract Documents:

1). Provide instrumentation, hardware, conductors and raceway required for a complete and operable system specified in the Contract Documents. Provide all labor and materials to provide a complete and working process control system..

2). Provide all required labor, materials, software, PLC programming, and system configuration and integration to create a complete operational process control system in accordance with these Contract Documents.

3). Provide personnel to check out, test and commission the system.

4). Provide personnel to train the Owner's staff as specified.

5). Provide all required software and programming in the PLCs, OITs, and computer system HMI for a complete and operational system in accordance with these Contract Documents.

6). Coordinate and fully cooperate with the Owner to provide all required hardware and PLC hardware and PLC programming necessary to interface with the existing remote sites. Utilize the existing SCADA system software configuration to determine the IO tags and communications type at each location.

7). Provide factory trained personnel to train the Owner's staff as specified.

8). Provide software programming to modify and create new screens on the computer system as specified. Provide a copy of all screens to the Owner as an official submittal when screens are developed.

9). Provide PLC programming, interconnection wiring, etc. as required by the Plans and the Process Control Narratives. Additionally, supply a Mission panel and perform all necessary programming to integrate it into the system.

1.03 REFERENCE STANDARDS

A. Referenced Standards:

1. Instrumentation Systems and Automation Society (ISA)
    a. S.5.1, Instrumentation Symbols and Identification
    b. S.5.4, Standard Instrument Loop Diagrams
    c. S20, Standard Specification Forms for Process Measurement and Control Instruments, Primary Elements and Control Valves
    d. S101, Human Machine Interfaces
    e. S18.2, Management of Alarm Systems for the Process Industries
    f. S88, Batch Process Control
    g. RP60.6, Nameplates, Labels and Tags for Control Centers
2. National Electrical Manufacturers Association (NEMA)
    a. NEMA ICS 1 - Industrial Control and Systems: General Requirements.
    b. NEMA ICS 4 - Industrial Control and Systems: Terminal Blocks.
    c. NEMA ICS 5 - Industrial Control and Systems: Control Circuit and Pilot Devices.
    d. NEMA ICS 6 - Industrial Control and Systems: Enclosures.
    e. NEMA 250 - Enclosures for Electrical Equipment (1000 V maximum).
3. National Fire Protection Agency (NFPA)
    a. 70, National Electrical Code (NEC)
    b. 820, Standard for Fire Protection in Wastewater Treatment and Collection Systems
4. National Institute of Standards and Technology (NIST)
5. Underwriters Laboratory (UL)
    a. 508A, Standard for Industrial Control Panels
    b. 698A, Standard for Industrial Control Panels Relating to Hazardous (Classified) Locations

c. 913, Standard For Intrinsically Safe Apparatus And Associated Apparatus For Use In Class I, II, III, Division 1, Hazardous (Classified) Locations

d. 1077, Supplementary Protectors

6. American National Standards Institute (ANSI)

a. ANSI/IEEE 37.13 - Low Voltage AC Power Circuit Breaker (600 V Insulation Class)

7. FM Global (FM)

1.04 DEFINITIONS

A. Common terms

1. SCADA: Supervisory Control and Data Acquisition
2. PLC: Programmable Logic Controller
3. OIT: Operator Interface Terminal
4. HMI: Human Machine Interface
5. OT: Operational Technology
6. PCS: Process Control System
7. PCSI: Process Control System Integrator

1.05 SUBMITTALS

A. General: Submittals shall be in accordance with Division 01 requirements. Submit in sufficient detail to show full compliance with Contract Documents.

B. Product Data:

1. For each component, include manufacturer descriptive literature, product specifications, published details, technical bulletins, performance and capacity rating curves, charts and schedules, catalog datasheets, and other submittal materials as required to verify that the proposed products conform to the quality and function ability of the specified products.

C. Shop Drawings:

1. Submittals shall be original printed material or clear, unblemished photocopies of original printed material:

a. Facsimile information is not acceptable.

b. In addition to printed copies, provide an electronic copy of submittals in PDF format.

2. Limit the scope of each submittal to one (1) Specification Section:

a. Each submittal must be submitted under the Specification Section containing requirements of submittal contents.

b. Do not provide any submittals for Specification Section 40 61 13 – “Process Control System General Provisions”.

3. Documentation of instrumentation subcontractor qualifications and experience as defined in Paragraph 1.06.
4. Product technical data including:
    a. Equipment catalog cut sheets.
    b. Instrument data sheets:
        1). ISA S20 or approved equal.
        2). Separate data sheets for each instrument.
    c. Materials of construction.
    d. Minimum and maximum ranges, calibration information (in engineering units or as otherwise noted).
    e. Physical limits of components, including temperature and pressure limits.
    f. Size and weight.
    g. Electrical power requirements and wiring diagrams.
    h. NEMA rating of housings.
    i. Submittals shall be marked with arrows to show the exact features to be provided. Features and options not being provided shall be crossed out.
5. Loop diagrams per ISA S5.4
6. Comprehensive set of wiring diagrams
7. Panel fabrication drawings
8. PLC equipment drawings.
9. Programming software for PLC and OIT as specified in Section 40 61 96, “Process Control Descriptions”.
10. Nameplate layout drawings.
11. Drawings, systems, and other elements are represented schematically in accordance with ISA S5.1 and ISA S5.3:
    a. The nomenclature, tag numbers, equipment numbers, panel numbers, and related series identification contained in the Contract Documents shall be employed throughout submittals.
12. All Shop Drawings shall be modified with as-built information.
13. All panel and wiring drawings shall be provided in softcopy form:
    a. Furnish electronic files over a secure medium.
    b. Drawings in AUTO CAD and PDF format. Coordinate the AUTO CAD version with the Owner.
14. Provide a parameter setting summary sheet for each field configurable device.

15. Communication protocol addresses: Submit a complete list of outstation addresses for all field equipment. The list shall include the cable number that has been assigned and the port the cable is assigned to in the PLC, OIT, or other device.

16. Certifications:

    a. Documentation verifying that calibration equipment is certified with NIST traceability.

    b. Approvals from independent testing laboratories or approval agencies, such as UL or FM:

        1). Certification documentation is required for all equipment for which the specifications require independent agency approval.

1.06 QUALITY ASSURANCE

A. Contractor's Qualifications:

1. The Instrumentation System Integrator Contractor's personnel shall have a minimum of ten years of prior experience in furnishing, installation, testing, programming, debugging, start-up, and training for systems at least as large and similar to the one in this Contract. The system installer shall have employees who are qualified technicians for the duration of the contract located in the project area. The Contractor shall submit for evaluation within one week of Notice to Proceed, his instrumentation systems installer's company resumes complete with company history, project lists, locations, Owner, costs, type of system installed, and references with phone numbers. Installers not meeting these qualifications shall not be accepted. As a part of this contract, the instrumentation system installers shall assume complete system responsibility, including coordination and interfacing with all subsystems and equipment suppliers and manufacturers. The Contractor shall actively be involved in control system integration industry for the last five years. The Contractor shall not act as a broker for the project; he shall provide and be responsible for all hardware, interfacing software, training, testing, and extended warranties.

    a. No others shall be accepted.

2. The following PCSI are pre-qualified with the Forsyth County for Hardware.

    a. MR Systems, an Inframark Company

    b. Southern Flow

    c. All others shall submit qualifications to the Owner and the Engineer for review and approval prior to bid submittal a minimum of 3 weeks prior to bid due date. Any submittals after this time period shall not be evaluated. Qualifications shall include SCADA Integrators who have had at least 10 years of successful experience in the integration of similar projects . Qualifications shall include a list of similar projects within the last 5 years with the name of the project and contact information of the Owner.

2.00 PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Instrumentation:

1. All instruments and control devices must perform in accordance with the manufacturers' specifications and design requirements.

B. Software:

1. All software must meet the design requirements and Owner’s requirements.

2.02 MATERIALS AND QUALITY

A. Provide new and defect-free hardware of specified quality. Maintain manufacturer congruence for provided instruments, instrument accessories and devices.

B. Lifecycle: Provide current-generation products that the manufacturer plans to support for 10 years from the date submittals are approved.

3.00 EXECUTION

3.01 PROJECT REQUIREMENTS

A. Commissioning: Perform system commissioning in accordance with specification Section 40 61 21, “Process Control System Testing”.

B. Training: Provide the Owner’s staff with all required training and operating procedures at no extra cost to the Owner. The training schedule shall be coordinated with the Owner’s Representative. Training shall include operating, testing, calibration, programming, and troubleshooting of the system. The training shall include manuals that are specifically written for the system provided as described in Division 01 - General Provisions of these Specifications. Refer to Section 40 61 26, “Process Control System Training” for further requirements.

3.02 LEAD TIMES

A. Due to extended lead times for many parts, Contractor is encouraged to purchase components up front, including spare parts. Contractor must store all equipment at their facility and provide insurance for all equipment.

END OF SECTION

40 61 21 PROCESS CONTROL SYSTEM TESTING

1.00 GENERAL

1.01 SUMMARY

A. Section Includes:

1. General Requirements for commissioning a complete instrumentation system for process control.

B. Related Sections

1. Section 01 33 04, “Operation and Maintenance Data”
2. Section 01 79 00, “Training of Operation and Maintenance Personnel”
3. Section 40 61 13, “Process Control System General Provisions”
4. Section 40 61 93, “Process Control System IO List”
5. Section 40 61 96, “Process Control Descriptions”
6. Section 40 61 96.01, “Kentmere Lift Station”
7. Section 40 67 23, “Control System Equipment Racks and Panels”
8. Section 40 71 13, “Magnetic Flow Meters”
9. Section 40 72 76, “Level Switches”

1.02 SCOPE

A. Inspection, operational testing, adjustment, and calibration of each device, subsystem, and system, and placement of each device and system into service. The system supplier shall submit certified calibration reports for all instruments and loops for this project. The calibration shall comply with the manufacturers and ISA recommended practices. All calibrations shall be performed in the presence of OWNERs authorized representative. Calibrations of all instruments shall be performed by the instrument manufacturer’s factory technicians only.

1.03 REFERENCES

A. References:

1. Applicable Documents and Electrical Testing Requirements of:
    a. America National Standards Institute (ANSI): as applicable, including:
        1). ANSI C2, National Electrical Safety Code.
        2). ANSI Z244.1, Lockout, Tagout and Alternative Methods.
    b. National Electrical Manufacturer's Association (NEMA): as applicable, including:
        1). NEMA ICS 2.3 - Instructions for the Handling, Installation, Operation and Maintenance of Motor Control Centers.

2). NEMA ICS 7.1 - Safety Standards for Construction and Guide for selection, Installation, and Operation of Adjustable Speed Drive Systems.

3). NEMA PB 1.1 - General Instructions for Proper Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less.

4). NEMA PB 2.1 - Proper Handling, Installation, Operation and Maintenance of Deadfront Switchboards Rated 600 Volts or Less.

c. American Society for Testing and Materials (ASTM), as applicable.

d. Institute of Electrical and Electronics Engineers (IEEE), as applicable, including:

1). IEEE C.57.13, IEEE Standard Requirements for Instrument Transformers.

2). IEEE 81, Section 9.03; Guide for Measuring Earth Resistivity, Ground Impedance and Earth Surface Potentials of a Grounding System

e. National Fire Protection Association (NFPA), as applicable, including:

1). NFPA 70 - National Electrical Code (NEC).

2). NFPA 70E - Electrical Safety Requirements for Employee Workplaces.

3). NFPA 72 - National Fire Alarm Code (NFAC).

f. International Electrical Testing Association (IETA) as applicable, including:

1). NETA ATS Acceptance Testing Specifications for Electric Power Distribution Equipment and Systems.

g. Insulated Cable Engineer's Association (ICEA), as applicable.

h. Local Utility Codes and Ordinances.

i. Occupational Safety and Health Administration (OSHA), as applicable, including:

1). Title 29-2022, Parts 1910 and 1936.

j. National Electrical Testing Association:

1). ATS-2021 Acceptance Testing.

1.04 SUBMITTALS

A. Test Plan:

1. At least 21 days before Factory Acceptance Testing (FAT) of control panels, submit a description of the tests to be conducted.

2. At least 60 days before commissioning starts, submit a description of the tests to be conducted. The test procedures shall be detailed step-by-step on a loop-by-loop basis.

3. Include a list of test equipment, test procedures, checklists, and test report formats.

4. At the completion of each commissioning phase, deliver all test reports for the phase to ENGINEER with a statement that phase test requirements have been satisfied.

5. Shop drawings.

6. All other applicable requirements of Division 01 - General Provisions.

B. Test Reports:

1. The CONTRACTOR shall be required to develop, maintain, and update Test Reports of all test results and conditions that were recorded during the course of the testing. The test results shall include:

   a. Identification of the test being conducted.

   b. Date and time of test.

   c. Prerequisite tests and demonstrations.

   d. Brief statement of test objective(s) and scope.

   e. Brief test description.

   f. List of calibration (within the past calendar year) test and monitoring equipment required to perform test (as applicable).

   g. Test results.

   h. List of test deficiencies and their resolutions.

   i. Retesting requirements (if required).

   j. Failure events.

   k. CONTRACTORS certification (as applicable).

C. Responsibility: Review for acceptance by the OWNER representative of any plan, report, or other commissioning activity will not relieve the CONTRACTOR of his responsibility to meet the CONTRACT requirements.

2.00 PRODUCTS

2.01 MATERIALS

A. Devices and systems are specified in other sections of this Specification. Reference to “devices” means all devices included in the Contract.

B. Any device that fails to meet contract requirements or published performance specifications of the manufacturer must be repaired or replaced as directed by the OWNER at no cost to the OWNER.

C. Demonstrate that test equipment is fully operational and properly calibrated.

D. The OWNER reserves the right to disapprove test equipment that is improper or functioning improperly.

3.00 EXECUTION

3.01 OBSERVATION

A. The Owner and/or Engineer reserves the right to witness any test, inspection, calibration, or start-up activity.

B. Notify the Engineer in writing at least two working days in advance of any test. All tests executed without notifying the Engineer are invalid and must be repeated.

C. Perform commissioning of each device, subsystem and system under direct supervision of the individual manufacturer's factory-trained representative.

3.02 TEST PLANS

A. Testing requirements shall be part of every installation. The PCSI shall demonstrate the system was fully tested during development and installation. The control system must be demonstrated to be a functioning, integrated, and reliable control system before final payments are released. The basic testing requirements shall require a comprehensive series of PCSI conducted tests, which will be witnessed by ENGINEER and OWNER.

B. Test all software and all equipment related to the PCS. If specific tests were not defined in the CONTRACT for a piece of equipment or software, the PCSI will develop the testing procedures.

C. The PCSI will prepare and submit the following to the ENGINEER for approval. Any test performed before ENGINEER approval are invalid.

1. Factory Acceptance Test (FAT) plan and procedures
2. Operational Readiness Test (ORT) plan and procedures
3. Functional Demonstration Test (FDT) plans and procedures
4. Site Acceptance Test (SAT) plan and procedures

3.03 FACTORY ACCEPTANCE TEST (FAT)

A. Scope: Applies to all control panels.

B. Perform the FAT and verify all deliverable equipment and programs prior to shipping. The purpose of the test is to verify the equipment is manufactured and assembled correctly, operates as intended, and is in compliance with the CONTRACT. The test verifies the hardware and software meet the functional requirements of the CONTRACT. Perform the FAT at the panel manufacturing facility. The ENGINEER and OWNER may or may not attend the testing.

C. At a minimum, the FAT includes the following:

1. Visual Inspection: Inspect the termination of wires, wire stripping, labeling, wire installation, equipment mounting, paint, finish, and cable routing.
2. Control cabinet hardware and wiring verification: Test all IO from the field terminals to the PLC.
3. Functional Test:
    a. Fully energize the panel for 48 hours prior to conducting the functional tests.
    b. Test all PLC IO from the field terminal blocks to the PLC input.
    c. Verify functionality, performance, and stability of hardware and software. Correct and retest deficiencies identified during the test.
    d. Test for the correct sequence of operations while testing IO.
    e. Validate analog input and output accuracy.

f. Perform power fail tests for all AC and DC voltage supplies. Validate failover where applicable. Ensure the PLC only indicates a power fail alarm and loss of permissives during a power fail.

g. Test all communication ports.

h. Test all indicators, hand switches, and interlocks.

i. Validate the correct mechanical operation of all mechanical components including doors and breakers.

D. Documentation

1. Fully document all tests performed and the results.

2. CONTRACTOR manufacturing supervisor must sign off on the tests.

3. If OWNER or ENGINEER is present, they must sign off on the tests.

E. Location

1. Conduct the FAT within 100 miles of the project location.

3.04 INSTALLATION

A. Install panels in non-hazardous areas as depicted in the CONTRACT drawings.

B. Install free standing panels on a 4 inch tall concrete housekeeping pad.

C. Follow manufacturers guidelines for installation.

D. Install conduits according to design documents and obtain ENGINEER approval to deviate from the design.

3.05 OPERATIONAL READINESS TEST (ORT)

A. Perform the ORT after installation and prior to the SAT.

B. The purpose of the ORT is to verify that all equipment and cables are properly installed, re-test the functionality of the hardware and software, and perform tests with other hardware and software that were not feasible during the FAT. The ORT allows for defect detection and corrections prior to SAT.

C. Perform tests using field instruments. If it is not feasible to use the field instrument, simulate the signal at the field terminals.

D. Sequencing:

1. Perform all commissioning in accordance with the instructions on the Contract Drawings, these Specifications, manufacturer’s instruction manuals, and the direction of the Owner’s representative.

2. Commission field devices after installation of field instruments and prior to commissioning the instrument or the control panel.

3. After installation of the instrument or control panel, and prior to loop commissioning, commission panel-mounted devices and systems.

4. After commissioning field devices and panel-mounted devices, commission loops.

E. Transmitters and Receivers:

1. Remove shipping stops before starting with these procedures.
2. Have manufacturer's instruction manuals available.
3. Install miscellaneous components such as charts, illumination, etc., which have been supplied separately but are integral parts of equipment.
4. Test and exercise each instrument to demonstrate correct operation, first individually, then collectively, as a functional network.
5. Check calibration of and recalibrate, where necessary, instruments at a minimum of three points over full operational range and prove instruments to be within specified accuracy.
6. Calibrate instruments individually and, where applicable, as loop (i.e., transmitter, controller, and valve).
7. Specified accuracy for loop is defined as root-mean-square summation (RMS) of individual device-specified accuracies.
8. Individual device-specified accuracy requirements shall be as specified by contract requirements or by published manufacturer accuracy specifications whenever contract accuracy requirements are not specified.
9. Test each loop by applying simulated analog and/or discrete inputs to the first elements of the loop (i.e., applying simulated analog and/or discrete sensor signals) and measuring outputs from final elements of the loop (i.e., controllers, alarms, indicators, etc.).
10. Apply continuously variable analog inputs to verify proper operation and setting of discrete devices (i.e., alarms, etc.).
11. Make provisional settings on controllers, alarms, etc., during loop installation tests.
12. Prepare calibration report on each instrument and loop.

F. Loop Tests

1. The intent of loop testing is to verify panel and field wiring is correct. Verify field wiring continuity from Field device to PLC Panel termination.
2. Check each loop from the end element to the respective control display. Include instruments, field wiring, control devices, panels, termination cabinets, input/output cards and other devices in the loop to ensure proper operation and linkage to control station displays. Test I/O for field devices in the following manner.
    a. I/O Testing
        1). At the respective external terminal block, verify each controller analog input with the use of an analog signal generator. Make sure the proper setting is selected for the respective input type (2-wire current, 4-wire current, RTD, T/C). Using the specific programming software tools, verify that the proper value is read by the PLC. At a minimum, check proper value for 0 percent, 50 percent, and 100 percent of input range. Using the control panel wiring diagrams as a checklist, mark each analog input as it is checked.

2). At the respective external terminal block, verify each PLC analog output with the use of an ammeter or other current measuring device. Using the PLC programming software tools, force the respective analog output at 0 percent, 50 percent and 100 percent of the output range and verify that the proper value is read by the ammeter. Using the control panel wiring diagrams as a checklist, mark each analog output as it is checked.

3). At the respective external terminal block, verify each PLC digital input utilizing a copper jumper wire or test switch. Using the PLC programming software tools, verify that the selected input either is turned on or off by the PLC in response to the jumper or test switch position. Using the control panel wiring diagrams as a checklist, mark each digital input as it is checked.

4). At the respective external terminal block, verify each PLC digital output with the use of an ohmmeter (for isolated outputs) or voltmeter (for non-isolated outputs). Using the PLC programming software tools, force the respective digital outputs on or off and verify that the ohmmeter/voltmeter indicates the proper output state. Using the control panel wiring diagrams as a checklist, mark each digital output as it is checked.

5). If any I/O point does not function as expected, examine the wiring and hardware, and correct the wiring or hardware, and retest the I/O point.

3. Test operation of the final control element through panels and through control stations. If a final control element is out of service or not released by the OWNER for testing, simulate operation at the final control element location.

   a. Hardwired Circuits Test

      1). Functionally test all hardwired control circuits as shown on the approved control panel drawings. Verify that all devices (i.e., selector switches, push buttons, pilot lights, relays, etc.) are wired and function correctly.

      2). Functionally test all discrete analog devices and circuits as shown on the approved control panel drawings. Verify that all devices (i.e., signal isolators, process indictors, single loop controllers, direct current alarms, etc.) are wired, calibrated and function correctly.

4. For loops found to contain defective or inoperable equipment perform the following:

   a. Correct and recheck these loops when equipment is operable.

   b. The ENGINEER will assist in coordinating the correction of defective work by others.

   c. Do not perform additional checkout work unless directed by the ENGINEER.

G. Loop Tuning

1. Complete loop checkout and problem correction prior to loop testing.

2. Tune regulatory control loops to produce stable control. Use a loop-tuning software program to document loop performance.

3. For conventional control loops for PI and PID control, use minimum ITAE (Integral of Time and Absolute Error) criteria with overshoot constrained to 10 % unless otherwise directed by the ENGINEER.

4. Utilize averaging control for liquid level and gas pressure in storage vessels unless otherwise directed by the ENGINEER.
5. Provide reduced gains or filtering to minimize unnecessary output activity to electric actuators as directed by the ENGINEER.
6. Adjust input scan time or time intervals between controller calculations as necessary to produce stable control.
7. Tune cascaded controllers like the above with the inner loop tuned first while the outer loop is off or inactive.
8. Derive initial tuning parameters from open loop tests. Make final tuning parameter adjustments based on closed loop tests.
9. Operate tuned loops for a minimum of 24 hours prior to control strategy testing.

H. Process Control Testing

1. The purpose of the process control test is to ensure the process performs in accordance with the Process Control Narrative (PCN)
2. Fully test control strategies to verify specified operations. Include the following:
    a. Sequences.
    b. Alternate control modes.
    c. Dynamic gain adjustments.
    d. Contingency responses to device failures, where possible.
    e. Display and keyboard interaction.
    f. Messages.
3. Prior to use on the process equipment, compare strategies with approved submittals to verify that as-built linkages and logic agree with the documentation. Note and correct discrepancies.
4. Test as much of the logic as possible for process equipment. It may not be possible to test all logic due to operational constraints.
5. Annotate changes made during testing on the documentation to reflect final as-built conditions.

I. Documentation

1. Fully document all tests performed and the results.
2. CONTRACTOR manufacturing supervisor must sign off on the tests.
3. If OWNER or ENGINEER is present, they must sign off on the tests.

3.06 FUNCTIONAL DEMONSTRATION TESTING (FDT)

A. Purpose of the FDT is to certify that the entire PCS is ready for operation by demonstrating each specified function on a paragraph-by-paragraph, loop-by-loop, and site-by-site basis. FDT is to be witnessed by the Engineer and/or Owner.

B. FDT shall be performed after successful completion of the ORT and individual process startup, and prior startup and the SAT. The FDT shall be completed in a single testing period. The testing period may span over several days.

C. Failure of five (5) percent of I/O tested or more than one (1) hour of troubleshooting during the FDT will deem test as unsuccessful and the FDT shall be rescheduled once the system is ready for retesting.

D. All test shall be the same as specified under ORT, except that the entire installed system shall be tested and all functions demonstrated using live field-based data to the greatest extent possible.

E. Required Documents for Test:

1. Set of panel drawings and wiring diagrams from WFAT and ORT with corrections noted.
2. A set of Contract drawings and specification including addenda and change orders.
3. Signed-off master copy of the PCSI developed field testing signoff forms.
4. Testing procedures.
5. Copy of completed calibration forms.
6. One copy of all O&M Manuals for PCSI supplied equipment.

F. Daily schedule during FDT shall be as follows:

1. Morning meeting to review the day's test schedule.
2. Scheduled tests and signoffs.
3. End of day meeting to review day's test results and to review or revise next day's test schedule.
4. Unstructured testing period by Engineer and/or Owner.

G. The system shall operate for 96 continuous hours without failure before this test shall be considered successful. The start of the continuous hours will commence after all testing has been completed.

H. Punch list items and resolutions noted during the test shall be documented on the Punch list/Resolution form. In the event of rejection of any part or function test procedure, the PCSI shall perform repairs, replacement, and/or retest within 10 days.

I. Upon successful completion of the FDT, PCSI shall submit a record copy of test results to the Engineer and/or Owner as specified and request the scheduling of the SAT.

3.07 SITE ACCEPTANCE TESTING (SAT)

A. All database errors must be corrected prior to the start of the 30-Day Site Acceptance Test. The SAT will not be considered successful until all databases are correct.

B. Any malfunction during the test shall be analyzed and corrections made by the CONTRACTOR. The OWNER'S REPRESENTATIVE and OWNER will determine whether any such malfunctions are sufficiently serious to warrant a repeat of the test. The cost of a retest shall be borne by the CONTRACTOR as specified.

C. After completion of the Functional Demonstration Test and Plant Start-up, the CONTRACTOR shall be responsible for operation of the entire System for a period of 30 consecutive days, under conditions of full plant process operation, without single non-field repairable malfunction.

D. During this test, CONTRACTOR personnel shall be present as required. The CONTRACTOR shall provide personnel for this test who have an intimate knowledge of the hardware and software of the system and also are familiar with the overall plant process. The Supplier shall be on call for the 30-Day Acceptance Test. During the test period the supplier shall be available and on the job site within 48 hours of any failure.

E. While this test is proceeding, the OWNER shall have full use of the system. Only plant operating personnel shall be allowed to operate equipment associated with live plant processes.

F. Any malfunction, during this 30 consecutive day test period, which cannot be corrected within 24 hours of occurrence by the CONTRACTOR's personnel, or more than two similar failures of any duration, will be considered as a non-field-repairable malfunction.

G. Upon completion of repairs, by the Supplier, the test shall be repeated as specified herein.

H. In the event of rejection of any part or function, the Supplier shall perform repairs within 5 days or replacement within 30 days.

I. Upon successful completion of the SAT, approval of all as-built drawing and O&M Manuals, completion of all related OWNER training, and delivery of all spare, expendable, and test equipment, the systems shall be considered substantially complete, and the warranty period shall commence.

END OF SECTION

40 61 26 PROCESS CONTROL SYSTEM TRAINING

1.00 GENERAL

1.01 SUMMARY

A. Section includes:

1. General requirements for the training of a complete instrumentation system for process control.

B. Related sections:

1. Section 01 33 04, “Operation and Maintenance Data”
2. Section 01 79 00, “Training of Operation and Maintenance Personnel”
3. Section 40 61 13, “Process Control System General Provisions”
4. Section 40 61 93, “Process Control System IO List”
5. Section 40 61 96, “Process Control Descriptions”
6. Section 40 61 96.01, “Kentmere Lift Station”
7. Section 40 67 23, “Control System Equipment Racks and Panels”
8. Section 40 71 13, “Magnetic Flow Meters”
9. Section 40 72 76, “Level Switches”

1.02 DEFINITIONS:

A. PCSI: Process Control Systems Integrator (Instrumentation and Networking subcontractor)

B. PCS: Process Control System

1.03 SCOPE

A. PCSI shall coordinate all training activities with the Owner, Engineer, Contractor, all affected subcontractors, equipment suppliers, and vendors.

B. PCSI shall not include training for equipment items not manufactured or supplied by the PCSI. This training shall be provided by an authorized manufacturer's representative as set forth within this section and related sections of the specifications.

C. The training and instruction shall be directly related to the system being supplied.

D. The training program shall represent a comprehensive program covering all aspects of the operation and maintenance of the system.

E. PCSI shall conduct training courses for Owner personnel. Training shall be provided for the following, and as outlined under this specification section:

1. Instruments.
2. Process Control System Hardware.
3. Process Control System Software.

4. SCADA Network System.

F. Unused specified training courses/sessions shall be returned as a credit to the contract.

1.04 REFERENCES

A. Applicable Documents and Electrical Testing Requirements of:

B. America National Standards Institute (ANSI), as applicable, including:

C. ANSI C2, National Electrical Safety Code.

D. ANSI Z244.1, Lockout, Tagout and Alternative Methods.

E. National Electrical Manufacturer's Association (NEMA), as applicable, including:

F. NEMA ICS 2.3 - Instructions for the Handling, Installation, Operation and Maintenance of Motor Control Centers.

G. NEMA ICS 7.1 - Safety Standards for Construction and Guide for selection, Installation, and Operation of Adjustable Speed Drive Systems.

H. NEMA PB 1.1 - General Instructions for Proper Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less.

I. NEMA PB 2.1 - Proper Handling, Installation, Operation and Maintenance of Deadfront Switchboards Rated 600 Volts or Less.

J. American Society for Testing and Materials (ASTM), as applicable.

K. Institute of Electrical and Electronics Engineers (IEEE), as applicable, including:

L. IEEE C.57.13, IEEE Standard Requirements for Instrument Transformers.

M. IEEE 81, Section 9.03; Guide for Measuring Earth Resistivity, Ground Impedance and Earth Surface Potentials of a Grounding System.

N. National Fire Protection Association (NFPA), as applicable, including:

1. NFPA 70 - National Electrical Code (NEC).

2. NFPA 70E - Electrical Safety Requirements for Employee Workplaces.

3. NFPA 72 - National Fire Alarm Code (NFAC).

O. International Electrical Testing Association (IETA) as applicable, including:

1. NETA ATS Acceptance Testing Specifications for Electric Power Distribution Equipment and Systems.

P. Insulated Cable Engineer’s Association (ICEA), as applicable.

Q. Local Utility Codes and Ordinances.

R. Occupational Safety and Health Administration (OSHA), as applicable, including:

1. Title 29-2022, Parts 1910 and 1936.

S. National Electrical Testing Association:

1. ATS-2021 Acceptance Testing.

2.00 PRODUCTS

2.01 MATERIALS

A. Devices and systems are specified in other sections of this Specification. Reference to "devices" means all devices included in the Contract.

B. Any device that fails to meet contract requirements or published performance specifications of the manufacturer must be repaired or replaced as directed by the Owner at no cost to the Owner.

C. Demonstrate that test equipment is fully operational and properly calibrated.

D. The Owner reserves the right to disapprove test equipment that is improper or functioning improperly.

3.00 EXECUTION

3.01 TRAINING – GENERAL

A. Training Summary:

1. The following training courses listed in the summary table shall, as a minimum, be provided:

Training Course Description	Minimum Course Duration (hours)	Maximum Number of Trainees per Course	Number of Times Course to be Given	Intended Audience
PCSI Onsite Training				
Installed Process Control System Training (PCSI)	2	4	2	Maintenance, Administrator
Instruments PCSI Training (PCSI)	4	4	2	Maintenance
Instruments Training - Operator familiarity (PCSI or Manufacturer Representative)	2	8	2	Operations
Software Maintenance Training	2	4	2	Maintenance, Administrator

2. Definitions of audience roles:

a. Administrator: Personnel responsible for maintaining the HMI / SCADA system.

b. Maintenance: Personnel responsible for maintaining the field controller hardware and instrumentation system.

c. Operations: Personnel responsible for daily plant operations.

d. Management: Non-daily operations personnel.

B. Owner shall select Technicians, Operators, Engineers, and Managers of the facility to be trained on new processes and equipment included within the project scope. The training courses shall address operation, maintenance, and troubleshooting of the system provided.

The courses shall be designed specifically for the type of personnel attending, such as operators, engineers, etc.

C. PCSI standard training courses may be used to meet the training objectives specified. Where standard courses do not meet these objectives, additional coursework shall be developed.

1. Clock hour requirements for each level of training shall be as listed herein. A "clock hour" is defined as one hour of instruction or supervised training exercise.

2. Training hour requirements are the number of hours of training to be provided for each student. Additional training time shall be provided if considered necessary to meet the training objectives.

D. Training Instructors:

1. All onsite training shall be conducted by experienced instructors who are intimately familiar with the operation and control of the Owner's facilities and with the specific system supplied.

E. Training Material:

1. Provide detailed training manuals to supplement the training courses. The manuals shall include specific details of equipment supplied and operations specific to the project. The manuals shall be provided in hardcopy for each student. Provide electronic copy of each training manual in PDF format for Owner's future use.

2. The trainer shall make use of teaching aids, manuals, slide/video presentations, etc. After the training services, all training materials shall be delivered to Owner.

F. Training Costs:

1. All costs associated with the training program, excluding travel, lodging, and per diem expenses for Engineer and/or Owner personnel to attend off-site training programs shall be the responsibility of PCSI and shall be included in the contract price.

2. The cost of Travel for off-site training including travel, lodging, and per diem expenses for Engineer and/or Owner personnel shall be paid directly by the entity employing the staff doing the traveling.

3. All costs associated with the manufacturer’s training sessions, including travel and lodging for the Engineer and/or Owner, shall be the responsibility of the PCSI and shall be included in the contract price. Travel for the Engineer and/or Owner shall be via non-stop flight, originating and terminating at OWNER’s preferred Airport. PCSI shall provide transportation from the airport to lodging and the training site for the Engineer and/or Owner personnel.

G. Training Schedules:

1. All training schedules shall be coordinated with and at the convenience of the Owner. Shift training may be required to correspond to the Owner’s working schedule.

H. Lessons:

1. Training lesson plans and other information shall be submitted at least 30 days prior to the start of training.

I. Video Recording:

1. The Owner reserves the right to videotape all custom training sessions. All training tapes shall become the sole property of the Owner.
2. All training sessions shall be video recorded by the PCSI for Owner's future use in training other personnel. Video recorded sessions shall be saved as electronic files for delivery to Owner.
3. Pre-recorded videos of standard training programs may be substituted if they cover the same topics and are developed for the same versions of hardware and software.
4. Furnishing videos of standard training programs shall not relieve the PCSI from any of the training requirements specified herein.

3.02 TRAINING SUBMITTALS

A. Training Plan Submittal:

1. PCSI shall provide proposed lesson plans or outlines for all training courses specified herein. Training submittals shall include:
    a. Course objectives and target audience.
    b. Proposed schedule including proposed dates, duration, and location.
    c. Resumes of trainers including instructors' qualifications and experience.
    d. Prerequisite requirements for each class.
    e. Samples of handouts for review.
2. Complete copies of all proposed handouts and training materials. Training information shall be bound and logically arranged with all materials reduced to a maximum size of 11 inch by 17 inch, then Z-folded to 8.5 inch by 11 inch for inclusion into the binder.
3. Refer to Section 40 61 13, "Process Control System General Provisions" for the submittal order.

3.03 MANUFACTURER'S TRAINING

A. Instrument Manufacturer Training:

1. Manufacturer instrument training shall be provided for those instruments where specifically indicated in the Training Summary table. This shall be on-site training provided by an authorized representative of the manufacturer. This work shall not be done by the PCSI or the Contractor. The manufacturer's representative shall be fully knowledgeable of the operation and maintenance of the equipment.

3.04 ONSITE TRAINING

A. Training personnel shall be intimately familiar with the control system equipment, its manipulation, and configuration. Training personnel shall command knowledge of system debugging, program modification, troubleshooting, maintenance procedure, system operation, and programming, and shall be capable of transferring this knowledge in an orderly fashion to technically oriented personnel.

B. Installed Process Control System Training:

1. Provide training for the Owner's personnel in the functionality, maintenance, and troubleshooting of the installed Control System. The training shall be held before the WORT, but not more than two months before.
2. Training and instruction shall be specific to the system that is being supplied.
3. Training shall consist of classroom instructions and hands-on instruction utilizing the Owner's system.
4. Detailed training shall be provided on the actual configuration and implementation for this Contract. Training shall cover all aspects of the system that will allow the Owner's personnel to maintain, modify, troubleshoot, and develop future additions/deletions to the system. The training shall cover the following subjects, as a minimum:
    a. System overview.
    b. System hardware components and specific equipment arrangements.
    c. Periodic maintenance.
    d. Troubleshooting and diagnosis.
    e. Network configuration, communications, and operation.
    f. TCP/IP addressing procedures for all Ethernet devices.

C. Instrument PCSI Training:

1. Provide instruction on the maintenance of the field and panel instrumentation for the Owner's instrumentation technicians. This training shall be conducted before the WORT, but no more than 1 month before and at a time suitable to the Owner. This training shall take place at the Owner's facility. As a minimum the following shall be included:
    a. Training in standard hardware maintenance for the instruments provided.
    b. Specific training for the actual instrumentation configuration to provide a detailed understanding of how the equipment and components are arranged, connected, and set up for this Contract.
    c. Test, adjustment, and calibration procedures.
    d. Troubleshooting and diagnosis.
    e. Periodic maintenance.

D. Instruments - Operator familiarity:

1. Provide operator level instruction on the use of the field and panel instrumentation for the Owner's operations staff. This training shall be conducted before the 30-day site acceptance test, but no more than 1 month before and at a time suitable to the Owner. This training shall take place at the Owner's facility. Include hands on demonstration of the information each transmitter indicates, and the method used to retrieve any operator information from the transmitter, including use of pushbuttons and interpretation of international graphic symbols used on the instruments.

E. Software Maintenance:

1. Provide training on how to back-up PLCs, HMIs, OITs, and any other software in this system.

2. Provide training on all aspects covered in the O&M Software Maintenance Manuals.
3. Provide training on PLC program structure, HMI configuration structure, tips in how to edit programming code, and other items which will supplement the maintenance staff's ability to edit and maintain the programs.

END OF SECTION

40 61 93 Process Control System IO List

Line Item No.	Location	Loop	Point Type	Equipment tag	Signal Description	Function	I/O Char.	Isolated/ Loop	Cabinet
1	KENTMERE LIFT STATION	1000	DI	LSLL-1000	WET WELL LOW LOW LEVEL ALARM				EXISTING CONTROL PANEL
2	KENTMERE LIFT STATION	1001	DI	MOV-1001	MOTORIZED VALVE 1 OPEN STATUS				VALVE CONTROL PANEL
3	KENTMERE LIFT STATION	1001	DI	MOV-1001	MOTORIZED VALVE 1 CLOSE STATUS				VALVE CONTROL PANEL
4	KENTMERE LIFT STATION	1001	DI	MOV-1001	MOTORIZED VALVE 1 OPEN REQUEST				EXISTING MISSION RTU
5	KENTMERE LIFT STATION	1001	DI	MOV-1001	MOTORIZED VALVE 1 CLOSE REQUEST				EXISTING MISSION RTU
6	KENTMERE LIFT STATION	1001	DI	MOV-1001	MOTORIZED VALVE 1 FAULT				VALVE CONTROL PANEL
7	KENTMERE LIFT STATION	1001	DI	MOV-1001	MOTORIZED VALVE 1 IN REMOTE (TO CONTROL PANEL)				VALVE CONTROL PANEL
8	KENTMERE LIFT STATION	1001	DI	MOV-1001	MOTORIZED VALVE 1 IN REMOTE (TO MISSION PANEL)				EXISTING MISSION RTU
9	KENTMERE LIFT STATION	1002	DI	MOV-1002	MOTORIZED VALVE 2 OPEN REQUEST				EXISTING MISSION RTU
10	KENTMERE LIFT STATION	1002	DI	MOV-1002	MOTORIZED VALVE 2 CLOSE REQUEST				EXISTING MISSION RTU
11	KENTMERE LIFT STATION	1002	DI	MOV-1002	MOTORIZED VALVE 2 OPEN STATUS				VALVE CONTROL PANEL
12	KENTMERE LIFT STATION	1002	DI	MOV-1002	MOTORIZED VALVE 2 CLOSE STATUS				VALVE CONTROL PANEL
13	KENTMERE LIFT STATION	1002	DI	MOV-1002	MOTORIZED VALVE 2 FAULT				VALVE CONTROL PANEL
14	KENTMERE LIFT STATION	1002	DI	MOV-1002	MOTORIZED VALVE 2 IN REMOTE (TO CONTROL PANEL)				VALVE CONTROL PANEL
15	KENTMERE LIFT STATION	1002	DI	MOV-1002	MOTORIZED VALVE 2 IN REMOTE (TO MISSION PANEL)				EXISTING MISSION RTU
16	KENTMERE LIFT STATION	1001	DO	MOV-1001	MOTORIZED VALVE 1 OPEN COMMAND				VALVE CONTROL PANEL
17	KENTMERE LIFT STATION	1001	DO	MOV-1001	MOTORIZED VALVE 1 CLOSE COMMAND				VALVE CONTROL PANEL
18	KENTMERE LIFT STATION	1002	DO	MOV-1002	MOTORIZED VALVE 2 OPEN COMMAND				VALVE CONTROL PANEL
19	KENTMERE LIFT STATION	1002	DO	MOV-1002	MOTORIZED VALVE 2 CLOSE COMMAND				VALVE CONTROL PANEL
20	KENTMERE LIFT STATION	1001	AI	FE/FIT-1001	ELCECTROMAGNETIC FLOW METER NO. 1 FLOW				VALVE CONTROL PANEL
21	KENTMERE LIFT STATION	1002	AI	FE/FIT-1002	ELCECTROMAGNETIC FLOW METER NO. 2 FLOW				VALVE CONTROL PANEL
22	KENTMERE LIFT STATION	1001	AO	FE/FIT-1001	ELCECTROMAGNETIC FLOW METER NO. 1 FLOW STATUS				EXISTING MISSION RTU
23	KENTMERE LIFT STATION	1002	AO	FE/FIT-1002	ELCECTROMAGNETIC FLOW METER NO. 2 FLOW STATUS				EXISTING MISSION RTU
24	KENTMERE LIFT STATION (EXISTING)	1000	DI	PMP-1000-A	PUMP NO. 1 RUNNING (TO CONTROL PANEL)				EXISTING CONTROL PANEL
25	KENTMERE LIFT STATION (EXISTING)	1000	DI	PMP-1000-A	PUMP NO. 1 FAULT (TO CONTROL PANEL)				EXISTING CONTROL PANEL
26	KENTMERE LIFT STATION (EXISTING)	1000	DI	PMP-1000-A	PUMP NO. 1 RUNNING (TO MISSION RTU)				EXISTING MISSION RTU
27	KENTMERE LIFT STATION (EXISTING)	1000	DI	PMP-1000-A	PUMP NO. 1 FAULT (TO MISSION RTU)				EXISTING MISSION RTU
28	KENTMERE LIFT STATION (EXISTING)	1000	DI	PMP-1000-B	PUMP NO. 2 RUNNING (TO CONTROL PANEL)				EXISTING CONTROL PANEL
29	KENTMERE LIFT STATION (EXISTING)	1000	DI	PMP-1000-B	PUMP NO. 2 FAULT (TO CONTROL PANEL)				EXISTING CONTROL PANEL
30	KENTMERE LIFT STATION (EXISTING)	1000	DI	PMP-1000-B	PUMP NO. 2 RUNNING (TO MISSION RTU)				EXISTING MISSION RTU
31	KENTMERE LIFT STATION (EXISTING)	1000	DI	PMP-1000-B	PUMP NO. 2 FAULT (TO MISSION RTU)				EXISTING MISSION RTU
32	KENTMERE LIFT STATION (EXISTING)	1000	DI	LSH-1000	WET WELL HIGH LEVEL ALARM (TO CONTROL PANEL)				EXISTING CONTROL PANEL
33	KENTMERE LIFT STATION (EXISTING)	1000	DI	LSH-1000	WET WELL HIGH LEVEL ALARM (TO MISSION RTU)				EXISTING MISSION RTU
34	KENTMERE LIFT STATION (EXISTING)	1000	DI		EXISTING CONTROL PANEL PHASE FAULT (TO CONTROL PANEL)				EXISTING CONTROL PANEL
35	KENTMERE LIFT STATION (EXISTING)	1000	DI		EXISTING CONTROL PANEL PHASE FAULT (TO MISSION RTU)				EXISTING MISSION RTU
36	KENTMERE LIFT STATION (EXISTING)	1000	DI	BUE-1000	BACK UP ENGINE RUNNING				EXISTING MISSION RTU
37	KENTMERE LIFT STATION (EXISTING)	1000	DI	BUE-1000	BACK UP ENGINE FAIL				EXISTING MISSION RTU
38	KENTMERE LIFT STATION (EXISTING)	1000	AI	LT/AE	BUBBLER WET WELL LEVEL				EXISTING CONTROL PANEL
39	KENTMERE LIFT STATION (EXISTING)	1000	AO	LT/AE	BUBBLER WET WELL LEVEL				EXISTING MISSION RTU

40 61 96 PROCESS CONTROL DESCRIPTIONS

1.00 GENERAL

1.01 SCOPE OF WORK

A. This Specification section provides general control loop requirements for the programming of the Process Control System by the Applications System Programmer (ASP).

B. These descriptions are intended to provide an overview of the operating concept of the plant process equipment rather than describing in detail every operating feature or interlock.

C. All Process Control System PLC controller programming and Operator Interface Terminal (OIT) or Operator Workstation Station (OWS) graphics and programming shall be performed as defined herein.

1.02 ASSOCIATED SECTIONS

A. This section encompasses the equipment and services specified in the following sections:

1. 26 29 16 “Motor Operators for Valves”
2. 40 05 62 “Eccentric Plug Valves”
3. 40 61 13 “Process Control System General Provisions.”
4. 40 61 93 “Process Control System IO List”
5. 40 61 96.01 “Kentmere Lift Station”

1.03 SUBMITTALS

A. Refer to Section 01 33 00 “Document Management” for general submittal requirements.

B. Refer to Section 40 61 18 “Process Control System General Provisions” for the specific submittal requirements.

2.00 PRODUCTS (NOT USED)

3.00 EXECUTION

3.01 GENERAL

A. Control descriptions are provided for each process area and are attached at the end of this section. The following is a list of attached Sections that have detailed control descriptions for each process area. The list shows the specification attachment number, process area with accompanying process number.

B. The control descriptions are organized in the following format:

1. General
    a. Process Area
    b. Process Overview

c. Associated Equipment

d. Associated Instruments

e. Associated PLC

f. Associated Control Panels

g. Associated P&ID(s)

2. Controller Programming

a. Control Modes

b. Software Permissives

c. Hardwired Interlocks

d. Calculated Alarms and Variables

e. Power Failure

3. System Configuration

a. Status

b. Setpoints

c. Trending

d. Alarms

e. HMI Requirements

4. Alarm Management

3.02 GENERAL CONTROL CRITERIA

A. General configuration and programming tasks are required for system PLCs. Each PLC may have several occurrences of each of these tasks or may not have any occurrences of some or all of these tasks.

B. The input/output lists in Section 40 61 93 Process Control System IO List and detailed equipment control descriptions included in the attachments of this section shall be referenced to determine the requirements for each PLC.

C. All alarm and control setpoints shall be adjustable by the Operator at the HMI unless specifically stated otherwise, even if not shown on the Drawings. These setpoints shall be password protected to allow access by only the Operators who are given clearance by the Owner.

D. HMI computers shall function as a monitoring system and a controller, for the process equipment. The computer shall download set points and other information to the PLCs, and the PLCs shall perform all control algorithms, so a temporary failure of any HMI computer will not disrupt lift station control.

E. Rack and module definitions for the PLC, as well as the PLC communications configuration shall be completely configured to allow proper addressing of all field connected I/O points.

F. The PLC database will include both field I/O points and internally generated points required for programming. All field I/O points and internal programming points shall be fully defined according to database naming conventions approved by Owner. As a minimum, each database point shall be provided with a tag name, engineering unit, alarm parameters, and description.

G. All PLC-generated process alarms, equipment statuses, and process variable values shall be available at any operator workstation.

H. Failure of a PLC shall result in safe shutdown of associated process equipment. Interposing relays shall be provided where required to assure that equipment will revert to its fail-safe condition. Failure of any PLC or its communication shall be alarmed on the HMI computer.

3.03 EQUIPMENT CONTROL AND CONTROL MODE OVERVIEW

A. The control descriptions correspond to the P&ID control hierarchical layers shown as process area, field panels, PLC, and SCADA.

B. The control descriptions are consist of four control modes. There may be one or more modes per loop depending on the process and associated equipment. Control modes consists of the following:

1. Local Manual Control – This is the lowest layer of control and is typically located either in the process area located near the equipment or in the field panels at an equipment's control panel or MCC.

2. Local Auto Control – This layer of control is typically located in the field panels at the equipment's control panel or MCC, either by hardwired relay logic or process specific PLCs. This control is most commonly used in batch processes or vendor supplied systems.

3. Remote Manual Control – This layer of control is typically provided at the OIT/HMI. This control allows operators to manipulate process equipment remotely. Commands issued at the OIT/HMI are sent to the PLC where signals are generated to process equipment for control and monitoring.

4. Remote Auto Control – The highest layer of control is done by the process control system PLC. In remote auto, operators typically enter a control setpoint at an OIT/HMI. Process instrumentation provides feedback signals to the PLC. The PLC is programmed to take the setpoints and feedback signals and to manipulate process equipment according to a specific algorithm. Any functions done in the operator workstations also take place at all the SCADA OITs.

C. Descriptions for local control are included in the detailed equipment control descriptions. They are provided primarily for documentation purposes and for information. These controls are provided by the equipment vendors and require no programming effort with the exception of process interfacing such as setpoint adjustments, etc.

D. Descriptions for remote control are included in the detailed equipment control descriptions and are to be used by the PCSI to program algorithms for process equipment control.

3.04 PLC PROGRAMMING FUNCTIONAL REQUIREMENTS

A. The following covers functional requirements of the software, which are generic and may or may not be related to any specific control loop.

B. Analog Scaling

1. Each analog input and output will be appropriately scaled for use in internal PLC programming, monitoring by the HMI computers, or transmission to other PLCs.

2. Requirements for raw count values shall be coordinated with the operator interface software to ensure compatibility.

C. Flow Values

1. Flow values shall be integrated, totalized, and stored in the PLC registers so the values displayed on the HMI computers and on the field processor will be identical.

D. Flow Totalization:

1. Every reading that monitors the flow of the main water flow needs to be totalized daily.

a. Only values with a good value status are totalized.

b. All flow totals will be maintained in millions of gallons (MG) for MGD rates.

c. Flow rates and flow totals shall be indicated and recorded at the HMI.

2. Running Total

a. The running total starts at the beginning of the day and totalizes the volume throughout the day.

b. At the end of the day, it resets that total and starts over.

c. Before the total is reset, it is stored for examination throughout the next day. Therefore, the flow total consists of two values: previous day's total, and the total for this day since midnight.

1). For example: The total reading is calculated by integrating the minutely average of the MGD readings every minute. The minutely average need to be scaled to millions of gallons per minute before it is totalized. While MGD units is used in this example, flow totalization may be for other volumetric flow units such as gallons per minute (gpm), standard cubic feet per minute (scfm), etc.

d. ASP shall provide flow totalization in the base units of the flow signal being totalized, unless stated as otherwise in the specifications.

e. Flow shall not be totalized:

1). When a valve is closed or a pump is not running, the flow totalizer shall not accumulate values caused by noise or errors in calibration.

2). If the analog signal is outside the 4-20 mA range.

3). If the value of the flow input is less than 2% of the full range of the input.

$$MG_{Daily} = \sum_{1}^{1440} \frac{MGD_{MinAvg}}{60Min * 24Hours}$$

3. Each flow totalization shall come with a reset button on the HMI screen.

E. Equipment Runtimes and Starts

1. To support routine maintenance functions, all motorized equipment (pumps, motors, motorized gates, etc.) whose "run" status is monitored by a PLC, will have their runtime and number of starts accumulated by the respective PLC.

    a. The runtime procedure will monitor the status of the equipment "run" contact and, when the equipment is running, increment a software timer that maintains equipment runtime to within a one-minute resolution.

    b. The timer shall stop incrementing, but not reset, when the "run" contact indicates that the equipment is not running.

    c. The timer value shall increment an hour counter that maintains an integer value representing the equipment run time in hours.

    d. The counter value shall be available for display on the HMI computer.

2. Both the runtime and number of starts will continue to be collected until reset by an operator with permissions at the supervisor level and above. When reset, both values will be set to zero, and the date/time when it was reset will be noted. A manual reset of the runtime value shall be available at the HMI.

3. Two runtime parameters shall be provided for equipment:

    a. Accumulated Runtime – Accumulates for the life of the equipment.

    b. Resettable Runtime – Runtime with reset capabilities.

F. Equipment Availability

1. Remote Switch Monitoring

    a. In general, equipment with PLC control has been provided with a local selector switch that transfers control to the PLC.

    b. The PLC shall monitor the position of this switch to determine if the equipment is available for PLC control.

    c. If the equipment is not available, the PLC program shall not attempt to implement remote manual or automatic status changes for the equipment.

    d. The PLC program may, however, need to implement special routines if equipment unavailability affects a sequence (as described in the detailed equipment descriptions).

2. Equipment Out Of Service tag (OOS) Command

    a. All controllable equipment is provided with the ability to have an operational tag applied to it.

    b. Upon receiving an Out Of Service tag command from the Operator, the control logic will inhibit all remote controls of the equipment.

G. Power Faults and Maintained Outputs

1. The use of maintained control outputs to equipment should be evaluated to determine whether contacts need to be de-energized upon power loss, so equipment does not automatically energize upon restoration of power, and if any startup sequencing is

needed. Utilize plant power monitoring systems to determine when utility power is lost and restored.

H. Maintained/Momentary Outputs

1. The need for maintained or momentary control outputs shall be determined from the input/output listing and the electrical schematics.

2. In general, equipment with only one control output indicated in the I/O list shall be programmed for a maintained control output.

3. Equipment with two (or more) control outputs shall be programmed for momentary outputs.

4. Provisions shall be made, in either case, to remove the active state (start, open, forward, initiate, etc.) control output when an equipment failure is sensed or when the equipment transitions from available to unavailable (local switch change).

I. Control Mode Transition:

1. Equipment Failures

a. Unless otherwise indicated in the equipment control descriptions, equipment in automatic mode shall be transitioned to manual mode (and stopped) if the equipment fails or becomes unavailable or if the PLC processor resets.

2. Manual/Auto Bumpless Transfer

a. Programming at the PLC shall be such that switching between manual and automatic control modes results in a smooth (bumpless) transition without upsetting the process or inadvertently changing equipment states.

b. Equipment running in local manual mode shall be tracked by the PLC code such that the PLC maintains the running status and speed setpoint when switching the equipment's Hand-Off-Auto (or Local-Remote) switch from Hand to Auto (or Local to Remote).

c. When switching equipment directly into an Automatic PID or sequence type control function, the PLC shall use the tracking values (running status and speed) as initial values.

3. Equipment running or stopped in automatic mode shall remain running or stopped when manual mode is selected.

4. Peer-to-Peer Communications

5. If equipment tracking is via peer-to-peer communications (rather than hardwired interface) and communications link goes down, the PLC shall be programmed to re-verify equipment running and speed status before allowing the switch to remote control mode.

6. This is intended to prevent PLC code from inadvertently shutting down equipment when communications are restored.

J. PID Tuning Parameters:

1. All tuning parameters for each PLC software PID controller are entered at the HMI.

2. Tuning trends are provided to tune and monitor each PID operation.

3. Tuning parameters settings are password protected.

3.05 ALARM CRITERIA

A. Preclusion logic shall be added to all applicable alarms. This logic will prevent secondary alarms that are a direct result of a primary alarm from being annunciated. For example, station power failure should not cause a circuit breaker-tripped alarm to be annunciated.

B. All software adjustable alarm setpoints accessible from the HMI shall have adjustable deadbands unless specifically noted otherwise.

C. Plant personnel must acknowledge all alarms before they can be cleared. No alarm shall clear automatically until it has been acknowledged.

D. Command Fault (Discrepancy) and Failure Alarms:

1. For all controlled devices such as pumps, valves, etc., if the device is commanded to Start or Stop (or Open or Close) by the PLC and the device feedback state does not match the commanded state within a pre-set time, a Command Fault Alarm is generated by the PLC for display and alarming at the HMI (valves shall remain in the last state).

2. If a duty pump, or system, is commanded to start and does not start within the pre-set time, an alarm shall be generated by the PLC for display and alarming at the HMI and the standby pump shall start without operator intervention.

3. If a device feedback state does not match the commanded state at any time, excluding the change of state described above, an uncommented Change of State Alarm is generated by the PLC for display and alarming at the HMI (valves shall remain in the last state).

4. After a Command Fault Alarm occurs, the device cannot be started again until the Operator at the HMI has issued a Reset. All controlled devices with feedback shall generate Failure alarms at the PLC for display and alarming at the associated process graphic displays, even if not shown on the Drawings.

5. All motors shall be programmed so that if a motor stops for any reason, it shall not be re-started automatically once the problem with the motor has been resolved.

a. The start command on the HMI shall not be a maintained contact but a momentary command to the PLC. The run confirms of all motors shall seal in the control output to the motor once the momentary start command drops out.

b. The run confirms shall be on a five second timer delay in that if the run confirm is not present after five seconds, the contact output to the motor from the PLC shall drop out. Thus, the only way a motor can be restarted after five seconds by the SCADA system is if the operator reinitiates the start command for that motor on the HMI or when that motor control at the HMI is placed in complete automatic mode and the SCADA OWS, through logic/interlocks, requests the motor to run.

E. Analog Alarms:

1. All analog alarms shall be generated at the HMI level as follows, with the exceptions of bad value processing and deviation alarms.

a. If the analog point's value exceeds or drops below the alarm limit value and set time delay has been passed, then an alarm shall be generated at the HMI for display and alarming.

b. To eliminate excessive alarm reporting, the analog point shall remain in alarm until the analog point's value returns beyond the limit set by the analog limit deadband.

2. All process analog inputs are displayed, historically collected, and trended. Low-low, low, high, and high-high alarms shall be calculated at the HMI for display and alarming.

   a. Nuisance alarms, such as low turbidity, shall be inhibited.

   b. When a valve is closed or a pump is not running, the analog flow signal associated with that valve or pump shall not generate a low flow alarm, and it shall be forced to a zero value.

3. When an analog signal goes outside the 4-20 mA range due to a failure at the instrument or PLC card, the following SCADA programming shall take place:

   a. Alarm the signal at any local OITs and in the HMI system.

   b. If the analog signal is associated with a control loop or ratio control loop that loop shall go into manual.

   c. If the analog signal is used in a calculation, that calculation shall use the last good analog signal. The computer shall place the control loop in manual if using the calculation.

4. Manual Override:

   a. This capability is implemented within the PLC controller. Since scaling is processed at the controller, the manual override value (operator entered at the HMI) will be in engineering units, not raw counts. When a point is placed in manual override mode, the point's associated data quality is forced to be "Good" as well. Providing this capability in the controller allows the rest of the logic to operate in the manual override mode.

5. Data Quality

   a. A key attribute of every analog input is its associated data quality. This is a simple Boolean value that indicates whether the analog reading can be trusted. The value is reset when the value is good, and it is set when it is bad. There are several checks done on the value before it is declared as "Good."

6. Bad Value Processing:

   a. If the value is not in Manual Override, then the raw value needs to be processed further before it is converted into its engineering units.

   b. Check to ensure the raw reading is within the limits of the instrument. These limits are specified on an individual point basis.

      1). Normally the limits need to check over or under-range (open-loop) values, such as the raw count readings for 3-21mA on a 4-20mA instrument.

      2). Depending upon the process being monitored, it may require the range to be narrowed further. For example, a temperature instrument may have a range

from 0 degrees F to 200 degrees F. If the process being measured is water temperature, then the readings should never get outside 40 degrees F to 100 degrees F.

3). By specifying this set of limits, any reading outside this range would indicate an instrument problem.

4). If the raw reading is outside these limits, the point's data quality would be set to "Bad.".

5). The controller will not maintain the last good reading; values will be presented as processed by the controller.

7. Deviation Alarms:

a. For all variable speed pumps, if the pump is commanded to run at a specific speed and the speed feedback signal deviates from the commanded speed by a pre-set dead band (initially set for 5%) for a pre-set time period (initially set for 30-seconds), a Speed Deviation alarm is generated by the PLC for display and alarming at the HMI.

b. For all modulating valves, if the valve is commanded to a specific position, and the position feedback signal deviates from the requested position by a pre-set dead band (initially set for 5%) for a pre-set time period (initially set for 30-seconds), a Position Deviation alarm is generated by the PLC for display and alarming at the HMI.

c. For all controlled setpoints (i.e., level, flow, etc.), if a process is requested to a specific setpoint, and the control variable feedback signal deviates from the requested setpoint by a pre-set dead band (initially set for 5%) for a pre-set time period (initially set for 30-seconds), a Setpoint Deviation alarm is generated by the PLC for display and alarming at the HMI.

F. Communication Alarms:

1. Provide specific communication status(es) for all Peer-to-Peer data communications. Upon a Peer-to-Peer communication failure, a communication failure alarm shall be generated at each PLC for display and alarming at the HMI. This communication failure alarm shall also be utilized for the associated control strategy

END OF SECTION

40 61 96.01 KENTMERE LIFT STATION

1.00 GENERAL

1.01 SCOPE OF WORK

A. This Specification section provides detailed control loop descriptions for the programming of the Process Control System by the Applications System Programmer (ASP).

2.00 PRODUCTS (NOT USED)

3.00 EXECUTION

3.01 GENERAL

A. Process Overview

1. The Kentmere Lift Station modifications to enhance operation efficiency include modifying the existing pump control levels, 2 new float level switches, 2 new motorized plug valves, and 2 new flow meters.

    a. The existing pump control level changes involve the 4 existing air bubbler system elevation setpoints to be increased for the lift station efficiency enhancement. With both the high water level alarm and low water level alarm bubbler setpoints, this will also include new float level switches. If the air bubbler fails for the high water level alarm setpoint and/or the float level switch sets the alarm, all pumps will turn on to lower the wet well's water elevation. If the air bubbler fails for the low water level alarm setpoint and/or the float level switch sets the alarm, cut all pumps off to allow for the wet well's water elevation to increase.

    b. There will be a 30 second time delay between pump start commands and pump permissives.

    c. Lock out Pump No. 2 if the Back Up Engine (BUE) is running and the 30 second time delay expires.

    d. The motor operated valves will be controlled by SCADA and be monitored in the RTU panel. Flow meters will be monitored in both the SCADA and RTU panel.

    e. When transitioning between force mains, there should always be a valve 100% open. If transitioning from using Motor Operated Valve No. 1 to Motor Operated Valve No. 2, Motor Operated Valve No. 2 must be 100% open before closing Motor Operated Valve No. 1. It is the same process for transitioning from Motor Operated Valve No. 2 to Motor Operated Valve No. 1. If both motor operated valves are closed, the pump will be locked out. If the pump(s) are running and both motor operated valves close, the pumps will cut off.

B. Associated Equipment

Equipment Service Description	Equipment Tag Number

Pump No. 1	PMP-1000-A
Pump No. 2	PMP-1000-B
Back Up Engine (BUE)	BUE-1000
Motor Operated Valve No. 1	MOV-1001
Motor Operated Valve No. 2	MOV-1002

C. Associated Instruments

Instrument Service Description	Instrument Tag Number
Wet Well Level Switch High	LSH-1000
Wet Well Level Switch Low Low	LSLL-1000
Wet Well Bubbler System	AE/LT
Flow Meter No. 1	FE/FIT-1001
Flow Meter No. 2	FE/FIT-1002

D. Associated Control Panels

1. Pump Station Control Panel
    a. PCP-1000
2. Mission Control Panel
    a. MCP-1000
3. Valve Control Panel
    a. VCP-1000

E. Associated Loop Number(s)

1. 1000
2. 1001
3. 1002

F. Hardwired Interlocks

1. Wet Well Low Low Level Cutoff Float Switch shall stop all pumps and prevent them from starting.
2. Wet Well High Level Float Switch shall turn on all pumps.

3.02 CONTROLLER PROGRAMMING

A. Local Manual Control Mode

1. When a pump is set to LOCAL control at the control panel, the operator shall be able to START and STOP the pump at the control panel.

B. Local Automatic Control Mode

1. None.

C. Remote Manual Control Mode

1. When the pumps are set to REMOTE at the control panel, the HMI will be able to start and stop the pumps.

D. Remote Automatic Control Mode

1. None.

E. Software Permissives

1. Wet Well Bubbler Low Low Level Alarm will turn off all pumps.
2. Wet Well Bubbler Low Level Alarm will turn the Lead Pump on.
3. Wet Well Bubbler High Level Alarm will turn the Lag Pump on.

F. Calculated Alarms and Variables

1. None.

G. Power Failure

1. Control shall resume with the control mode established prior to the power failure.

3.03 SYSTEM CONFIGURATION

A. Status

1. The HMI shall indicate the following statuses at a minimum DIs and Ais:
    a. Pump No.1 Running.
    b. Pump No.2 Running.
    c. Back Up Engine Running.
    d. Wet Well Level.
    e. Motor Operated Valve No. 1 Open
    f. Motor Operated Valve No. 1 Closed
    g. Motor Operated Valve No. 2 Open
    h. Motor Operated Valve No. 2 Closed

B. Setpoints

1. Wet Well High Level Alarm
2. Wet Well Lag Pump On
3. Wet Well Lead Pump On

4. Wet Well Low Level Pump Off

C. Trending

1. All PLC inputs, outputs and setpoints shall be recorded for trending at the HMI.

D. Alarms

1. Pump No.1 Fault.
2. Pump No.2 Fault.
3. BUE Alarm
4. Valve Control Panel Power Loss Alarm
5. Valve Control Panel Fault

E. HMI Requirements

1. Equipment and instrumentation shall be depicted on the HMI screen. Displays shall be per the Owners' current HMI Standards and Conventions.

END OF SECTION

40 67 00 CONTROL SYSTEM EQUIPMENT PANELS AND RACKS

1.00 GENERAL

1.01 SUMMARY

A. Section Includes: General requirements for PLC Control Panels and associated hardware.

B. Related Sections:

1. Section 40 61 13, “Process Control System General Provisions”
2. Section 40 61 21, “Process Control System Testing”

1.02 SCOPE

A. Provide a valve control panel containing surge protection and all appurtenances to provide a complete working system.

1.03 REFERENCES

A. In addition to the requirements of Section 40 61 13, “Process Control System General Provisions”, conform all materials and workmanship to the latest published applicable provisions of the following codes and standards:

1. National Fire Protection Association
    a. NFPA70 – National Electrical Code.
2. National Electrical Manufacturers Association
    a. NEMA ICS 1 - Industrial Control and Systems: General Requirements.
    b. NEMA ICS 4 - Industrial Control and Systems: Terminal Blocks.
    c. NEMA ICS 5 - Industrial Control and Systems: Control Circuit and Pilot Devices.
    d. NEMA ICS 6 - Industrial Control and Systems: Enclosures.
    e. NEMA 250 - Enclosures for Electrical Equipment (1000 V maximum).
3. American National Standards Institute
    a. ANSI-C-37.13 - Low Voltage AC Power Circuit Breaker (600 V Insulation Class).
4. International Society of Automation
    a. ISA–RP60.6 – Nameplates, Labels, and Tags for Control Centers.
5. UL – Underwriters Laboratories
    a. UL 508A – Standard for the Construction of Industrial Control Panels.
    b. UL 1077 – Supplementary Protectors.

1.04 DEFINITIONS

A. Refer to Section 40 61 13, “Process Control System General Provisions”.

1.05 SUBMITTALS

A. General: Submit following Section 01 33 00, “Document Management”. Submit in sufficient detail to show full compliance with Contract Documents.

B. Product Data:

1. For each component, include manufacturers descriptive literature, product specifications, published details, technical bulletins, performance, and capacity rating curves, charts, and schedules, catalog datasheets, and other submittal materials as required to verify that the proposed products conform to the quality and function ability of the specified products.

C. Shop Drawings:

1. Load Calculations:

a. Provide electrical load calculations for power supplies, transformers, and UPSs to determine that the appropriate size and capacity have been selected.

b. Provide heating and cooling requirement calculations.

D. Arrangement Drawings:

a. Provide Arrangement Drawing for external front panel, internal side, and rear mounting sub-panels.

b. Provide Bill of Materials, on Arrangement Drawing, identifying equipment shown. Reference equipment by a numerical item number. Include the following information in the Material schedule:

1). Item

2). Identity

3). Quantity

4). Description

5). Manufacturer

6). Catalog Number

7). Remarks

c. Provide nameplate schedule, on the Arrangement Drawings, and include the following information:

1). Item

2). Quantity

3). Line 1 Text

4). Line 2 Text

5). Line 3 Text

6). Text Height

7). Nameplate Size

d. Provide Legend schedule, on the Arrangement Drawings, and include the following information:

1). Item

2). Quantity

3). Line Text

2. Ladder Diagrams:

a. Draw digital control with circuitry arranged in functional sequence on ladder type diagrams. Assign each horizontal line or “rung” on the ladder diagram a sequential number to the left the ladder. Use the rung number to develop the wire numbers and relay numbers.

b. Draw relay coils on the right side of the ladder. Show the line numbers on which the relay contacts appear on the right of each coil. Designate a normally closed contact by drawing a diagonal line through the contact. Designate timed contacts with "TR" under the line number.

c. Show field and control panel terminal blocks on the drawing with the terminal numbers.

d. Terminal block groups will be labeled in the control panel.

e. Conform symbols to NEMA standard and indicate on a symbols sheet.

f. Show field wiring as a dashed line with cable and or wire number identified.

g. Draw PLC input modules on the right side of the ladder and draw controller output modules on the left side of the ladder.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications

1. Manufacturer engaged in the assembly of control panels for not less than three years and who has experience with the assembly of specified PLC manufacturers.

2. Assemble control panels within a 150-mile radius of the Owner’s facilities.

B. Modifications to Panel Layout

1. Follow the arrangements of components shown on the Drawings. Make adjustments to allow each component to be mounted as recommended by the manufacturer, to facilitate easy installation, removal, and in-place maintenance of each component, and to enable normal operation of the component. Allow component arrangements for routing of wiring without kinking or bending around sharp edges, and for free flow of air around and through equipment that requires ventilation or cooling.

2. Test equipment and materials using a testing laboratory that meets, or exceeds, nationally recognized standards, or have been found suitable for use in the specific manner as intended by the Engineer.

3. Include equipment and materials utilized within published listings prepared by testing laboratories, inspection agencies, or other organizations concerned with product evaluations.

1.07 DELIVERY STORAGE AND HANDLING

A. Store all control panels and accessories specified in this Section, which are delivered to the project site prior to the time the Contractor is ready to install them. Verify from the Contractor the maximum and minimum temperature and maximum relative humidity for storing the equipment and conform to the Contractor's requirements. The minimum storage requirements will not be less than 50 degrees F. Protect the equipment from humid conditions which might cause corrosion of the electrical and electronic parts of the equipment. Failure to store equipment in the specified or approved manner shall be sufficient reason for not accepting the equipment, regardless of the outside appearance or warranty of the manufacturer. Protect all electronic equipment from a dusty environment by sealing the equipment in plastic.

1.08 SEQUENCING AND SCHEDULING

A. Coordinate scheduling with the Project Manager.

1.09 WARRANTY AND MAINTENANCE

A. In accordance with the following sections:

1. Section 01 33 04, “Operation and Maintenance Data”
2. Section 01 78 36, “Warranties and Service Agreements”

2.00 PRODUCTS

2.01 CONTROL PANEL ENCLOSURES

A. General

1. All enclosures shall fit within the allocated space shown on the Drawings. The Contractor shall examine plans and/or field inspect new and existing structures as required to determine installation requirements and shall coordinate the installation of all enclosures with the Owner and all affected contractors. The Contractor shall be responsible for all costs associated with installation of enclosures, including repair of damage to structures (Incidental, accidental, or unavoidable).
2. A minimum estimated size is shown on the Drawings. The Contractor shall furnish enclosures of the size and quantity required to house the manufacturers' equipment supplied and all other electrical components installed in the enclosure. In addition, provide useful space and power supply capacity as spare for future expandability to a minimum of one (1) item per item type installed or twenty percent (20%) of quantity of each type of item installed, whichever yields the greater spare space.
3. Enclosures (cabinets, panels, boxes, etc.) shall be formed or welded construction, reinforced with Unistrut, Powerstrut or equal to facilitate mounting of internal components or equipment. Sufficient access plates and doors shall be provided to facilitate maintenance and testing of the supplier's equipment. Doors shall be removable. Enclosures with any dimension thirty-six (36) inches or greater shall be provided with removable lifting lugs designed to facilitate safe moving and lifting of the panel during installation. No screws or bolts shall protrude through from the interior enclosure.

4. All steel enclosures shall be free from dirt, grease, burrs and shall be treated with a phosphatizing metal conditioner (phosphate conversion coating) before painting. All surfaces shall be filled, sanded, and finish coated by spraying a 1-2 mil epoxy prime coat and smooth, level, high grade textured finish between flat and semigloss shine. The colors shall be selected by the Owner from a minimum of six (6) color samples provided. All stainless-steel enclosures shall be polished to a No. 4 finish.
5. Enclosures shall be prefabricated cabinets and panels equal to Hoffman or Rittal. The Contractor may optionally provide enclosures custom fabricated by a reputable panel fabrication shop acceptable to the Owner and the Engineer.
6. Each panel shall incorporate a removable back panel on which control components shall be mounted.
7. All enclosures with any dimensions of (24) inches or larger shall be provided with drawing pockets for as-built panel drawings. One (1) laminated copy of the appropriate panel as-built drawings shall be furnished and left in the pocket of each panel.
8. All enclosures with a door height of (48) inches or larger shall be provided with a 316 SS door stop kit as manufactured by Fabtech or equivalent.
9. All enclosures shall be protected from internal corrosion-inhibiting vapor capsules as manufactured by Northern Instruments Model Zerust VC, Hoffman Engineering, Model A-HCL, or equal.
10. All metallic enclosures with door-mounted equipment shall have the door grounded by means of a flexible ground strap.
11. The equipment shall be mounted such that service can occur without removal of other equipment. Panel mounted equipment shall be flush or semi flush mounted with flat black escutcheons. All equipment shall be accessible such that adjustments can be made while the equipment is in service and operating.
12. Enclosures shall provide mounting for UPS, power supplies, control equipment, input /output subsystems, panel mounted equipment and appurtenances. Ample space shall be provided between equipment to facilitate servicing and cooling. Enclosures shall be sized to adequately dissipate heat generated by equipment mounted inside the panel.
13. Enclosures shall be provided with a minimum of one (1) unoccupied 120-volt duplex convenience GFCI receptacle, for service equipment and programming. Service lights, LED type, shall be provided for sufficient light coverage inside the panel. Service lights shall be provided with On/Off switch incorporated into light and/or a door switch to activate light when panel door is opened. Main breaker and branch breaker sizes shall be coordinated such that an overload in a branch circuit will trip only the branch breaker but not the main breaker. Circuit breakers shall be provided for the following internal branch circuits distributed within the panel:
    a. Receptacles and power strips.
    b. Panel Lighting
    c. UPS
    d. PLC power supply
    e. OIT power supply

f. Power Supplies (24VDC)

14. Loads not requiring surge protection devices (i.e., receptacles, lighting, HVAC , branch circuits to remote equipment, etc.) shall be connected ahead of the enclosure surge protective device.
15. Locate equipment , devices, hardware, power supplies, instrumentation and controls, electrical equipment and wiring to be installed inside the enclosures and/or as facial features on the enclosures so that connections can be easily made and so that there is ample room for servicing each item. Every component in and on the enclosures shall be able to be removed individually without affecting the other components and without the need to move other components. Support and restrain all internally, as well as panel-mounted components to prevent any movement.
16. All cabinets and/or enclosures shall be NEMA rated for the environment in which it is to be installed and as noted in the Drawings.
17. Materials and equipment used shall be U.L. approved wherever such approved equipment and materials are available.
18. Panel enclosures (PLC panels) shall be provided with a security door switch mounted at the top of the enclosure, as shown on the drawings. The door switch shall be general duty, Reed switch type operation with a straight plunger. Maximum voltage rating shall be 240 VAC and 125/VDC with 1pole, double throw, one position momentary signal switch unit. Door switch shall be Square D, 9007MS01S0300 or approved equal.
19. Control panels shall be built in accordance with UL508A Industrial Control Panels and NEC Article 409 Industrial Control Panels. Control panels for areas classified as Hazardous shall be built in accordance with UL698 Industrial Control Equipment for Use in Hazardous Locations. Control panels shall be UL508A and/or UL698 labeled and marked as defined in NEC 409.110 with the following:
    a. Manufacturer's name and contact information (i.e., address, phone, website, email, etc.)
    b. Supply voltage, phase, frequency, and full-load current.
    c. Short-circuit current rating or the industrial panel based on one of the following:
        1). Short-circuit current rating of a listed and labeled assembly.
        2). Short-circuit current rating established utilizing an approved method.
        3). Electrical wiring diagram numbers or the index sheet to the electrical wiring diagrams.
        4). The enclosure type number (i.e., NEMA 1A, 3R, 12, 4X, 9, 9, etc.).
        5). If the industrial control panel is intended as service equipment, it shall be marked to identify it as being suitable for use as service equipment.
        6). Panel labels shall be TMP-US-MAG1 (0803341) or approved equal by Owner.
20. All work shall be performed in a professional manner and in consideration of allowing ease of future troubleshooting and maintenance. All equipment should be mounted so as to minimize crowding within the panel. All devices shall be mounted and wired in a

neat and workmanlike manner. Each component shall be prominently identified with the use of permanent engraved legend plates.

21. Grounding: All suppressors shall be grounded per the suppressor manufacturer's recommendations. Furnish control panels with an integral copper grounding bus for connection of suppressors and other required instrumentation.
22. Provide structural reinforcements within enclosures to ensure a level surface, to limit vibration and to provide rigidity during shipment, installation, and operation without distortion or damage to the panel or to any instrument.
23. Cut, punch, or drill cutouts for face-of-panel mounted instruments and smoothly finish with rounded edges.
24. Install steel stiffeners on the back of the panel face to prevent deflection due to instruments, operation of equipment, or opening/closing of doors. Use 1 inch by 1/4-inch by 1/2-inch minimum stiffeners and tack weld to the panel. Where panel mounted instruments require rear mounting support, provide support brackets per the manufacturer’s recommendations.
25. Provide internal condensation and freezing protection with thermostat control on outdoor enclosures.
26. Provide outdoor enclosures or enclosures in unheated areas with thermostatically controlled heaters to maintain internal temperature above 40 degrees F.
27. Provide calculations for sizing the cooling fans, air conditioners, and heaters.

B. Outdoor Enclosures

1. All outdoor enclosures shall be rated NEMA 4X, 3-Point latch handle, constructed of 316 stainless steel with a white powder epoxy coating finish unless specified otherwise. Outdoor enclosures shall have a hinged and gasketed door. Gaskets shall be polyurethane.
2. Outdoor panels shall be fitted with pad-lockable latch kits.
3. Outdoor enclosures with internal digital electronics, exterior indicators, or exterior indicator lights shall have external sun shields or sunshades, constructed of the same materials as the associated enclosure, unless otherwise specified.
4. Outdoor enclosures shall be designed for ambient conditions of -15 to 50°C and twenty to ninety-five percent (20% - 95%) relative humidity, unless otherwise specified. Outdoor enclosures shall be provided with thermostatically controlled space heaters to provide condensation protection.
5. Outdoor enclosures with in-door mounted OIT shall utilize Smith and Loveless Shade Aide for protection of OIT screen.

C. Terminals

1. Terminal blocks shall be assembled on non-current carrying galvanized steel DIN mounting rails, securely bolted to the cabinet sub-panel. Terminals shall be of the screw down pressure plate type equal to that manufactured by Allen Bradley, Phoenix Contact, Wieland, Square D, or equal.

2. Fused terminal blocks or miniature thermal circuit breaker terminal blocks shall be supplied for protection and isolation of enclosed equipment, or as specified in the Contract documents. Blown fuse indicators shall be provided and/or tripped breaker status shall be clearly visible. Fused or miniature thermal circuit breaker terminal blocks shall be provided for, but not limited to each of the following:

    a. Each PLC module requiring external power

    b. Each piece of equipment provided with a power supply (integral, internal or external) with the exception of devices with internal fusing plugged into a receptacle.

3. Terminals shall be marked with a black waterproof, permanent, continuous marking strip.

D. Wiring

1. Wireway, as required. All conductors run open shall be bundled and bound with nylon cable ties, at regular intervals, with intervals not to exceed 12 inches. Adequately support and restrain all wiring runs to prevent sagging or other movement. Use of sticky backed zip-tie mounting squares is not permitted. Weld-on studs or similar non-penetrating mechanical fastener methods should be used for wire loom securing and management. Care shall be taken to separate communication, network, electronic signal, AC discrete signal, DC discrete signal and power wiring. Wiring to equipment mounted on doors or where movement of the equipment will take place, shall be installed in nylon spiral wrapping sheaths.

2. Wires shall be color coded as follows:

    a. Equipment Ground – GREEN

    b. 120 VAC Power Distribution – BLACK

    c. 120 VAC Power Neutral – WHITE

    d. 120 VAC Control (Internally Powered) – RED

    e. 120 VAC Control (Externally Powered) – YELLOW

    f. 24 VAC Control – ORANGE

    g. DC Power (+) – BLUE

    h. DC Power (-) – BLUE/WHITE

    i. DC Control – BLUE

    j. Analog Signal (+) – BLACK

    k. Analog Signal (-) – WHITE

3. All wiring shall comply with accepted standard instrumentation and electrical practices. Field wiring for power, control and signal wires shall comply with Division 16 of the specifications. For each pair of parallel terminal blocks, the field wiring shall be between the blocks.

4. Internal panel wiring shall be as follows:

a. AC power wiring: 14 AWG minimum, stranded copper conductors, THHN/THHW wire rated for 600 volts and 90 °C. For wiring carrying more than 15 amps, use sizes required by NEC.

b. AC control and dc power and control wiring: 16 AWG minimum, stranded copper conductors, THHN/THHW wire rated for 600 volts and 90 °C.

c. Instrument signal wiring: 18 AWG stranded conductors, tinned copper, twisted pair or triad, overall, one hundred percent (100%) aluminum foil shield with 20 AWG stranded drain wire, plenum rated 300V 60°C FEP insulated wire with FEP jacket, equal to Belden 3090A.

d. All stranded wire shall have a minimum of sixteen (16) strands, except for drain wires.

e. Install a tin-plated copper ferrule on all stranded wire terminated in a terminal block using a pin type ferrule with a gray insulation. Phoenix Contact type P/N 3200535 or equivalent.

E. Identification

1. Provide a laminated black nameplate with beveled edges and ½ inch white letters to identify each console, panel or cabinet on the front of the enclosure.

2. Provide laminated, beveled edge, plastic legend plates and nameplates, with 1/4-inch letters, for each front panel mounted device as shown on the Drawings. Legend plates and nameplates shall be the size as shown on the Drawings. Color shall be black lettering on white background except caution/warning nameplates which shall be white lettering on a red background. Attach front panel nameplates with both a permanent adhesive and stainless-steel machine screws into tapped holes.

3. Tag all interior instruments and other components with engraved, laminated plastic nameplates. Legends shall be consistent with wiring and layout drawings. Nameplates shall be attached with screws to the panel, near the device or on the device itself or as otherwise approved by the Engineer.

4. Number and label each wire in the systems. Every unique wiring node shall have its own individual unique number. Numbers shall be shown on all submitted drawings.

F. Climate Control:

1. Ventilation:

a. Install ventilation kit on enclosure exterior.

b. Install two vents per manufacturer’s instructions to maintain NEMA 4X rating.

c. Manufacturers:

1). Allied Moulded - AMVENT4XLG.

2. Heaters for Condensation Control and Freeze Protection:

a. Provide thermostatically controlled, fan driven heaters for all outdoor enclosures for condensation control unless otherwise specified.

b. Built-in thermostats that sense air temperature in the panel and is adjustable from 0 to 100 degrees F.

c. Aluminum alloy outer casing.

d. Mount heaters near the bottom center of the enclosure. Do not mount any components closer than 6 inches to the top heater and within 1 inch of the sides and bottom of the heater.

e. Meet the following requirements:

1). Power: 115 Vac, 60 Hz.

2). Rating: As determined by calculations.

f. Manufacturers:

1). Hoffman DAH Series.

2). Saginaw Control and Engineering.

3). Or approved equal.

2.02 POWER DISTRIBUTION AND POWER DEVICES

A. General Requirements

1. Control panel shall be supplied with a single 120VAC, 1-phase, 2 wire plus ground power source. All other voltages required to operate the system served by the control panel shall be derived from within the panel and DC power supplies.

2. Provide separate branch circuit protection for each valve load, panel heaters, lights, receptacles, control circuit, etc.

a. 30A Main Breaker for panel

b. 20A Breaker for MOV-1001

c. 20A Breaker for MOV-1002

d. 20A Breaker for instrumentation and controls

e. 20A Breaker for spare

B. Main Overcurrent Protective Device

1. Where 120 VAC circuits enter the control panel, provide an overcurrent protective device. Device shall be either a molded case circuit breaker or fuse type disconnect assembly where permitted, heavy duty, backplane mounted. Provide shaft extension for external handle mounted to front panel door to operate device without opening door. External handle shall indicate open and closed positions, must be padlockable, chrome plated, and maintain NEMA rating of enclosure. Nonmetallic type handles will not be permitted.

a. Where door-in-door is specified, disconnect assembly handle shall be mounted to inner door.

2. Device type selection criteria: Provide a molded case circuit breaker for the main overcurrent protective device unless current limiting fuses are required to meet the control panel SCCR specified.

2.03 ENCLOSURE ACCESSORIES

A. Panel Light

1. Light to emit a minimum of 400 lumens.
2. Light should turn on when the panel door is opened.
3. Operating voltage 120 Vac, 50/60 Hz or 24VDC
4. Operating temperature -4 to 122 degrees F.
5. Lamp life 50,000 hours in warm white color temperature.
6. Integral LED drivers.
7. Include integral door switch.
8. Manufacturers:
    a. Phoenix Contact PLD Series
    b. Hoffman Panelite Series.
    c. Or approved equal.

B. Door switches (Intrusion)

1. Switch permits the PLC input for an intrusion alarm.
2. Manufacturers:
    a. Schneider Electric 9007MS01S0300
    b. Or approved equal.

2.04 CONTROL PANEL BACKPLATES

A. General

1. Provide backplates according to size listed on drawings.
2. Install all panel components on the panel backplate.

B. Construction:

1. 12-gauge Carbon steel powder coated white.
2. Back panels shall be secured to the enclosures with collar studs.
3. All components shall be of the highest industrial quality and securely mounted to the removable back panels with screw and lock washers.
4. Back panels shall be tapped to accept all mounting screws.
5. Self-tapping screws shall not be used to mount any component.

C. Spares:

1. None.

2.05 NAMEPLATES

A. General:

1. Install new nameplates on the front door of all new and existing PLC control panels.
2. Conform nameplates to ISA Recommended Practice publication ISA-RP60.6.

B. Construction:

1. Use nameplates to display basic information and functions.
2. Letters shall be Helvetica 1 uppercase. Minimum height shall be 1/8-inch with a 3/64-inch space between lines.
3. Provide nameplates made of laminated engraving stock having a white core with a black surface.
4. Engrave characters using an industry-standard engraving machine.
5. Attach nameplates to the enclosure using stainless steel screws.
6. For enclosure identification nameplates, use larger-sized letters, 3/16-inch minimum.
7. Conform abbreviations to appendix B of ISA Recommended Practice publication ISA-RP60.6.
8. Conform margins to the following:
    a. With holes
        1). Top/bottom: 1/16-inch minimum
        2). Sides left/right: 5/16-inch minimum
    b. Without holes
        1). Top/bottom: 1/16-inch minimum
        2). Sides left/right: 1/8-inch minimum

C. Spares:

1. None.

2.06 ADHESIVE LABELS

A. General:

1. Provide labels that conform to ISA Recommended Practice publication ISA-RP60.6.

B. Construction:

1. Use adhesive labels inside the panel to identify equipment.
2. Provide mechanically printed smudge proof labels with adhesive backing.

C. Spares:

1. None.

2.07 LEGEND PLATES

A. General:

1. Provide legend plates that conform to ISA Recommended Practice publication ISA-RP60.6.

B. Construction:

1. Display basic functions of push buttons, selector switches, and pilot lights using legend plates.
2. Letters shall be Helvetica 1 uppercase. Minimum height shall be 1/8-inch with a 3/64-inch space between lines.
3. Provide legend plates made of laminated engraving stock having a white core with a black surface.
4. Engrave characters using an industry standard engraving machine.
5. Hold legend plates to enclosure with ring nuts used to hold the operator in place.
6. Make all legend plates for a particular panel the same size and shape.

C. Spares:

1. None.

2.08 WIRE LABELS

A. General:

1. Provide wire labels and tags that conform to ISA Recommended Practice publication ISA-RP60.6.

B. Construction:

1. Identify each wire using shrink-type wire labels on each side.
2. Use a unique number, incorporate equipment tag number, correlate with schematic drawings to allow for easy cross referencing and match wire labels on each end.
3. All wires shall be labeled at each termination and junction of the wire and at 30-inch intervals along the wire.
4. All multiconductor cables shall be labeled at each end and at 30-inch intervals with CBL-XXX and also label each conductor at both ends.
5. Labeling shall use Cable marker US-WMT (0828768) and Conductor marker carrier PATG 1/18 (0820510) manufactured by Phoenix Contact or approved equal by Owner. All labels shall be machine-printed with wire and /or cable numbers.

C. Spares:

1. None.

D. Manufacturers:

1. Brady PermaSleeve Heat-Shrink Polyolefin.
2. Phoenix Contact.
3. Or approved equal.

2.09 PANEL WIRING AND TERMINATION

A. General:

1. Wire and terminate equipment in accordance with the latest revisions of UL Standard 508A and the National Electrical Code, as well as state and local electrical codes.

B. Construction:

1. Use flexible stranded (7 strand) tinned copper wiring. Run wires in continuous lengths from terminal to terminal. Do not splice wires. Provide wire service loops to permit device removal.

2. Use type MTW wire (inside wiring) and XHHW wire (outside wiring), with insulation rated at 600 V. Use 14 AWG or larger for power wiring. Use 16 AWG or larger for ac control signal wiring.

3. For analog signal wiring, use uniformly twisted shielded pairs not smaller than 18 AWG with a minimum of six twists per foot. Separate analog signal wiring at least six inches from power wiring. Provide continuous foil or metalized plastic shields with 100 percent coverage. Include a drain wire in continuous contact with the shield.

4. For 12/24 Vdc control circuits, including wiring for dc input and output discrete signals, use uniformly twisted pairs no smaller than 18 AWG with a minimum of six twists per foot.

5. Use Phoenix Contact tin plated wire ferrules at wire ends for all wires 12 AWG or smaller. Use wire ferrules with a sleeve length of 10 mm and strip wires no longer than 13 mm. Use gray ferrules for all wires or match the ferrule and wire colors for all wires.

6. Segregate analog signal wiring, 24 Vdc control wiring, ac control wiring and power wiring accordingly. Group functionally and arrange neatly to facilitate tracing of circuits. Separate analog signal wiring at least one inch from 24 Vdc control wiring and six inches from ac control wiring and power wiring.

7. Use plastic spiral wiring wraps to bundle wires, outside of wiring ducts. Securely fasten the bundles to the steel structure at intervals not exceeding 12 inches. Use Panduit, Phoenix Contact, or approved equal. Provide a minimum of 20 percent cross-sectional area as spare space.

8. Do not intermix signals within the same bundle or duct.

9. Use twisted unshielded wire for other dc signals and segregate from wire conducting ac signals.

10. Identify wires at both ends with white sleeve-type labels. Correspond the wire labels to the wire designation shown on the panel record drawings. Identify I/O card connections with the Rack-Slot-Point designations identified in the Drawings and I/O Lists.

11. In panels where foreign voltages exist, furnish a highly visible, white with red letters, warning label outside the panel with the following words: “WARNING: FOREIGN VOLTAGES EXIST IN THIS PANEL. THEY ARE IDENTIFIED BY YELLOW WIRE COLOR.”

C. Spares:

1. None.

2.10 TERMINAL BLOCKS

A. General

1. Provide captive screw with pressure plate, DIN rail mounted, 600 V rated terminal blocks, unless otherwise shown or specified.

B. Construction:

1. Assemble terminal blocks on a DIN rail mounting channel and bolt the channel to the inside of the panel. Space terminal block strips no closer than 4 inches center to center for subpanels not using wire duct and 6 inches center to center for subpanels using wire duct.
2. Provide screw type 300 and 600 V rated single level terminals with pressure plate to accept wire size 12 AWG and smaller.
3. Power terminal blocks shall be single tier with a minimum rating of 600 volts, 30 amps.
4. Signal terminal blocks shall be single tier with a minimum rating of 600 volts, 20 amps.
5. Reserve one side of each terminal strip for field incoming conductors. Do not make common connections and jumpers required for internal wiring on the field side of the terminal. Terminate no more than two wires at any one terminal.
6. Wire all spare discrete and analog inputs and outputs from I/O cards to field wiring terminals.

C. Spares:

1. Provide spare terminal blocks for unused spare PLC I/O. Provide space at the end of terminal blocks to allow for future expansion of the PLC I/O.

D. Manufacturers:

1. Phoenix Contact
    a. 600 V rated single level terminals UK 3 N terminals.
    b. Single level grounded QTCU 1 terminals.
    c. Identify terminal blocks with the “Panel-Block” designations used on the Drawings. Provide Phoenix Contact type UBE and UBE/D terminal block numbering.
    d. Provide terminal numbers for each terminal. Provide type ZB6 terminal strip numbering with horizontal numbering for horizontally groups of terminals and vertical numbering for vertical groups of terminals.
2. Allen Bradley.
    a. 600 V rated single level terminals.
    b. Single level grounded Bulletin 1492 terminals.
    c. Identify terminal blocks with the “Panel-Block” designations used on the Drawings. Provide terminal block numbering.
    d. Provide terminal numbers for each terminal. Provide strip numbering with horizontal numbering for horizontally groups of terminals and vertical numbering for vertical groups of terminals.
    e. Or approved equal.

2.11 FUSED TERMINAL BLOCKS

A. General
   1. Provide captive screw with pressure plate and DIN rail mounted fused terminal blocks.
   2. Glass Fuse.

B. Construction
   1. Allen Bradley
      a. 1492-WFB4
         1). Voltage Rating: 300 V (RU and CSA), 500V (IEC Certification)
         2). Maximum Current: 15 A
         3). Fuse Size: 5 by 20 mm
         4). Operating Temperature: -40 to 221 degrees F
      b. 1492-WFB424
         1). Voltage Rating: 10 to 57 V
         2). Maximum Current: 15 A
         3). Fuse Size: 5mm by 20 mm
         4). Operating Temperature: -40 to 195 degrees F
      c. 1492-WFB4250
         1). Voltage Rating: 85 to 264 V
         2). Maximum Current: 15 A
         3). Fuse Size: 5 by 20 mm
         4). Operating Temperature: -40 to 195 degrees F
      d. Phoenix Contact UK TB 4-HESI
         1). Voltage Rating: 500 V
         2). Maximum Current: 6.3 A
         3). Fuse Size: 5mm by 20 mm
         4). Operating Temperature: -76 to 221 degrees F

C. Spares
   1. Provide five spare fuses of each type and size.

D. Manufacturers
   1. Allen Bradley 1492-WFB4, 1492-WFB424, 1492-WFB4250.
   2. Phoenix Contact TB 4-HESI.
   3. Or approved equal.

2.12 CIRCUIT BREAKERS (TELEMETRY SYSTEMS)

A. General:

1. Provide thermal-magnetic quick-make/quick-break DIN rail mount
2. Provide circuit breakers that conform to UL 1077.
3. Provide with networking, cellular and radio equipment.

B. Construction:

1. Single assembly.

C. Spares:

1. No spares are required.

D. Manufacturers:

1. Phoenix Contact – Models 0916603, 0916605, or 0916610.
2. Or approved equal.

2.13 CIRCUIT BREAKERS (NON - TELEMETRY SYSTEMS)

A. General:

1. Provide thermal-magnetic quick-make/quick-break
2. Provide circuit breakers that conform to UL 1077.

B. Construction:

1. Single assembly.

C. Spares:

1. No spares are required.

D. Manufacturers:

1. Siemens 5SJ4 Series
2. Square-D Multi 9 Series or QOU Unit Mount
3. Or approved equal

2.14 RELAYS

A. General:

1. Provide general purpose screw terminal type relay sockets for light duty, electronic duty or solid state. Utilize captive screw terminals and washers which accept one or two 14 AWG wires.
2. Install relay sockets adjacent to one another

B. Construction:

1. 24 VDC double pole double throw (DPDT) plug-in type relay
2. Finger grips for easy relay removal from socket
3. Removeable lock down door for testing and maintenance

4. LED status indicator
5. Mechanical relay status indicator
6. Spring return test Button
7. Diode protection module

C. Spares
1. Provide two spares of each type.

D. Manufacturers:
1. General-Purpose
a. Square-D Zelio RUM series
b. Or approved equal.

2.15 INDICATION AND CONTROL STATION DEVICES

A. Pushbuttons, selector switches and LED indication (pilot) lights shall be 30.5 mm type with a chromium plated metal or bezel; dielectric strength of 2200V, 200,000 mechanical cycles, shall be oil-tight, dust-tight and water-tight, and shall match the NEMA rating of the associated enclosure. All push buttons and selector switches will be able to accept additional contact decks to expand number of poles to those indicated in the Drawings.

B. Pushbuttons, selector switches and indications lights shall be manufactured by Allen-Bradley 800T/H, Square D 9001K or Eaton 10250T.

C. Pushbuttons: Spring return type with head flush to bezel, with finger safe guard, with silver alloy contacts rated for 10A continuous current.

D. Mushroom Head Pushbuttons: Plastic40 or 45mm red color head, 2-position maintained push-pull type,, with silver alloy contacts rated for 10A continuous current.

E. Selector Switches: “Stay Put” short knob type, silver alloy contacts rated for 10A continuous current.

2.16 SURGE PROTECTION DEVICE (TVSS)

A. Low Voltage (120V)
1. General:
a. Provide voltage surge suppressors on equipment panels containing solid state electronic equipment to protect the equipment from damage due to electrical transients induced in the interconnecting lines from lightning discharges or nearby electrical devices.
b. Provide power line surge suppressors which include a surge arrester, RFI filter, voltage clamp, and terminals for incoming and load wires and which will not trip power feed circuit breakers. Use device with separate terminations for ground, common, and hot conductors. Shunt excess surge energy to electrical ground.
c. Install plug traps in field devices.
d. Antennas and mission board do not require surge suppression.

e. Disconnect and lockout capabilities required.

2. Construction:

a. Provide an industrial quality unit rated for continuous duty which meets the following requirements:

1). Power: 115 Vac, 15 A, 60 Hz.

2). Response Time: Less than 5 nanoseconds.

3). Recovery: Automatic.

4). Transient Reduction (Normal and common mode): 30 dB attenuation to IEE 587, category B, 6 kV impulse.

5). Regulation: Less than ±1 percent over all load ranges.

6). Operating Temperature: -40 to 176 degrees F.

3. Spares:

a. Provide two spares.

4. Manufacturers:

a. Phoenix Contact PLT-SEC-T3-120 Series model 2907918

b. Or approved equal.

B. DC Voltage (24 V)

1. General

a. Provide voltage surge protection for the main feed out of the DC power supplies.

2. Construction:

a. Provide an industrial quality unit rated for continuous duty which meets the following requirements.

1). Supply Power: None – passive device

2). Protection Power: 24 VDC nominal with an amperage rated based on the DC power supply.

3). Response Time: Less than 25 nanoseconds

4). Indication: Optical and remote indicator contact

3. Manufacturers:

a. Phoenix Contact PLT-SEC-T3-24 Series model 2905223

b. Or approved equal

C. Analog Signal (4-20mA)

1. General

a. Provide a HART compatible analog signal surge suppression for all analog signals entering the PLC control cabinet.

2. Construction:

a. Provide an industrial quality unit rated for continuous duty which meets the following requirements.

1). Supply Power: None – passive device

2). Protection Power: 28VDC continuous at 450 mA

3). Response Time: Less than 100 nanoseconds

3. Manufacturers

a. Phoenix Contact model 2838228 with integral base 2839208

2.17 DC POWER SUPPLY

A. General:

1. Furnish and install DIN rail mounted; 24 V dc power supplies that can be connected in parallel for redundant operation. Power supplies to be equipped with pluggable screw type terminal blocks for ac input and dc output and are to include an LED status indicator for dc output.

2. Provide two DC power supplies and connect them in parallel for redundant operation.

3. Exceed power supply wattage by 25 percent of the calculated load.

4. Trips standard circuit breakers selectively, loads that are connect in parallel continue working.

5. Preventive function monitoring indicates critical operating states before errors occur.

6. Signaling thresholds and characteristic curves that can be adjusted via NFC maximize system availability.

7. Integrated gas-filled surge arrester allows for high degree of immunity.

B. Construction:

1. Power: 24 Vdc, 5 A, 60 Hz.

2. Response Time: 300 ms (From sleep mode).

3. Transient surge protection.

4. Operating Temperature: -13 to 158 degrees F.

C. Spares

1. Provide two spares of each type.

D. Manufacturers:

1. Phoenix Contact

a. Series: Quint 4

b. Model: 2904602

2. Or approved equal

2.18 UNITERUPTIBLE POWER SUPPLY

A. Furnish and install a DIN rail mounted Uninterruptible Power Supply compatible with and sized for the DC power supply.

B. Construction:

1. Input Voltage: 24 VDC
2. Max Input Voltage: 35VDC
3. Output Voltage: 24 VDC
4. Output Current: 20A minimum
5. Charging Current: 5A
6. Reverse polarity protected
7. Efficiency: 97%
8. Outputs: One (1)
9. Battery Support: Up to five (5) in parallel
10. Communications:
    a. Protocols: Ethernet/IP and MODBUS TCP
    b. Ports: Two (2) Ethernet Ports
    c. Speed: 10/100 Mbps auto negotiation

C. Manufacturers:

1. Phoenix Contact Model 2907074
2. Or approved equal

2.19 UNINTERRUPTIBLE POWER SUPPLY BATTERIES

A. General:

1. Capacity: 12 Amp-Hour per battery.
2. Dimensions: Width 202 mm, Height 202 mm, Depth 110mm
3. Operating Temperature: 32 to 104 degrees F.
4. Mounting: DIN Rail
5. Output Voltage: 24VDC
6. Output current: 50A max
7. End of charge voltage: 27.6 VDC
8. Output fuse: 25A on each output wire

B. Spares

1. Provide one spare.

C. Manufacturers:

1. Phoenix Contact Model 1274119

2. Or approved equal

2.20 WIRING DUCT

A. General:
   1. Provide Plastic wiring duct of slotted type with dust cover.
   2. Size according to application requirements.
B. Construction:
   1. Use gray color duct.
C. Spares:
   1. None.
D. Manufacturers:
   1. Iboco
   2. Or approved equal.

2.21 DIN RAILS

A. General:
   1. 33 mm DIN rail
      a. Material: Steel.
      b. Coating: Galvanized, passivated with a thick layer.
      c. Color: silver.
   2. Brackets
      a. Angle: 30 degrees
      b. Height: 46 mm
      c. Model: Phoenix Contact 1206421
B. Manufacturers:
   1. Phoenix Contact Model 1201099.
   2. Or approved equal.

2.22 PROCESS INDICATOR DISPLAY

A. Manufacturer:
   1. Red Lion Controls.
B. Model:
   1. LDA Series, LD4A05P0 model.
C. Functional Requirements:
   1. Display type: LED.

2. Display resolution: 16 bits/ 5 digits.
3. Accuracy: +/- 0.01%.
4. Supply voltage: 120-V AC.
5. DC process range: 4-20 mA.
6. Communication: Selectable RS232/RS485 Communication.
7. Digit height: 4-inches high.
8. Dual 5 Amp From-C Relays.

D. Physical Requirements:

1. Casing material: Aluminum.
2. Connection type: Terminal block.
3. Display digit height: 4-inches.
4. Degree of protection: NEMA4X/IP65.
5. Dimensions:
    a. Height: 9-inches maximum.
    b. Length: 27-inches maximum.
    c. Depth: 23-inches maximum.

3.00 EXECUTION

3.01 ADDITIONAL PANEL FABRICATION

A. Wiring

1. Maximize separation between signal wiring and power wiring or control wiring, to avoid inductive pickup. A practical distance is not less than 6 inches. If power wiring must cross the signal wiring, the crossing should be as close to a right angle as possible.
2. Run wires in open slot vinyl wire duct with covers. Hold wire duct to the back plate with 10-32 by 1/2-inch Philips pan heads. Fill duct no more than 75 percent of the manufacturer's recommended maximum fill capacity. Where it is not practical to use wire duct, use wire ties to neatly bundle wires together.
3. Where wire is required to flex often, use high strand wire and spiral wrap.
4. Wires that are not de-energized by the main breaker shall be of the same color and labeled with a warning label stating same.
5. Do not jump control power and neutral from device to device. Use power distribution blocks.
6. Ground analog signal wiring drain wires at the panel only.
7. Terminate all spare PLC input/output points to the terminal blocks.
8. Terminate single wire and cable conductors according to the requirements of the terminal device.

9. On shielded cables, cover the drain wire with insulating tubing along its full bare length between the cable jacket and the terminal lug or terminal pressure plate.
10. Provide transparent, hinged cover for terminal blocks carrying 120 Vac power circuits, for personnel protection and accessibility.
11. Only one wire per terminal block terminal screw will be permitted.

B. Equip new enclosures with a utility power terminal block for the utility Line 1, Line 2, and the Neutral. For each utility power distribution circuit breaker, a separate power feed wire will be used from the utility distribution terminal block. For each utility power distribution circuit, connect an individual neutral wire to the utility power distribution terminal block neutral. Only one wire will be permitted per utility power distribution terminal. The line wires will be labeled as “L1” and “L2”. The neutral will be labeled as “N” and the ground will be labeled “G”.

C. Equipment enclosures with a UPS terminal block for the UPS output line and Neutral. For each UPS circuit breaker, a separate power feed wire will be used from the UPS terminal block. For each UPS circuit, connect an individual neutral wire to the UPS terminal block neutral. Only one wire will be permitted per terminal. The line wires will be labeled as “LU”. The neutral will be labeled as “NU”. The terminal block will be rated for the UPS circuit. Terminal block jumpers are allowed for the UPS terminal blocks.

D. Grounding

1. Provide a minimum of two 1/4 inch by 1 inch copper ground buses with each enclosure.
2. Ground all equipment with one non-isolated ground bus that is electrically bonded to the panel. Run all equipment ground wires directly from the equipment to a non-isolated ground bus.
3. Provide single-point connection of all grounds to grounding bus using the shortest possible path. Each grounded object shall have a separate connection to the ground bus.
4. Ground the drain wire of signal wiring using the other non-isolated ground bus. Jump no more than 5 drain wires together before being run to the isolated ground bus. Connect the isolated ground bus to a non-isolated grounded bus with a 10-gauge wire.
5. Do not connect cable shields to suppressor ground terminal or daisy-chain ground connections.
6. Connect all TVSS devices to a non-isolated ground bus with a dedicated green colored ground conductor that is a minimum 10 AWG. The TVSS ground conductor shall be as short as possible. Reliance on the TVSS mounting channel alone for the ground connection is not acceptable.

E. Layout and Typical Wiring

1. Obtain the Owner’s Typical Control Panel Layout and Schematics Guide from the Engineer for guidance on component layout.

END OF SECTION

40 71 13 MAGNETIC FLOW METERS

1.00 GENERAL

1.01 SUMMARY

A. Section Includes:

1. General requirements for providing magnetic flow meters.

B. Related Section:

1. Section 01 33 00 – Document Management.
2. Section 01 33 02 – Shop Drawings.
3. Section 01 33 03 – Product Data.
4. Section 01 33 04 – Operation and Maintenance Data.
5. Section 01 75 00 – Starting and Adjusting.
6. Section 01 78 36 – Warranties and Service Agreements.
7. Section 01 79 00 – Training of Operation and Maintenance.
8. Section 40 60 13 – Process Control System General Provisions.

1.02 WORK INCLUDED

A. Provide an electromagnetic measurement sensor that includes a magnetic flow tube and a microprocessor-based "smart" transmitter that converts and transmits a signal from the flow tube. It utilizes the characterized field principle of electromagnetic induction and produces DC signals directly proportional to the liquid flow rate.

B. Furnish labor, materials, equipment, and incidentals necessary to install all equipment for complete instrumentation and controls. CONTRACTOR'S work includes but is not limited to the following:

1. Installation of instrumentation equipment furnished under this contract.
2. Interconnections between equipment furnished under this contract.
3. Interconnection between equipment furnished under this contract and the existing instrumentation and control equipment or that furnished and installed under other contracts.
4. Coordination between suppliers' scope of work and the contract documents to provide all required startups, checkouts, installation, hardware, and certifications as indicated in the contract not provided by subs.

C. The CONTRACTOR'S attention is directed to the fact that instrumentation is an integrated system and as such it must be furnished by one vendor or system integrator who is required to provide all the equipment and appurtenances, regardless of manufacture, and be responsible to the CONTRACTOR for satisfactory operation of the entire system.

D. CONTRACTOR is responsible for providing supervision, labor, tools, materials for installation of the instrumentation equipment, material furnished herein, and their interconnection.

Installation work must conform to applicable city, state, and national building and electrical codes.

E. Coordinate the work of the system manufacturer's service personnel during construction, testing, calibration, and acceptance of the instruments.

1.03 QUALITY ASSURANCE

A. General: Provide equipment that is the Manufacturers latest proven design. Specifications and drawings call attention to certain features, but do not purport to cover all details entering the design of the instrumentation system. The completed system must be compatible with the functions required and the equipment furnished by the CONTRACTOR.

B. Operating Voltage: Electrical components of the system operate on 120-volt, 1-phase, 60-Hertz, except as otherwise noted in the specifications.

C. Power Supplies: The drawings and specifications indicate the energy sources that will be provided. Additional devices or power supplies necessary to obtain proper operation of the instrument system from these energy sources must be furnished with the instrumentation.

D. Protection:

1. The instrumentation system supplier must provide input-output isolation of all incoming and outgoing signals.

2. Each 4-20 mA DC process measurement current loop installed on this contract which extends outside the remote I/O cabinet, RTU cabinet, or PLC cabinet requires to be protected by insertion of a 1/16-amp fuse, Buss Type MKB.

3. The equipment must be supplied with the necessary fuses or switches required by the Instrumentation Manufacturer. The instruments requiring an internal power supply must be equipped with an internal on-off switch.

E. Input/Output:

1. In general, and unless specifically stated otherwise, inputs and outputs involving instrumentation systems shown are 4-20 mA DC process measurement signals. Current loop isolators, current repeaters, or other signal isolators must be furnished and installed as required to meet instrument specifications and to make the instrumentation system fully operational.

1.04 SUBMITTALS

A. Submittals must be in accordance with Section 01 33 00, SUBMITTAL PROCEDURES and include:

1. Shop Drawings:

a. Shop drawings must be submitted to the ENGINEER for approval before fabrication or shipment to the job. Equipment must not be fabricated or shipped to the job before receipt of approved shop drawings from the ENGINEER. Submittals for approval include:

1). Component manufacturing data sheet indicating pertinent data and identifying each component by item number and nomenclature.

2). An organized submittal with a cover sheet listing each instrument being provided. Each instrument is listed with the associated tag name, model number, and specified options.

3). Submittal is separated by tabbed sections; each section includes the product cut sheets from the manufacturer.

4). Component drawing showing dimensions, mounting, and external connection details.

5). Full description of operation.

6). Complete schematic diagram.

b. Following approval, the manufacturer is responsible for preparation of the required sets of these drawings for distribution as indicated in Division 00 and Division 01 specifications.

c. Every shop drawing must be submitted at the same time in the same package for all equipment furnished under this Section of the specifications. Partial submittals are not permitted. Sales bulletins and other general publications are not acceptable as submittals for approval.

2. Equipment Installation Report:

a. CONTRACTOR must provide an Equipment Installation Report for each instrument to the ENGINEER for approval. The equipment installation report includes documentation stating that the instrument was installed and properly calibrated per the manufacturer's recommendations by an Authorized representative of the instrument manufacturer. All parameters required for programming the instrument must be provided in a hard copy format as part of the equipment installation report. Documentation stating that the person performing the calibration and start-up is an authorized representative must be provided as well.

3. Operation and Maintenance Manuals:

a. Operating instructions must incorporate a functional description of the entire system including the system schematics which reflect "as-built" modifications.

b. Wiring diagrams must be furnished as part of the Operation and Maintenance Manuals which clearly show terminal numbers and wire numbers as they are in the instrumentation system.

c. For the instrument panel wiring, it is required that each wire installed has its own number designation at each end and such that no number is repeated.

d. Instrument panel wire tagging instructions must be followed as specified in Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables".

e. Clearly defined special maintenance requirements particular to the system are established along with special calibration and test procedures.

4. Field test

a. A manufacturer-certified letter is required to confirm that each meter is operational and working in the field as intended.

5. Warranty

    a. The CONTRACTOR is responsible for warranting the equipment for defects in material and workmanship for a period of two years from the date of final acceptance of the project. Include a copy of his special equipment warranty with the shop drawings. The warranty specified by this specification is exclusive, and in lieu of all other warranties whether written, implied, orally presented, or statutory.

1.05 STANDARDS

A. The applicable provisions of the following standards shall apply as if written here in their entirety:

1. ISO 9001:2015.
2. MET: Safety: UL61010-1 / CSA C22.2 No. 61010-1, Third Edition: Safety of Electrical Equipment for Measurement, Control, and Laboratory Use.
3. MET: Standards: ANSI / ISA12.12.01 / CSA C22.2 No. 213, Nonincendive Electrical Equipment.
    a. Class I and II, Division 2.
    b. Class III, Divisions 1 and 2 Hazardous (Classi- ed) Locations
4. NSF/ANSI.

1.06 JOB CONDITIONS

A. Spare Parts: Furnish all standard recommended spare parts as indicated in the Manufacturer's instruction manuals, for each component in the system.

B. Special Tools: Furnish a kit which contains special size wrenches and other types of tools, not normally available, which are necessary for assembling, disassembling, aligning, and calibrating each piece of equipment. In addition, any piece of equipment (meter, test set, etc.) required by the Manufacturer to align, adjust, or otherwise calibrate any item under this Section of the specification shall be furnished.

1.07 MAINTENANCE SERVICE. **[NOT USED]**

2.00 PRODUCTS

2.01 REMOTE EQUIPMENT

A. Controls for remote electrically operated or motor driven equipment shall be complete, including the necessary auxiliary relays to require only wiring and connections to the equipment control circuit. Contacts for control of remote motor operated or electrically operated equipment shall be rated not less than 10 amperes at 120 volts unless otherwise specified herein.

B. Remote motor operated or electrically operated equipment shall have a separate 120 V control circuit which operates through the dry contacts provided by the instrumentation system.

2.02 ENCLOSURES/PANELS

A. Enclosures and panels as indicated on the plans and in this specification shall be furnished, installed, and wired. Enclosures shall be NEMA 4X stainless steel for outdoor and indoor environments, unless specifically stated otherwise.

2.03 ELECTROMAGNETIC FLOW METER

A. Manufacturer.

1. Krohne.

B. Model.

1. Optiflux 2000 with signal converter IFC 300.
2. Or approved equal.

C. Functional requirements.

1. Type of Measurement: Electrical conductive liquids.
2. Power Consumption:
    a. AC: 22 VA
    b. DC: 12 W
3. Range: -40 ft/s to +40 ft/s (-12 m/s to +12 m/s).
4. Maximum Measuring Error: 0.2% of the measured value.
5. Repeatability: 0.1% of the measured value.
6. Digital indicators must display flow in engineering units.
7. A meter is required to be capable of running empty indefinitely without damage to any component.

D. Physical requirements.

1. Flow Direction: Forward and reverse.
2. Degree of protection: IP67.
3. Arrow on flow sensor indicates flow direction.

E. Environmental requirements.

1. Ambient Temperature: -40 to +65 C (-40 to +149 F)
2. Storage temperature: -50 to +70 C (-58 to +158 F).

F. Accessories/Documentation required:

1. Factory calibration: All meters shall be factory calibrated. A copy of the calibration report shall be included in the O&M manual.

2. Grounding:

    a. Meter shall be grounded in accordance with the manufacturer's recommendation.

    b. Provide ground rings, ground wires, gaskets, etc., as required.

    c. All materials shall be suitable for the liquid being measured and must be compatible with process fluid and with the process pipe.

    d. For meters with remote-mounted transmitters, signal cable for installation between the flow tube and the transmitter. Length shall be as required by installation as indicated on the Drawings.

3.00 EXECUTION

3.01 INSTALLATION

A. Mount the converter in electronics shed or environmental enclosure. The sun shield should be oriented in a direction to reduce sun damage and ensure readability.

B. The flow measurement element must be installed perpendicular to the pipe for a vertical installation.

3.02 INSTALLATION

A. PCSI will install the analyzer in strict accordance with the manufacturer’s instructions and recommendations.

B. The manufacturer’s representative will include a half-day of start-up service by a factory-trained technician, if requested.

C. PSCI will schedule a date and time for start-up.

D. PSCI will require the following people to be present during the start-up procedure.

1. CONTRACTOR.

2. KROHNE Analytical factory trained representative.

3. OWNER.

4. ENGINEER.

3.03 MANUFACTURER’S SERVICE AND START-UP

A. PCSI will include the manufacturer’s services to perform start-up on instrument to include basic operational training and certification of performance of the instrument.

B. PCSI will include a manufacturer’s Service Agreement that covers all the manufacturer’s recommended preventative maintenance, regularly scheduled calibration and any necessary repairs beginning from the time of equipment startup through to end user acceptance / plant turnover and the first 12 months of end-user operation post turnover.

C. Items A and B are to be performed by the manufacturer's factory-trained service personnel. Field service and factory repair by personnel not employed by the manufacturer is not allowed.

D. Use of the manufacturer's service parts and reagents is required. Third-party parts and reagents are not approved for use.

END OF SECTION

40 72 76 LEVEL SWITCHES

1.00 GENERAL

1.01 SUMMARY

A. Section includes:

1. General requirements for providing level switches.

B. Related Section:

1. Section 01 31 00, “Project Management and Coordination”
2. Section 01 33 00, “Document Management”
3. Section 01 33 02, “Shop Drawings”
4. Section 01 33 03, “Product Data”
5. Section 01 33 04, “Operation and Maintenance Data”
6. Section 01 75 00, “Starting and Adjusting”
7. Section 01 78 36, “Warranties and Service Agreements”
8. Section 01 79 00, “Training of Operation and Maintenance”
9. Section 40 61 13, “Process Control System General Provisions”
10. Section 40 61 21, “Process Control System Testing”

1.02 WORK INCLUDED

A. Furnish labor, materials, equipment and incidentals necessary to install all equipment for complete instrumentation and controls. Contractor's work shall include but not be limited to the following:

1. Installation of equipment furnished under this contract.
2. Interconnections between equipment furnished under this contract.
3. Interconnection between equipment furnished under this contract and the existing instrumentation and control equipment or that furnished and installed under other contracts.

B. The Contractor's attention is directed to the fact that instrumentation is an integrated system and as such shall be furnished by one vendor or system integrator who shall provide all the equipment and appurtenances, regardless of manufacture, and be responsible to the Contractor for satisfactory operation of the entire system.

C. Supervision, labor, tools, and materials necessary for installation of the instrumentation equipment and material furnished herein and their interconnection shall be provided by the Contractor. Installation work shall conform to applicable city, state, and national building and electrical codes.

D. Coordinate the work of the system manufacturer's service personnel during construction, testing, calibration and acceptance of the instruments.

1.03 QUALITY ASSURANCE

A. GENERAL: Equipment shall be the Manufacturer's latest and proven design. Specifications and drawings call attention to certain features, but do not purport to cover all details entering into the design of the instrumentation system. The completed system shall be compatible with the functions required and the equipment furnished by the Contractor.

B. OPERATING VOLTAGE: Electrical components of the system shall operate on 120-V, single-phase, 60-Hz, except as otherwise noted in the specifications.

C. POWER SUPPLIES: The drawings and specifications indicate the energy sources that will be provided. Any other devices or power supplies necessary to obtain proper operation of the instrument system from these energy sources shall be furnished with the instrumentation.

D. PROTECTION:

1. The instrumentation system supplier shall provide input-output isolation of all incoming and outgoing signals.

2. Each 4-20 mA DC process measurement current loop installed on this contract which extends outside the PLC/RTU enclosure shall be protected by insertion of a 1/16-amp fuse, Buss Type MKB. Fuses shall be installed in standard fuse blocks behind the PLC/RTU enclosure door.

3. The necessary fuses or switches required by the Instrumentation Manufacturer shall be provided with the equipment. The instruments requiring an internal power supply shall have an internal ON-OFF switch.

E. INPUT/OUTPUT:

1. In general, and unless specifically stated otherwise, inputs and outputs involving instrumentation systems shown shall be 4-20 mA DC process measurement signals. Current loop isolators, current repeaters, or other signal isolators shall be furnished and installed as required to meet instrument specifications and to make the instrumentation system fully operational.

1.04 SUBMITTALS

A. Submittals shall be in accordance with Division 1 and shall include:

1. Shop Drawings:

a. Shop drawings shall be submitted to the Engineer for approval before fabrication or shipment to the job. Equipment shall not be fabricated or shipped to the job before receipt of approved shop drawings from the Engineer. Submittals for approval shall include component manufacturing data sheet indicating pertinent data and identifying each component by item number and nomenclature.

b. The submittal shall be organized with a cover sheet listing each instrument being provided. Each instrument shall be listed with the associated tag name, model number, and specified options.

c. Separated by tabbed sections, each section shall include the product cut sheets from the manufacturer.

d. Component drawing showing: dimensions, mounting, external connection details.

e. Wiring schematic.

f. Full description of operation.

g. Complete schematic diagram.

h. The manufacturer shall be responsible for preparation of the required sets of these drawings for distribution as indicated in Division 0 and Division 1 specifications.

i. Shop drawings submitted for all equipment furnished under this section of the specifications shall be submitted at the same time in the same package. Partial submittals will not be reviewed. Sales bulletins and other general publications are not acceptable as submittals for approval.

2. Equipment installation Report:

a. Contractor shall provide an Equipment Installation Report for each instrument (flow meter, level transmitter, etc.) to the Engineer for approval. The equipment installation report shall include documentation stating that the instrument was installed and properly calibrated per the manufacturer's recommendations by an Authorized representative of the instrument manufacturer. All parameters required for programming of the instrument shall be provided in a hard copy format as part of the equipment installation report. Documentation stating that the person performing the calibration and start-up is an authorized representative shall be provided as well.

3. Operation and Maintenance Manuals:

a. Operating instructions shall incorporate a functional description of the entire system including the system schematics which reflect "as-built" modifications.

b. Wiring diagrams shall clearly show terminal numbers and wire numbers as they are in the instrumentation system.

c. Instrument panel wiring shall be such that each wire installed has its own number designation at each end and such that no number is repeated.

d. Setup parameters: O&M shall include an ISA datasheet with each instrument. The ISA form shall be filled out with ordering information, setup parameters, ranges, and approximate location.

e. Special maintenance requirements particular to the system shall be clearly defined along with special calibration and test procedures.

1.05 JOB CONDITIONS

A. SPARE PARTS:

1. Furnish all standard recommended spare parts as indicated in the Manufacturer's instruction manuals, for each component in the system.

B. SPECIAL TOOLS: Furnish a kit which contains special size wrenches and other types of tools, not normally available, which are necessary for assembling, disassembling, aligning, and calibrating each piece of equipment. In addition, any piece of equipment (meter, test set, etc.) required by the Manufacturer to align, adjust, or otherwise calibrate any item under this section of the specification shall be furnished.

2.00 PRODUCTS

2.01 FLOAT SWITCHES

A. Manufacturer:

1. Contegra.

B. Model:

1. Model FS 90.
2. Pre-approved equal.

C. Functional requirements:

1. Type: SPDT.
2. Power: Rated 1-A max, 120-V AC, 25-W max non-inductive.

D. Physical requirements:

1. Float diameter: 5-1/2”.
2. Housing: 316 stainless steel.
3. Life expectancy: 10 million operations.

E. Mounting:

1. Each set of float switches within an enclosed or open wet well shall mount to a 1/4” 316 stainless steel cable with a weighted anchor attached to the end. Locate cable in an obstructed location within wet well. Contractor must provide all mounting hardware to suspend cable from wet well lid or cable support rack, if a support rack is available.
2. Provide stainless steel mounting clip for cable mount.

F. The manufacturer supplied cable must be sufficient length to reach termination cabinet without splicing.

3.00 EXECUTION

3.01 INSTALLATION

A. Wire each device requiring power so that when wires are removed from any one device, power is not be disrupted to any other device. Ground the case of each device either by mounting directly on a steel frame or by a third wire.

3.02 FIELD QUALITY CONTROL

A. The supervisory service of a factory-trained service engineer who is specifically trained on the type of equipment herein specified shall be provided during construction to assist the Contractor in the location of sleeves; methods of installing conduit and special cable; mounting, piping, and wiring one of each type of device, and the methods of protecting all the equipment prior to placing it into service. Upon completion of the installation, the services of the above service engineer shall be provided for calibration and start-up of the

equipment and for instructing the operating personnel. The Manufacturer shall provide sufficient service to place the system in satisfactory operation.

B. Upon completion of installation of sample pumps, an acceptance test to verify the satisfactory operation of each unit shall be conducted. The test shall be conducted in a manner approved by and in the presence of the Engineer. The unit shall be checked for excessive noise, vibration, alignment, general operation, etc. The unit must perform in a manner acceptable to the Engineer before final acceptance will be made by the Owner.

C. Check out and calibrate the system upon completion of the installation.

D. Prior to the Owner turning on any form of energy to the system, the Contractor shall provide the Engineer with a certified statement of approval of the installation including his supplier's authorization for turning on energy to the system.

END OF SECTION