

TOWN OF EMMITSBURG

NEW CREAMERY ROAD SEWAGE PUMP STATION

BID DOCUMENTS

**UNITED STATES DEPARTMENT OF AGRICULTURE (USDA)
RURAL UTILITY SERVICES (RUS)**

PROJECT MANUAL



January 25, 2023

**TOWN OF EMMITSBURG
300A South Seton Avenue
Emmitsburg, Maryland 21727**



PREPARED BY:

**RK&K, LLP
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Professional Certification: I hereby certify that these documents were prepared or approved by me, and that I am a Duly Licensed Professional Engineer under the Laws of the State of Maryland. License No. 22765
Expiration Date: 07/09/2024

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BID DOCUMENTS

ADVERTISEMENT FOR BIDS

**Town of Emmitsburg
Emmitsburg, Maryland
New Creamery Road Sewage Pump Station**

General Notice

The Town of Emmitsburg (Owner) is requesting Bids for the construction of the following Project:

**New Creamery Road Sewage Pump Station
001**

Bids for the construction of the Project will be received at the **Town of Emmitsburg** located at **300A South Seton Ave., Emmitsburg, MD 21727**, until **Wednesday, March 22, 2023 at 4:00 P.M.** local time (EST). The time and date of receipt by the Owner shall be stamped or hand written on the outside of the bid proposal package by the Owner upon receipt. Bids shall remain unopened until Thursday, March 23, 2023 at 11:00 A.M. At that time the Bids received will be **publicly** opened and read.

The Project includes the following Work:

Furnishing all labor, materials, equipment and performance of work for construction of the New Creamery Road Sewage Pump Station.

Bids are requested for the following Contract: **New Creamery Road Sewage Pump Station/001.**

Obtaining the Bidding Documents

Information and Bidding Documents for the Project can be found at the following designated website:

https://www.emmitsburgmd.gov/null/public_bidding.php

Bidding Documents may be downloaded from the designated website. The designated website will be updated periodically with addenda, reports, and other information relevant to submitting a Bid for the Project. All official notifications, addenda, and other Bidding Documents will be offered only through the designated website. Neither Owner nor Engineer will be responsible for Bidding Documents, including addenda, if any, obtained from sources other than the designated website.

A pre-bid conference for the Project will be held on **Thursday, February 16, 2023 at 10:00 A.M at the Creamery Road Sewage Pump Station, 17700 Creamery Road, Emmitsburg, Maryland 21727.** Attendance at the pre-bid conference is encouraged but not required.

In the event of inclement weather on February 16, 2023, the pre-bid conference for the Project will be re-scheduled to be held on **Monday, February 20, 2023 at 10:00 A.M at the Creamery Road Sewage Pump Station, 17700 Creamery Road, Emmitsburg, Maryland 21727.** Attendees are encouraged to check the website at **https://www.emmitsburgmd.gov/null/public_bidding.php** for inclement weather updates at 5 PM on the evening of February 15, 2023.

Instructions to Bidders.

For all further requirements regarding bid submittal, qualifications, procedures, and contract award, refer to the Instructions to Bidders that are included in the Bidding Documents.

American Iron and Steel

Section 746 of Title VII of the Consolidated Appropriations Act of 2017 (Division A - Agriculture, Rural Development, Food and Drug Administration, and Related Agencies Appropriations Act, 2017) and subsequent statutes mandating domestic preference applies an American Iron and Steel requirement to this project. All iron and steel products used in this project must be produced in the United States. The term "iron and steel products" means the following products made primarily of iron or steel: lined or unlined pipes and fittings, manhole covers and other municipal castings, hydrants, tanks, flanges, pipe clamps and restraints, valves, structural steel, reinforced precast concrete, and Construction Materials.

The following waivers apply to this Contract:

De Minimis,

Minor Components,

Pig iron and direct reduced iron

The Town of Emmitsburg reserves the right to accept or reject any and/or all bids and to waive any informalities or irregularities in the bidding process.

The Town of Emmitsburg does not discriminate based on race, color, national origin, sex, sexual orientation, religion, age and disability in employment or the provision of services.

This Advertisement is issued by:

Owner: **Town of Emmitsburg**

By: **Cathy Willets**

Title: **Town Manager**

Date: **February 2, 2023**

INSTRUCTIONS TO BIDDERS FOR CONSTRUCTION CONTRACT

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ARTICLE 1—DEFINED TERMS

- 1.01 Terms used in these Instructions to Bidders have the meanings indicated in the General Conditions and Supplementary Conditions. Additional terms used in these Instructions to Bidders have the meanings indicated below:
- A. *Issuing Office*—The office from which the Bidding Documents 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. Authorization to download documents, or other distribution, includes the right for plan holders to print documents solely for their use, and the use of their prospective Subcontractors and Suppliers, provided the plan holder pays all costs associated with printing or reproduction. 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. Owner recommends that Bidder ~~register as a plan 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 plan holders will receive Addenda issued by Owner.~~
- ~~2.04 Bidder may register as a plan holder and obtain complete sets of Bidding Documents, in the number and 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 plan holders will receive Addenda issued by Owner.~~
- ~~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 plan holders from the Bidding Documents Website or~~

Issuing Office. Owner is not responsible for omissions in Bidding Documents or other documents obtained from plan rooms, or for a Bidder's failure to obtain Addenda from a plan room.

2.04 "Deleted"

2.05 "Deleted"

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 the 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 Version 2020 or later. It is the intent of the Engineer and Owner that such Electronic Documents are to be exactly representative of the paper copies of the documents. However, because the Owner and Engineer cannot totally control the transmission and receipt of Electronic Documents nor the Contractor's means of reproduction of such documents, the Owner and Engineer 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 printed 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 documents that were developed by Engineer as part of the Project design process, as Electronic Documents in native file formats.~~

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

~~a. **[List documents that will be made available to Contractor]**~~

~~2. Release of such documents will be solely for the convenience of the Contractor. 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 or Engineer 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 any electronic/digital information provided in Electronic Documents is appropriate and adequate for the Contractor's specific purposes.~~

~~4. In no case will the 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.~~

C. "Deleted"

ARTICLE 3—QUALIFICATIONS OF BIDDERS

~~3.01 To demonstrate Bidder’s qualifications to perform the Work, after submitting its Bid and within [number] days of Owner’s request, Bidder must submit the following information:~~

- ~~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. Subcontractor and Supplier qualification information.~~
- ~~E. Other required information regarding qualifications.~~

3.01 “Deleted”

~~3.02 Prospective Bidders must submit required information regarding their qualifications by [insert deadline for prequalification submittals]. Owner will review the submitted information to determine which contractors are qualified to bid on the Work. Owner will issue an Addendum listing those contractors that Owner has determined to be qualified to construct the project. Bids will only be accepted from listed contractors. The information that each prospective Bidder must submit to seek prequalification includes the following:~~

- ~~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. Prospective Bidder’s state or other contractor license number, if applicable.~~
- ~~D. Subcontractor and Supplier qualification information.~~
- ~~Other required information regarding qualifications.~~

3.02 “Deleted”

3.03 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. Subcontractor and Supplier qualification information.
- E. Other required information regarding qualifications.

- 3.04 A Bidder's failure to submit required qualification information within the times indicated may disqualify Bidder from receiving an award of the Contract.
- 3.05 No requirement in this Article 3 to submit information will prejudice the right of Owner to seek additional pertinent information regarding Bidder's qualifications.

ARTICLE 4—PRE-BID CONFERENCE

~~4.01 A pre bid conference will not be conducted for this Project.~~

~~4.01 "Deleted"~~

4.02 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 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.

~~4.03 A 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 discuss the Project. Proposals will not be accepted from Bidders who do not attend the conference. It is each Bidder's responsibility to sign in at the pre bid conference to verify its participation. Bidders must sign in using the name of the organization that will be submitting a Bid. A list of qualified Bidders that attended the pre bid conference and are eligible to submit a Bid for this Project will be issued in an Addendum.~~

~~4.03 "Deleted"~~

4.04 Information presented at the pre-Bid conference does not alter the Contract Documents. Owner will issue Addenda to make any changes to the Contract 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. 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 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/Geotechnical Data Report: The Bidding Documents contain a Geotechnical Baseline Report (GBR) and Geotechnical Data Report (GDR).~~
 - a. ~~As set forth in the Supplementary Conditions, the GBR describes certain select subsurface conditions that are anticipated to be encountered by Contractor during construction in specified locations ("Baseline Conditions"). The GBR is a Contract Document.~~
 - b. ~~The Baseline Conditions in the GBR are intended to reduce uncertainty and the degree of contingency in submitted Bids. However, Bidders cannot rely solely on the Baseline Conditions. Bids should be based on a comprehensive approach that includes an independent review and analysis of the GBR, all other Contract Documents, Technical Data, other available information, and observable surface conditions. Not all potential subsurface conditions are baselined.~~
 - c. ~~Nothing in the GBR is intended to relieve Bidders of the responsibility to make their own determinations regarding construction costs, bidding strategies, and Bid prices, nor of the responsibility to select and be responsible for the means, methods, techniques, sequences, and procedures of construction, and for safety precautions and programs incident thereto.~~
 - d. ~~As set forth in the Supplementary Conditions, the GDR is a Contract Document containing data prepared by or for the Owner in support of the GBR.~~
- 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. ~~In addition to the documents regarding existing Site conditions referred to in Paragraph 5.02.A, the following other documents relating to conditions at or adjacent to the Site are known to Owner and made available to Bidders for reference:~~

~~1. [List of other Site-related documents].~~

~~Owner will make copies of these other Site-related documents available to any Bidder on request.~~

~~B. Owner has not verified the contents of these other Site-related documents, and Bidder may not rely on the accuracy of any data or information in such documents. Bidder is responsible for any interpretation or conclusion Bidder draws from the other Site-related documents.~~

~~C. The other Site-related documents are not part of the Contract Documents.~~

~~D. Bidders are encouraged to review the other Site-related documents, but Bidders will not be held accountable for any data or information in such documents. The requirement to review and take responsibility for documentary Site information is limited to information in (1) the Contract Documents and (2) the Technical Data.~~

~~A. "Deleted"~~

~~B. "Deleted"~~

~~C. "Deleted"~~

~~D. "Deleted"~~

~~E. 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.~~

~~A. "Deleted"~~

~~B. A Site visit is scheduled following the pre-bid conference. Maps to the Site will be available at the pre-Bid conference.~~

~~C. A Site visit is scheduled for **[designate, date, time and location]**. Maps to the Site will be made available upon request.~~

~~C. "Deleted"~~

~~D. Bidders visiting the Site are required to arrange their own transportation to the Site.~~

~~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: **[provide contact information]**. Bidder must conduct the required Site visit during normal working hours.~~

~~E. "Deleted"~~

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

~~G. 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. Bidder is responsible for establishing access needed to reach specific selected test sites.~~

~~G. "Deleted"~~

~~H. Bidder must comply with all applicable Laws and Regulations regarding excavation and location of utilities, obtain all permits, and comply with all terms and conditions established by Owner or by property owners or other entities controlling the Site with respect to schedule, access, existing operations, security, liability insurance, and applicable safety programs.~~

~~H. "Deleted"~~

~~I. "Deleted"~~

~~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 noted in the Supplementary Conditions.

5.06 *Other Work at the Site*

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

ARTICLE 6—BIDDER'S REPRESENTATIONS AND CERTIFICATIONS

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

- A. The Bid Form that each Bidder will 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, Bidder (as Contractor) will make similar express representations and certifications when it executes the Agreement.

ARTICLE 7—INTERPRETATIONS AND ADDENDA

- 7.01 Owner, ~~through the Engineer, 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 Engineer in writing. Contact information and submittal procedures for such questions are as follows:
- A. Via email to Jeffrey S. Grow, PE at jgrow@rkk.com and copy Robert A. Linthicum, PE at rlinthicum@rkk.com; Cathy Willets at cwillets@emmitsburgmd.gov; and Madeline Shaw at mshaw@emmitsburgmd.gov.
- 7.03 Interpretations or clarifications considered necessary by Engineer in response to such questions will be issued by Addenda delivered to all registered plan holders. 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 Contract Documents.

ARTICLE 8—BID SECURITY

- 8.01 A Bid must be accompanied by Bid security made payable to Owner in an amount of **Five (5)** percent of Bidder's maximum Bid price (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. Such Bid bond will be issued in the form included in the Bidding Documents. Bid Security must be at least 5% of the Bidder's maximum Bid price.
- 8.02 The Bid security of the apparent Successful Bidder will be retained until Owner awards the contract to such Bidder, and such Bidder has executed the Contract, furnished the required Contract security, and met the other conditions of the Notice of Award, whereupon the Bid security will be released. If the Successful Bidder fails to execute and deliver the Contract and furnish the required Contract security within 15 days after the Notice of Award, Owner may consider Bidder to be in default, annul the Notice of Award, and the Bid security of that Bidder will be forfeited, in whole in the case of a penal sum bid bond, and to the extent of Owner's damages in the case of a damages-form bond. Such forfeiture will be Owner's exclusive remedy if Bidder defaults.
- 8.03 The Bid security of other Bidders that Owner believes to have a reasonable chance of receiving the award may be retained by Owner until the earlier of 7 days after the Effective Date of the

Contract or 61 days after the Bid opening, whereupon Bid security furnished by such Bidders will be released.

- 8.04 Bid security of other Bidders that Owner believes do not have a reasonable chance of receiving the award will be released within 7 days after the Bid opening.

ARTICLE 9—CONTRACT TIMES

- 9.01 The number of days within which, or the dates by which, the Work is to be (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 Bidder must set forth in the Bid the time by which Bidder must achieve Substantial Completion, subject to the restrictions established in Paragraph 13.07 of these Instructions. The Owner will take Bidder's time commitment regarding Substantial Completion into consideration during the evaluation of Bids, and it will be necessary for the apparent Successful Bidder to satisfy Owner that it will be able to achieve Substantial Completion within the time such Bidder has designated in the Bid. **[If applicable include the following: Bidder must also set forth in the Bid its commitments regarding the achievement of Milestones and readiness for final payment.]** The Successful Bidder's time commitments will be entered into the Agreement or incorporated in the Agreement by reference to the specific terms of the Bid.~~

9.02 "Deleted"

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

ARTICLE 10—SUBSTITUTE AND "OR EQUAL" ITEMS

~~10.01 The Contract for the Work, as awarded, will be on the basis of materials and equipment specified or described in the Bidding Documents without consideration during the bidding and Contract award process of possible substitute or "or-equal" items. 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, application for such acceptance may not be made to and will not be considered by Engineer until after the Effective Date of the Contract.~~

10.01 "Deleted"

- 10.02 The Contract for the Work, as awarded, will be on the basis of materials and equipment specified or described in the Bidding Documents, and those "or-equal" or substitute or materials and equipment subsequently approved by Engineer prior to the submittal of Bids and identified by Addendum. No item of material or equipment will be considered by Engineer as an "or-equal" or substitute unless written request for approval has been submitted by Bidder and has been received by Engineer within 10 days of the issuance of the Advertisement for Bids or invitation to Bidders. Each such request must comply with the requirements of Paragraphs 7.05 and 7.06 of the General Conditions, and the review of the request will be governed by the principles in those paragraphs. Each such request shall include the Manufacturer's Certification for Compliance with AIS. Refer to the Manufacturer's Certification form provided in these construction Contract Documents. The burden of proof of the merit of the proposed item is upon Bidder. Engineer's decision of approval or disapproval of a proposed item will be final. If Engineer approves any such

proposed item, such approval will be set forth in an Addendum issued to all registered Bidders. Bidders cannot rely upon approvals made in any other manner. Substitutes and “or-equal” materials and equipment may be proposed by Contractor in accordance with Paragraphs 7.05 and 7.06 of the General Conditions after the Effective Date of the Contract. Each such request shall include Manufacturer’s Certification letter to document compliance with AIS requirements of Section 746 of Title VII of the Consolidated Appropriations Act of 2017 (Division A - Agriculture, Rural Development, Food and Drug Administration, and Related Agencies Appropriations Act, 2017) and subsequent statutes mandating domestic preference, if applicable. Refer to Manufacturer’s Certification Letter provided in these Contract Documents.

- 11.03 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, as supplemented by Addenda. Any assumptions regarding the possibility of post-Bid approvals of “or-equal” or substitution requests are made at Bidder’s sole risk.

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 by the Bidding Documents or in the Specifications. 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 refrain from submitting a Bid.~~

11.01 “Deleted”

- 11.02 The apparent Successful Bidder, and any other Bidder so requested, must submit to Owner a list of the Subcontractors or Suppliers proposed for the following portions of the Work within five days after Bid opening:

A. **Cast-in-place concrete, electrical, instrumentation and controls, pre-cast concrete building, base-mounted pumping system, influent sewage grinder, painting, fencing, and site paving.**

- 11.03 If requested by Owner, such list must be accompanied by an experience statement with pertinent information regarding similar projects and other evidence of qualification for each such Subcontractor or Supplier. ~~If Owner or Engineer, after due investigation, has reasonable objection to any proposed Subcontractor or Supplier, Owner may, before the Notice of 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 making the Contract award.~~ If Owner or Engineer, after due investigation, has reasonable objection to any proposed Subcontractor, Supplier, individual, or entity, Owner may, before the Notice of Award is given, request apparent Successful Bidder to submit an acceptable substitute, without an increase in Bid price.

- 11.04 If apparent Successful Bidder declines to make any such substitution, Owner may award the Contract to the next lowest Bidder that proposes to use acceptable Subcontractors 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 or Engineer makes no written objection prior to the giving of the Notice of Award will be deemed acceptable to Owner and Engineer subject to subsequent revocation of such acceptance as provided in

Paragraph 7.07 of the General Conditions Declining to make requested substitutions will not constitute grounds for forfeiture of the Bid security of any Bidder.

11.05 The Contractor shall not award work to Subcontractor(s) in excess of the limits stated in SC 7.07A.

ARTICLE 12—PREPARATION OF BID

- 12.01 The Bid Form is included with the Bidding Documents.
- A. All blanks on the Bid Form must be completed in 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.
 - B. If the Bid Form expressly indicates that submitting pricing on a specific alternate item is optional, and Bidder elects to not furnish pricing for such optional alternate item, then Bidder may enter the words “No Bid” or “Not Applicable.”
- 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 8½ inch 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 executed in the corporate name by a corporate officer (whose title must appear under the signature), accompanied by evidence of authority to sign. The corporate address and state of incorporation must be shown. The corporate seal must be affixed and attested by the corporate secretary or an assistant corporate secretary.
- 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.
- 12.05 A Bid by a limited liability company must be executed in the name of the firm by a member or other authorized person and accompanied by evidence of authority to sign. The state of formation of the firm and the 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 executed 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 shown.

- 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 *Lump Sum*

- A. Bidders must submit a Bid on a lump sum basis as set forth in the Bid Form.

13.02 ~~Base Bid with Alternates~~

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

13.03 ~~Sectional Bids~~

- ~~A. Bidders may submit a Bid on any individual section or any combination of sections, as set forth in the Bid Form.~~
- ~~B. Submission of a Bid on any section signifies Bidder's willingness to enter into a Contract for that section alone at the price offered.~~
- ~~C. If Bidder submits Bids on individual sections and a Bid based on a combination of those sections, such combined Bid need not be the sum of the Bids on the individual sections.~~
- ~~D. Bidders offering a Bid on one or more sections must be capable of completing the Work covered by those sections within the time period stated in the Agreement.~~

13.04 ~~Cost Plus Fee Bids~~

- ~~A. Bidders must submit a Bid on the Contractor's fee, which must be in addition to compensation for Cost of the Work. Such fee must be either (1) a fixed fee, (2) percentages of specified categories of costs, or (3) a percentage applicable to the Cost of the Work as a whole, as set forth in the Bid Form.~~
- ~~B. If the Contractor's fee, as set forth in the Bid Form, is to be based on percentages of categories of cost, or on a percentage applicable to the Cost of the Work as a whole, then Bidders must enter a maximum amount limiting the total fee if required by the Bid Form to do so.~~
- ~~C. Bidders must submit a Bid on the Guaranteed Maximum Price, setting a maximum amount on the compensable Cost of the Work plus Contractor's fee, if required by the Bid Form to do so.~~

13.02 “Deleted”

13.03 “Deleted”

13.04 “Deleted”

13.05 *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 unit price Bid item will be the product of the “Estimated Quantity”, which Owner or its representative has set forth in the Bid Form, for the item and the corresponding “Bid Unit Price” offered by the Bidder. The total of all unit price Bid items will be the sum of these “Bid Prices”; such total will be used by Owner for Bid comparison purposes. The final quantities and Contract Price will be determined in accordance with Paragraph 13.03 of the General Conditions.
- C. Discrepancies between the multiplication of units of Work and unit prices will be resolved in favor of the unit prices. Discrepancies between the indicated sum of any column of figures and the correct sum thereof will be resolved in favor of the correct sum.

13.06 *Allowances*

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

~~13.07 *Price-Plus-Time Bids*~~

- ~~A. The Owner will consider the time of Substantial Completion commitment made by the Bidder in the comparison of Bids.~~
- ~~B. Bidder must designate the number of days required to achieve Substantial Completion of the Work and enter that number in the Bid Form as the total number of calendar days to substantially complete the Work.~~
- ~~C. The total number of calendar days for Substantial Completion designated by Bidder must be less than or equal to a maximum of [number], but not less than the minimum of [number]. If Bidder purports to designate a time for Substantial Completion that is less than the allowed minimum, or greater than the allowed maximum, Owner will reject the Bid as nonresponsive.~~
- ~~D. The Agreement as executed will contain the Substantial Completion time designated in Successful Bidder's Bid, and the Contractor will be assessed liquidated damages at the rate stated in the Agreement for failure to attain Substantial Completion within that time.~~
- ~~E. Bidder must also designate the time in which it will achieve Milestones, and achieve readiness for final payment. Such time commitments must be consistent with the “Time of Substantial Completion” to which Bidder commits. The Agreement as executed will contain, as binding Contract Times, Successful Bidder's time commitments regarding Milestones, as applicable, and readiness for final payment.~~

13.07 “Deleted”

ARTICLE 14—SUBMITTAL OF BID

- 14.01 The Bidding Documents include one separate unbound copy of the Bid Form, and, if required, the Bid Bond Form. The unbound copy of the Bid Form is to be completed and submitted with the Bid security and the other documents required to be submitted under the terms of Article 2 of the Bid Form.
- 14.02 A Bid must be received no later than the date and time prescribed and at the place indicated in the Advertisement or invitation to bid and must be enclosed in a plainly marked package with the Project title, and, if applicable, the designated portion of the Project for which the Bid is submitted, the name and address of Bidder, and must be accompanied by the Bid security and other required documents. If a Bid is sent by mail or other delivery system, the sealed envelope containing the Bid must be enclosed in a separate package plainly marked on the outside with the notation “BID ENCLOSED.” A mailed Bid must be addressed to the location designated in the Advertisement.
- 14.03 Bids received after the date and time prescribed for the opening of bids, or not submitted at the correct location or in the designated manner, will not be accepted and will be returned to the Bidder unopened.

ARTICLE 15—MODIFICATION AND WITHDRAWAL OF BID

- 15.01 An unopened Bid may be withdrawn by an appropriate document duly executed in the same manner that a Bid must be executed and delivered to the place where Bids are to be submitted prior to the date and time for the opening of Bids. Upon receipt of such notice, the unopened Bid will be returned to the Bidder.
- 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 and submit a new Bid prior to the date and time for the opening 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. Thereafter, if the Work is rebid, the Bidder will be disqualified from further bidding on the Work.

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, 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.

16.02 "Deleted"

~~16.02—Bids will be opened privately.~~

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.

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

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

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 prior to the Notice of Award.

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

- C. For determination of the apparent low Bidder(s) when sectional bids are submitted, Bids will be compared on the basis of the aggregate of the Bids for separate sections and the Bids for combined sections that result in the lowest total amount for all of the Work.
- D. For the determination of the apparent low Bidder 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 any lump sum items.
- ~~E. For the determination of the apparent low Bidder when cost plus fee bids are submitted, Bids will be compared on the basis of the Guaranteed Maximum Price set forth by Bidder on the Bid Form.~~
- E. "Deleted"
- F. "Deleted"
- ~~F. Bid prices will be compared after adjusting for differences in time of Substantial Completion (total number of calendar days to substantially complete the Work) designated by Bidders. The adjusting amount will be determined at the rate set forth in the Agreement for liquidated damages for failing to achieve Substantial Completion, or such other amount that Owner has designated in the Bid Form.~~
 - ~~1. The method for calculating the lowest bid for comparison will be the summation of the Bid price shown in the Bid Form plus the product of the Bidder specified time of Substantial Completion in calendar days times the rate for liquidated damages [or other Owner designated daily rate] in dollars per day.~~
 - ~~2. This procedure is only used to determine the lowest bid for comparison and contractor selection purposes. The Contract Price for compensation and payment purposes remains the Bid price shown in the Bid Form.~~

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

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

ARTICLE 19—BONDS AND INSURANCE

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

19.02 Article 8, Bid Security, of these Instructions, 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 Award to the Successful Bidder, it will be accompanied by the unexecuted counterparts of the Agreement along with the other Contract Documents as identified in the Agreement. Within 15 days thereafter, Successful Bidder must execute and

deliver the required number of counterparts of the Agreement and any bonds and insurance documentation required to be delivered by the Contract Documents to Owner. Within 10 days thereafter, Owner will deliver one fully executed counterpart of the Agreement to Successful Bidder, together with printed and electronic copies of the Contract Documents as stated in Paragraph 2.02 of the General Conditions.

ARTICLE 21—SALES AND USE TAXES

21.01 Owner is exempt from **Maryland** state sales and use taxes on materials and equipment to be incorporated in the Work. (Exemption No. **30042247**). Said taxes must not be included in the Bid. Refer to Paragraph SC-7.10 of the Supplementary Conditions for additional information.

ARTICLE 22—CONTRACTS TO BE ASSIGNED

22.01 Recipient shall not entertain the use of the businesses that are listed on the “Excluded Parties List System” at www.sam.gov in accordance with 2 CFR Part 1532 and Subpart B and C of 2 CFR Part 180.

ARTICLE 23—FEDERAL REQUIREMENTS

23.01 If the contract price is in excess of \$100,000, provisions of the Contract Work Hours and Safety Standards Act at 29 CFR 5.5(b) apply.

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

23.03 American Iron and Steel requirements apply to this project.

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: **the Town of Emmitsburg, 300A South Seton Ave., Emmitsburg, MD 21727.**
- 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. If Bid amount exceeds \$10,000, signed Compliance Statement (RD 400-6). Refer to specific equal opportunity requirements set forth in the Supplementary Conditions of the Construction Contract (EJCDC C-800);
 - H. If Bid amount exceeds \$25,000, signed Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion - Lower Tier Covered Transactions (AD-1048);
 - I. If Bid amount exceeds \$100,000, signed RD Instruction 1940-Q Exhibit A-1, Certification for Contracts, Grants, and Loans."
 - F. and
 - J. EEO Certification;
 - K. List of References; and
 - L. Certification of Receipt of Addenda;

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:

1. Lump Sum Price (Single Lump Sum)

Lump Sum Bid Price	\$
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~~2. Lump Sum Price (Base Bid and Alternates)~~

Lump Sum Bid Price for Base Bid	\$
Alternate A [Add] [Deduct]	\$
Alternate B [Add] [Deduct]	\$

~~3. Lump Sum Price (Sectional Lump Sum Bids)~~

Lump Sum Bid Price for Section I only	\$
Lump Sum Bid Price for Section II only	\$
Lump Sum Bid Price for Section I and II	\$

~~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.~~

Lump Sum for Cash Allowance 1	\$
Lump Sum for Cash Allowance 2	\$
Lump Sum for Cash Allowance 3	\$
Total for all Lump Sum for Cash Allowances	\$

~~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.~~

Lump Sum Contingency Allowance 1	\$
Lump Sum Contingency Allowance 2	\$
Lump Sum Contingency Allowance 3	\$
Total for all Lump Sum Contingency Allowances	\$

3.02 *Unit Price Bids*

A. Bidder will perform the following Work at the indicated unit prices:

Item No.	Description	Unit	Estimated Quantity	Bid Unit Price	Bid Amount
					\$
					\$
					\$
					\$
					\$
Total of All Unit Price Bid Items					\$

B. 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)	\$
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ARTICLE 4—~~"DELETED" BASIS OF BID—COST PLUS FEE~~

4.01 ~~— The Contract Price will be the Cost of the Work, determined as provided in Paragraph 13.01 of the General Conditions, together with the following fee, and subject to the Guaranteed Maximum Price.~~

4.02 ~~— Contractor's Fee~~

A. ~~— Contractor's fee will be [number] percent of the Cost of the Work. No fee will be payable on the basis of costs itemized as excluded in Paragraph 13.01.C of the General Conditions.~~

1. ~~— The maximum amount payable by Owner as a percentage fee (Guaranteed Maximum Fee) will not exceed \$[insert cap amount], subject to increases or decreases for changes in the Work.~~

B. ~~— Contractor's fee will be determined by applying the following percentages to the various portions of the Cost of the Work as defined in Article 13 of the General Conditions. No fee will be payable on the basis of costs itemized as excluded in Paragraph 13.01.C of the General Conditions:~~

Costs	Percent
Payroll costs (See Paragraph 13.01.B.1, General Conditions)	
Materials and Installed Equipment cost (GC 13.01.B.2)	
Amounts to be paid to Subcontractors (GC 13.01.B.3)	
Amount to be paid to special consultants (GC 13.01.B.4)	
Other costs (GC 13.01.B.5)	

1. ~~— The maximum amount payable by Owner as a percentage fee (Guaranteed Maximum Fee) will not exceed \$[insert cap amount], subject to increases or decreases for changes in the Work.~~

C. ~~— Contractor's fee will be the fixed sum of \$[number].~~

4.03 ~~— Guaranteed Maximum Price~~

A. ~~— The Guaranteed Maximum Price to Owner of the Cost of the Work including Contractor's Fee will not exceed \$[Bidder fill in GMP].~~

ARTICLE 5—“DELETED” PRICE PLUS TIME BID

5.01—~~Price Plus Time Contract Award (Stipulated Price Contract)~~

~~A. The Bidder to which an award of the Contract will be made will be determined in part on the basis of the Total Bid Price and the total number of calendar days to substantially complete the Work, in accordance with the following:~~

	Description		Amount
A	1. Total Bid Price		\${number}
	2. Total number of calendar days to substantially complete the Work	{number} days	
	3. Liquidated Damages Rate (from Agreement)	\${number}/day	
B	4. Adjustment Amount (2 x 3)		\${number}
A+B	5. Amount for Comparison of Bids		\${number}

~~B. The purpose of the process in the table above is only to calculate the lowest price plus time (A+B) bid amount for bid comparison purposes. The price for completion of the Work (the Contract Price) is the Total Bid Price.~~

~~C. Bonds required under Paragraph 6.01 of the General Conditions will be based on the Contract Price.~~

5.02—~~Price Plus Time Contract Award (Cost Plus Fee with Guaranteed Maximum Price Contract)~~

~~A. The Bidder to which an award of Contract will be made will be determined in part on the basis of the Guaranteed Maximum Price and the total number of calendar days to substantially complete the Work, in accordance with the following:~~

	Description		Amount
A	1. Guaranteed Maximum Price		\${number}
	2. Total number of calendar days to substantially complete the Work	{number} days	
	3. Liquidated Damages Rate (from Agreement)	\${number}/day	
B	4. Adjustment Amount (2 x 3)		\${number}
A+B	5. Amount for Comparison of Bids		\${number}

~~B. The purpose of the process in the table above is only to calculate the lowest price plus time (A+B) bid amount for bid comparison purposes. The price for completion of the Work (the Contract Price) is based on the cost of the Work, plus a fee, subject to a guaranteed maximum price, as set forth in the Agreement.~~

~~C. Bonds required under Paragraph 6.01 of the General Conditions will be based on the Contract Price.~~

ARTICLE 6—TIME OF COMPLETION

6.01 Bidder agrees that the Work will be substantially complete and will be completed and ready for final payment in accordance with Paragraph 15.06 of the General Conditions on or before the dates or within the number of calendar days indicated in the Agreement.

~~6.02 Bidder agrees that the Work will be substantially complete on or before [Bidder inserts date], and will be completed and ready for final payment in accordance with Paragraph 15.06 of the General Conditions on or before [Bidder inserts date].~~

~~6.02 "Deleted"~~

~~6.03 Bidder agrees that the Work will be substantially complete within [Bidder inserts number] calendar days after the date when the Contract Times commence to run as provided in Paragraph 4.01 of the General Conditions, and will be completed and ready for final payment in accordance with Paragraph 15.06 of the General Conditions within [Bidder inserts number] calendar days after the date when the Contract Times commence to run.~~

~~6.03 "Deleted"~~

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

ARTICLE 7—BIDDER’S ACKNOWLEDGEMENTS: ACCEPTANCE PERIOD, INSTRUCTIONS, AND RECEIPT OF ADDENDA

7.01 *Bid Acceptance Period*

A. This Bid will remain subject to acceptance for ~~60~~ 90 days after the Bid opening, or for such longer period of time that Bidder may agree to in writing upon request of Owner.

7.02 *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.

7.03 *Receipt of Addenda*

A. Bidder hereby acknowledges receipt of the following Addenda:

Addendum Number	Addendum Date

ARTICLE 8—BIDDER’S REPRESENTATIONS AND CERTIFICATIONS

8.01 *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 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.

8.02 *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.
- 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.

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) _____

BID BOND (PENAL SUM FORM)

Bidder Name: [Full formal name of Bidder] Address <i>(principal place of business)</i> : [Address of Bidder's principal place of business]	Surety Name: [Full formal name of Surety] Address <i>(principal place of business)</i> : [Address of Surety's principal place of business]
Owner Name: Town of Emmitsburg, Maryland Address <i>(principal place of business)</i> : 300A South Seton Avenue Emmitsburg, Maryland 21727	Bid Project <i>(name and location)</i> : New Creamery Road Sewage Pump Station, 001, Creamery Road, Emmitsburg, MD Bid Due Date: March 22, 2023
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 _____ <i>(Full formal name of Bidder)</i>	Surety _____ <i>(Full formal name of Surety) (corporate seal)</i>
By: _____ <i>(Signature)</i>	By: _____ <i>(Signature) (Attach Power of Attorney)</i>
Name: _____ <i>(Printed or typed)</i>	Name: _____ <i>(Printed or typed)</i>
Title: _____	Title: _____
Attest: _____ <i>(Signature)</i>	Attest: _____ <i>(Signature)</i>
Name: _____ <i>(Printed or typed)</i>	Name: _____ <i>(Printed or typed)</i>
Title: _____	Title: _____
<i>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.</i>	

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.

ARTICLE 1—GENERAL INFORMATION

1.01 Provide contact information for the Business:

Legal Name of Business:			
Corporate Office			
Name:		Phone number:	
Title:		Email address:	
Business address of corporate office:			
Local Office			
Name:		Phone number:	
Title:		Email address:	
Business address of local office:			

1.02 Provide information on the Business’s organizational structure:

Form of Business:	<input type="checkbox"/> Sole Proprietorship <input type="checkbox"/> Partnership <input type="checkbox"/> Corporation		
<input type="checkbox"/> Limited Liability Company <input type="checkbox"/> Joint Venture comprised of the following companies:			
1.			
2.			
3.			
Provide a separate Qualification Statement for each Joint Venturer.			
Date Business was formed:		State in which Business was formed:	
Is this Business authorized to operate in the Project location?		<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Pending	

1.03 Identify all businesses that own Business in whole or in part (25% or greater), or that are wholly or partly (25% or greater) owned by Business:

Name of business:		Affiliation:	
Address:			
Name of business:		Affiliation:	
Address:			
Name of business:		Affiliation:	
Address:			

1.04 Provide information regarding the Business’s officers, partners, and limits of authority.

Name:		Title:	
Authorized to sign contracts:	<input type="checkbox"/> Yes <input type="checkbox"/> No	Limit of Authority:	\$
Name:		Title:	
Authorized to sign contracts:	<input type="checkbox"/> Yes <input type="checkbox"/> No	Limit of Authority:	\$
Name:		Title:	
Authorized to sign contracts:	<input type="checkbox"/> Yes <input type="checkbox"/> No	Limit of Authority:	\$
Name:		Title:	

ARTICLE 2—LICENSING

2.01 Provide information regarding licensure for Business:

Name of License:			
Licensing Agency:			
License No:		Expiration Date:	
Name of License:			
Licensing Agency:			
License No:		Expiration Date:	

ARTICLE 3—DIVERSE BUSINESS CERTIFICATIONS

3.01 Provide information regarding Business’s Diverse Business Certification, if any. Provide evidence of current certification.

Certification	Certifying Agency	Certification Date
<input type="checkbox"/> Disadvantaged Business Enterprise		
<input type="checkbox"/> Minority Business Enterprise		
<input type="checkbox"/> Woman-Owned Business Enterprise		
<input type="checkbox"/> Small Business Enterprise		
<input type="checkbox"/> Disabled Business Enterprise		
<input type="checkbox"/> Veteran-Owned Business Enterprise		
<input type="checkbox"/> Service-Disabled Veteran-Owned Business		
<input type="checkbox"/> HUBZone Business (Historically Underutilized) Business		
<input type="checkbox"/> Other		
<input type="checkbox"/> None		

ARTICLE 4—SAFETY

4.01 Provide information regarding Business’s safety organization and safety performance.

Name of Business’s Safety Officer:		
Safety Certifications		
Certification Name	Issuing Agency	Expiration

4.02 Provide Worker’s Compensation Insurance Experience Modification Rate (EMR), Total Recordable Frequency Rate (TRFR) for incidents, and Total Number of Recorded Manhours (MH) for the last 3 years and the EMR, TRFR, and MH history for the last 3 years of any proposed Subcontractor(s) that will provide Work valued at 10% or more of the Contract Price. Provide documentation of the EMR history for Business and Subcontractor(s).

Year									
Company	EMR	TRFR	MH	EMR	TRFR	MH	EMR	TRFR	MH

ARTICLE 5—FINANCIAL

5.01 Provide information regarding the Business’s financial stability. Provide the most recent audited financial statement, and if such audited financial statement is not current, also provide the most current financial statement.

Financial Institution:		
Business address:		
Date of Business’s most recent financial statement:		<input type="checkbox"/> Attached
Date of Business’s most recent audited financial statement:		<input type="checkbox"/> Attached
Financial indicators from the most recent financial statement		
Contractor’s Current Ratio (Current Assets ÷ Current Liabilities)		
Contractor’s Quick Ratio ((Cash and Cash Equivalents + Accounts Receivable + Short Term Investments) ÷ Current Liabilities)		

ARTICLE 6—SURETY INFORMATION

6.01 Provide information regarding the surety company that will issue required bonds on behalf of the Business, including but not limited to performance and payment bonds.

Surety Name:			
Surety is a corporation organized and existing under the laws of the state of:			
Is surety authorized to provide surety bonds in the Project location?	<input type="checkbox"/> Yes <input type="checkbox"/> No		
Is surety listed in “Companies Holding Certificates of Authority as Acceptable Sureties on Federal Bonds and as Acceptable Reinsuring Companies” published in Department Circular 570 (as amended) by the Bureau of the Fiscal Service, U.S. Department of the Treasury? <input type="checkbox"/> Yes <input type="checkbox"/> No			
Mailing Address (principal place of business):			
Physical Address (principal place of business):			
Phone (main):		Phone (claims):	

ARTICLE 7—INSURANCE

7.01 Provide information regarding Business’s insurance company(s), including but not limited to its Commercial General Liability carrier. Provide information for each provider.

Name of insurance provider, and type of policy (CLE, auto, etc.):			
Insurance Provider		Type of Policy (Coverage Provided)	
Are providers licensed or authorized to issue policies in the Project location?			<input type="checkbox"/> Yes <input type="checkbox"/> No
Does provider have an A.M. Best Rating of A-VII or better?			<input type="checkbox"/> Yes <input type="checkbox"/> No
Mailing Address (principal place of business):			
Physical Address (principal place of business):			
Phone (main):		Phone (claims):	

ARTICLE 8—CONSTRUCTION EXPERIENCE

8.01 Provide information that will identify the overall size and capacity of the Business.

Average number of current full-time employees:	
Estimate of revenue for the current year:	
Estimate of revenue for the previous year:	

8.02 Provide information regarding the Business’s previous contracting experience.

Years of experience with projects like the proposed project:		
As a general contractor:		As a joint venturer:
Has Business, or a predecessor in interest, or an affiliate identified in Paragraph 1.03:		
Been disqualified as a bidder by any local, state, or federal agency within the last 5 years? <input type="checkbox"/> Yes <input type="checkbox"/> No		
Been barred from contracting by any local, state, or federal agency within the last 5 years? <input type="checkbox"/> Yes <input type="checkbox"/> No		
Been released from a bid in the past 5 years? <input type="checkbox"/> Yes <input type="checkbox"/> No		
Defaulted on a project or failed to complete any contract awarded to it? <input type="checkbox"/> Yes <input type="checkbox"/> No		
Refused to construct or refused to provide materials defined in the contract documents or in a change order? <input type="checkbox"/> Yes <input type="checkbox"/> No		
Been a party to any currently pending litigation or arbitration? <input type="checkbox"/> Yes <input type="checkbox"/> No		
Provide full details in a separate attachment if the response to any of these questions is Yes.		

8.03 List all projects currently under contract in Schedule A and provide indicated information.

8.04 List a minimum of three and a maximum of six projects completed in the last 5 years in Schedule B and provide indicated information to demonstrate the Business’s experience with projects similar in type and cost of construction.

8.05 In Schedule C, provide information on key individuals whom Business intends to assign to the Project. Provide resumes for those individuals included in Schedule C. Key individuals include the Project Manager, Project Superintendent, Quality Manager, and Safety Manager. Resumes may be provided for Business’s key leaders as well.

ARTICLE 9—REQUIRED ATTACHMENTS

9.01 Provide the following information with the Statement of Qualifications:

- A. If Business is a Joint Venture, separate Qualifications Statements for each Joint Venturer, as required in Paragraph 1.02.
- B. Diverse Business Certifications if required by Paragraph 3.01.
- C. Certification of Business’s safety performance if required by Paragraph 4.02.
- D. Financial statements as required by Paragraph 5.01.

- E. Attachments providing additional information as required by Paragraph 8.02.
- F. Schedule A (Current Projects) as required by Paragraph 8.03.
- G. Schedule B (Previous Experience with Similar Projects) as required by Paragraph 8.04.
- H. Schedule C (Key Individuals) and resumes for the key individuals listed, as required by Paragraph 8.05.
- I. Additional items as pertinent.

This Statement of Qualifications is offered by:

Business: _____
(typed or printed name of organization)

By: _____
(individual's signature)

Name: _____
(typed or printed)

Title: _____
(typed or printed)

Date: _____
(date signed)

(If Business 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)

Address for giving notices:

Designated Representative:

Name: _____
(typed or printed)

Title: _____
(typed or printed)

Address: _____

Phone: _____

Email: _____

Schedule A—Current Projects

Name of Organization					
Project Owner			Project Name		
General Description of Project					
Project Cost			Date Project		
Key Project Personnel	Project Manager	Project Superintendent	Safety Manager	Quality Control Manager	
Name					
Reference Contact Information (listing names indicates approval to contacting the names individuals as a reference)					
	Name	Title/Position	Organization	Telephone	Email
Owner					
Designer					
Construction Manager					

Project Owner			Project Name		
General Description of Project					
Project Cost			Date Project		
Key Project Personnel	Project Manager	Project Superintendent	Safety Manager	Quality Control Manager	
Name					
Reference Contact Information (listing names indicates approval to contacting the names individuals as a reference)					
	Name	Title/Position	Organization	Telephone	Email
Owner					
Designer					
Construction Manager					

Project Owner			Project Name		
General Description of Project					
Project Cost			Date Project		
Key Project Personnel	Project Manager	Project Superintendent	Safety Manager	Quality Control Manager	
Name					
Reference Contact Information (listing names indicates approval to contacting the names individuals as a reference)					
	Name	Title/Position	Organization	Telephone	Email
Owner					
Designer					
Construction Manager					

Schedule B—Previous Experience with Similar Projects

Name of Organization					
Project Owner			Project Name		
General Description of Project					
Project Cost			Date Project		
Key Project Personnel	Project Manager	Project Superintendent	Safety Manager	Quality Control Manager	
Name					
Reference Contact Information (listing names indicates approval to contacting the names individuals as a reference)					
	Name	Title/Position	Organization	Telephone	Email
Owner					
Designer					
Construction Manager					

Project Owner			Project Name		
General Description of Project					
Project Cost			Date Project		
Key Project Personnel	Project Manager	Project Superintendent	Safety Manager	Quality Control Manager	
Name					
Reference Contact Information (listing names indicates approval to contacting the names individuals as a reference)					
	Name	Title/Position	Organization	Telephone	Email
Owner					
Designer					
Construction Manager					

Project Owner			Project Name		
General Description of Project					
Project Cost			Date Project		
Key Project Personnel	Project Manager	Project Superintendent	Safety Manager	Quality Control Manager	
Name					
Reference Contact Information (listing names indicates approval to contacting the names individuals as a reference)					
	Name	Title/Position	Organization	Telephone	Email
Owner					
Designer					
Construction Manager					

Schedule B—Previous Experience with Similar Projects

Name of Organization					
Project Owner			Project Name		
General Description of Project					
Project Cost			Date Project		
Key Project Personnel	Project Manager	Project Superintendent	Safety Manager	Quality Control Manager	
Name					
Reference Contact Information (listing names indicates approval to contacting the names individuals as a reference)					
	Name	Title/Position	Organization	Telephone	Email
Owner					
Designer					
Construction Manager					

Project Owner			Project Name		
General Description of Project					
Project Cost			Date Project		
Key Project Personnel	Project Manager	Project Superintendent	Safety Manager	Quality Control Manager	
Name					
Reference Contact Information (listing names indicates approval to contacting the names individuals as a reference)					
	Name	Title/Position	Organization	Telephone	Email
Owner					
Designer					
Construction Manager					

Project Owner			Project Name		
General Description of Project					
Project Cost			Date Project		
Key Project Personnel	Project Manager	Project Superintendent	Safety Manager	Quality Control Manager	
Name					
Reference Contact Information (listing names indicates approval to contacting the names individuals as a reference)					
	Name	Title/Position	Organization	Telephone	Email
Owner					
Designer					
Construction Manager					

Schedule C—Key Individuals

Project Manager			
Name of individual			
Years of experience as project manager			
Years of experience with this organization			
Number of similar projects as project manager			
Number of similar projects in other positions			
Current Project Assignments			
Name of assignment		Percent of time used for this project	Estimated project completion date
Reference Contact Information (listing names indicates approval to contact named individuals as a reference)			
Name		Name	
Title/Position		Title/Position	
Organization		Organization	
Telephone		Telephone	
Email		Email	
Project		Project	
Candidate's role on project		Candidate's role on project	
Project Superintendent			
Name of individual			
Years of experience as project superintendent			
Years of experience with this organization			
Number of similar projects as project superintendent			
Number of similar projects in other positions			
Current Project Assignments			
Name of assignment		Percent of time used for this project	Estimated project completion date
Reference Contact Information (listing names indicates approval to contact named individuals as a reference)			
Name		Name	
Title/Position		Title/Position	
Organization		Organization	
Telephone		Telephone	
Email		Email	
Project		Project	
Candidate's role on project		Candidate's role on project	

Safety Manager			
Name of individual			
Years of experience as project manager			
Years of experience with this organization			
Number of similar projects as project manager			
Number of similar projects in other positions			
Current Project Assignments			
Name of assignment		Percent of time used for this project	Estimated project completion date
Reference Contact Information (listing names indicates approval to contact named individuals as a reference)			
Name		Name	
Title/Position		Title/Position	
Organization		Organization	
Telephone		Telephone	
Email		Email	
Project		Project	
Candidate's role on project		Candidate's role on project	
Quality Control Manager			
Name of individual			
Years of experience as project superintendent			
Years of experience with this organization			
Number of similar projects as project superintendent			
Number of similar projects in other positions			
Current Project Assignments			
Name of assignment		Percent of time used for this project	Estimated project completion date
Reference Contact Information (listing names indicates approval to contact named individuals as a reference)			
Name		Name	
Title/Position		Title/Position	
Organization		Organization	
Telephone		Telephone	
Email		Email	
Project		Project	
Candidate's role on project		Candidate's role on project	

COMPLIANCE STATEMENT

This statement relates to a proposed contract with _____

(Name of borrower or grantee)

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

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

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

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

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

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

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

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

DATE _____

(Signature of Bidder or Prospective Contractor)

Address (including Zip Code)

U.S. DEPARTMENT OF AGRICULTURE

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

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

(BEFORE COMPLETING CERTIFICATION, READ INSTRUCTIONS ON REVERSE)

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

Organization Name

PR/Award Number or Project Name

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

Signature(s)

Date

Instructions for Certification

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

CERTIFICATION FOR CONTRACTS, GRANTS AND LOANS

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

1. No Federal appropriated funds have been paid or will be paid, by or on behalf of the undersigned, to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with the awarding of any Federal contract, the making of any Federal grant or Federal loan, and the extension, continuation, renewal, amendment, or modification of any Federal contract, grant or loan.

2. If any funds other than Federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with this Federal contract, grant or loan, the undersigned shall complete and submit Standard Form - LLL, "Disclosure of Lobbying Activities," in accordance with its instructions.

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

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

(name)

(date)

(title)

oOo

NOTICE OF AWARD

Date of Issuance:

Owner: The Town of Emmitsburg, Maryland

Owner’s Project No.: 001

Engineer: RK&K, LLP

Engineer’s Project No.: 19082

Project: New Creamery Road Sewage Pump Station

Contract Name: New Creamery Road Sewage Pump Station

Bidder:

Bidder’s Address:

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

Furnishing all labor, materials, equipment and performance of work for construction of the New Creamery Road Sewage Pump Station. The Contract Price of the awarded Contract is \$**[Contract Price]**. Contract Price is subject to adjustment based on the provisions of the Contract, including but not limited to those governing changes, Unit Price Work, and Work performed on a cost-plus-fee basis, as applicable.

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

Drawings will be delivered separately from the other Contract Documents.

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

1. Deliver to Owner **[number of copies sent]** counterparts of the Agreement, signed by Bidder (as Contractor).
2. Deliver with the signed Agreement(s) the Contract security (such as required performance and payment bonds) and insurance documentation, as specified in the Instructions to Bidders and in the General Conditions, Articles 2 and 6.
3. Other conditions precedent (if any): **[Describe other conditions that require Successful Bidder’s compliance]**

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

Within 10 days after you comply with the above conditions, Owner will return to you one fully signed counterpart of the Agreement, together with any additional copies of the Contract Documents as indicated in Paragraph 2.02 of the General Conditions.

Owner: **The Town of Emmitsburg, Maryland**

By (signature): _____

Name (printed): _____

Title: _____

Copy: Engineer

SECTION II

CONTRACT DOCUMENTS

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

This Agreement is by and between **Town of Emmitsburg** (“Owner”) 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: **Furnishing all labor, materials, equipment and performance of work for construction of the New Creamery Road Sewage Pump Station**

ARTICLE 2—THE PROJECT

2.01 The Project, of which the Work under the Contract Documents is a part, is generally described as follows: **New Creamery Road Sewage Pump Station**

ARTICLE 3—ENGINEER

3.01 The Owner has retained **Rummel, Klepper & Kahl, LLP (RK&K)** (“Engineer”) 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.

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.

4.02 ~~“Deleted” Contract Times: Dates~~

~~A. The Work will be substantially complete on or before **[date]**, and completed and ready for final payment in accordance with Paragraph 15.06 of the General Conditions on or before **[date]**.~~

4.03 *Contract Times: Days*

A. The Work will be substantially complete within **450** 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 **480** days after the date when the Contract Times commence to run.

4.04 ~~“Deleted” Milestones~~

A. ~~Parts of the Work must be substantially completed on or before the following Milestone(s):~~

1. ~~Milestone 1 [event & date/days]~~

2. ~~Milestone 2 [event & date/days]~~

3. ~~Milestone 3 [event & date/days]~~

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 \$1,000.00 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 \$1,250.00 for each day that expires after such time until the Work is completed and ready for final payment.~~

3. ~~“Deleted” Milestones: Contractor shall pay Owner \$[number] for each day that expires after the time (as duly adjusted pursuant to the Contract) specified above for achievement of Milestone 1, until Milestone 1 is achieved, or until the time specified for Substantial Completion is reached, at which time the rate indicated in Paragraph 4.05.A.1 will apply, rather than the Milestone rate.~~

4. ~~Liquidated damages for failing to timely attain Milestones, 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.~~

C. ~~“Deleted” Bonus: Contractor and Owner further recognize the Owner will realize financial and other benefits if the Work is completed prior to the time specified for Substantial Completion. Accordingly, Owner and Contractor agree that as a bonus for early completion, Owner shall pay Contractor \$[number] for each day prior to the time specified above for Substantial Completion (as duly adjusted pursuant to the Contract) that the Work is substantially complete. The maximum value of the bonus will be limited to \$[number].~~

4.06 ~~Special Damages~~

A. ~~Contractor shall reimburse Owner (1) for any fines or penalties imposed on Owner as a direct result of the Contractor’s failure to attain Substantial Completion according to the Contract~~

Times, and (2) for the actual costs reasonably incurred by Owner for engineering, construction observation, inspection, and administrative services needed after the time specified in Paragraph 4.02 for Substantial Completion (as duly adjusted pursuant to the Contract), until the Work is substantially complete.

- B. After Contractor achieves Substantial Completion, if Contractor shall neglect, refuse, or fail to complete the remaining Work within the Contract Times, Contractor shall reimburse Owner for the actual costs reasonably incurred by Owner for engineering, construction observation, inspection, and administrative services needed after the time specified in Paragraph 4.02 for Work to be completed and ready for final payment (as duly adjusted pursuant to the Contract), until the Work is completed and ready for final payment.
- C. The special damages imposed in this paragraph are supplemental to any liquidated damages for delayed completion established 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 that follow, subject to adjustment under the Contract:

- A. For all Work other than Unit Price Work, a lump sum of **\$(number)**.

All specific cash allowances are included in the above price in accordance with Paragraph 13.02 of the General Conditions.

- B. 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).

Unit Price Work					
Item No.	Description	Unit	Estimated Quantity	Unit Price	Extended Price
				\$	\$
				\$	\$
				\$	\$
				\$	\$
				\$	\$
Total of all Extended Prices for Unit Price Work (subject to final adjustment based on actual quantities)					\$

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.

- C. Total of Lump Sum Amount and Unit Price Work (subject to final Unit Price adjustment) **\$(number)**.
- D. For all Work, at the prices stated in Contractor’s Bid, attached hereto as an exhibit.

ARTICLE 6—PAYMENT PROCEDURES

6.01 *Submittal and Processing of Payments*

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

6.02 *Progress Payments; Retainage*

- A. Owner shall make progress payments on the basis of Contractor's Applications for Payment on or about the 5th day of each month 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).
 - 1) ~~"Deleted" If 50 percent or more of the Work has been completed, as determined by Engineer, and if the character and progress of the Work have been satisfactory to Owner and Engineer, then as long as the character and progress of the Work remain satisfactory to Owner and Engineer, there will be no additional retainage; and~~
 - b. 95 percent of cost of materials and equipment not incorporated in the Work (with the balance being retainage).
 - B. Upon Substantial Completion of the entire construction to be provided under the construction Contract Documents, Owner shall pay an amount sufficient to increase total payments to Contractor to 100 percent of the Work completed, less such amounts set off by Owner pursuant to Paragraph 15.01.E of the General Conditions, and less 200 percent of Engineer's estimate of the value of Work to be completed or corrected as shown on the punch list of items to be completed or corrected prior to final payment.

6.03 *Final Payment*

- A. Upon final completion and acceptance of the Work, 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.

6.05 *Interest*

- A. All amounts not paid when due will bear interest at the rate of 5 percent per annum.

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).
 - 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 **60** sheets with each sheet bearing the following general title: **New Creamery Road Sewage Pump Station**.
 7. ~~“Deleted” Drawings listed on the attached sheet index.~~
- ~~**Notes to Users**—In the following paragraph list the numbers and dates of those Addenda that modified the Contract Documents; do not list Addenda that only affected the Bidding Requirements, and therefore should not be Contract Documents. See EJCDC® C-001 Commentary on the 2018 EJCDC Construction Documents (2018).~~
8. Addenda (numbers **[number]** to **[number]**, inclusive).
 9. Exhibits to this Agreement (enumerated as follows):
 - a. **N/A**
 10. The following which may be delivered or issued on or after the Effective Date of the Contract and are not attached hereto:
 - a. Notice to Proceed.
 - b. Work Change Directives.
 - c. Change Orders.
 - d. Field Orders.
 - 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.
 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 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.

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).

Owner:

Town of Emmitsburg, Maryland

(typed or printed name of organization)

By:

(individual's signature)

Date:

(date signed)

Name:

(typed or printed)

Title:

(typed or printed)

Attest:

(individual's signature)

Title:

(typed or printed)

Address for giving notices:

Designated Representative:

Name:

(typed or printed)

Title:

(typed or printed)

Address:

Phone:

Email:

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

Contractor:

(typed or printed name of organization)

By:

(individual's signature)

Date:

(date signed)

Name:

(typed or printed)

Title:

(typed or printed)

(If [Type of Entity] is a corporation, a partnership, or a joint venture, attach evidence of authority to sign.)

Attest:

(individual's signature)

Title:

(typed or printed)

Address for giving notices:

Designated Representative:

Name:

(typed or printed)

Title:

(typed or printed)

Address:

Phone:

Email:

License No.:

(where applicable)

State:

PERFORMANCE BOND

<p>Contractor Name: [Full formal name of Contractor] Address <i>(principal place of business)</i>: [Address of Contractor's principal place of business]</p>	<p>Surety Name: [Full formal name of Surety] Address <i>(principal place of business)</i>: [Address of Surety's principal place of business]</p>
<p>Owner Name: Town of Emmitsburg, Maryland Mailing address <i>(principal place of business)</i>: 300A Seton Avenue, Emmitsburg, Maryland 21727</p>	<p>Contract Description <i>(name and location)</i>: New Creamery Road Sewage Pump Station, 17700 Creamery Road, Emmitsburg, Maryland 21727 Contract Price: [Amount from Contract] Effective Date of Contract: [Date from Contract]</p>
<p>Bond Bond Amount: [Amount] Date of Bond: [Date] <i>(Date of Bond cannot be earlier than Effective Date of Contract)</i> Modifications to this Bond form: <input type="checkbox"/> None <input type="checkbox"/> See Paragraph 16</p>	
<p>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.</p>	
Contractor as Principal	Surety
<i>(Full formal name of Contractor)</i>	<i>(Full formal name of Surety) (corporate seal)</i>
By: _____ <i>(Signature)</i>	By: _____ <i>(Signature)(Attach Power of Attorney)</i>
Name: _____ <i>(Printed or typed)</i>	Name: _____ <i>(Printed or typed)</i>
Title: _____	Title: _____
Attest: _____ <i>(Signature)</i>	Attest: _____ <i>(Signature)</i>
Name: _____ <i>(Printed or typed)</i>	Name: _____ <i>(Printed or typed)</i>
Title: _____	Title: _____
<p><i>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.</i></p>	

1. The Contractor and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors, and assigns to the Owner for the performance of the Construction Contract, which is incorporated herein by reference.
2. If the Contractor performs the Construction Contract, the Surety and the Contractor shall have no obligation under this Bond, except when applicable to participate in a conference as provided in Paragraph 3.
3. If there is no Owner Default under the Construction Contract, the Surety's obligation under this Bond will arise after:
 - 3.1. The Owner first provides notice to the Contractor and the Surety that the Owner is considering declaring a Contractor Default. Such notice 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;
 - 3.2. The Owner declares a Contractor Default, terminates the Construction Contract and notifies the Surety; and
 - 3.3. The Owner has agreed to pay the Balance of the Contract Price in accordance with the terms of the Construction Contract to the Surety or to a contractor selected to perform the Construction Contract.
4. Failure on the part of the Owner to comply with the notice requirement in Paragraph 3.1 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.
5. When the Owner has satisfied the conditions of Paragraph 3, the Surety shall promptly and at the Surety's expense take one of the following actions:
 - 5.1. Arrange for the Contractor, with the consent of the Owner, to perform and complete the Construction Contract;
 - 5.2. Undertake to perform and complete the Construction Contract itself, through its agents or independent contractors;
 - 5.3. Obtain bids or negotiated proposals from qualified contractors acceptable to the Owner for a contract for performance and completion of the Construction Contract, arrange for a contract to be prepared for execution by the Owner and a contractor selected with the Owners concurrence, to be secured with performance and payment bonds executed by a qualified surety equivalent to the bonds issued on the Construction Contract, and pay to the Owner the amount of damages as described in Paragraph 7 in excess of the Balance of the Contract Price incurred by the Owner as a result of the Contractor Default; or
 - 5.4. Waive its right to perform and complete, arrange for completion, or obtain a new contractor, and with reasonable promptness under the circumstances:

- 5.4.1 After investigation, determine the amount for which it may be liable to the Owner and, as soon as practicable after the amount is determined, make payment to the Owner; or
 - 5.4.2 Deny liability in whole or in part and notify the Owner, citing the reasons for denial.
- 6. If the Surety does not proceed as provided in Paragraph 5 with reasonable promptness, the Surety shall be deemed to be in default on this Bond seven days after receipt of an additional written notice from the Owner to the Surety demanding that the Surety perform its obligations under this Bond, and the Owner shall be entitled to enforce any remedy available to the Owner. If the Surety proceeds as provided in Paragraph 5.4, and the Owner refuses the payment, or the Surety has denied liability, in whole or in part, without further notice, the Owner shall be entitled to enforce any remedy available to the Owner.
- 7. If the Surety elects to act under Paragraph 5.1, 5.2, or 5.3, then the responsibilities of the Surety to the Owner 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:
 - 7.1. the responsibilities of the Contractor for correction of defective work and completion of the Construction Contract;
 - 7.2. additional legal, design professional, and delay costs resulting from the Contractor's Default, and resulting from the actions or failure to act of the Surety under Paragraph 5; and
 - 7.3. liquidated damages, or if no liquidated damages are specified in the Construction Contract, actual damages caused by delayed performance or non-performance of the Contractor.
- 8. If the Surety elects to act under Paragraph 5.1, 5.3, or 5.4, the Surety's liability is limited to the amount of this Bond.
- 9. The Surety shall not be liable to the Owner or others for obligations of the Contractor that are unrelated to the Construction Contract, and the Balance of the Contract Price 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.
- 10. The Surety hereby waives notice of any change, including changes of time, to the Construction Contract or to related subcontracts, purchase orders, and other obligations.
- 11. Any proceeding, legal or equitable, under this Bond 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.
- 12. 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.
- 13. When this Bond has been furnished to comply with a statutory or other legal requirement in the location where the construction was to be performed, any provision in this Bond conflicting with said statutory or legal requirement will be deemed deleted therefrom 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.

14. Definitions

- 14.1. *Balance of the Contract Price*—The total amount payable by the Owner to the Contractor under the Construction Contract after all proper adjustments have been made including allowance for the Contractor for any amounts received or to be received by the Owner in settlement of insurance or other claims for damages to which the Contractor is entitled, reduced by all valid and proper payments made to or on behalf of the Contractor under the Construction Contract.
 - 14.2. *Construction Contract*—The agreement between the Owner and Contractor identified on the cover page, including all Contract Documents and changes made to the agreement and the Contract Documents.
 - 14.3. *Contractor Default*—Failure of the Contractor, which has not been remedied or waived, to perform or otherwise to comply with a material term of the Construction Contract.
 - 14.4. *Owner Default*—Failure of the Owner, which has not been remedied or waived, to pay the Contractor as required under the Construction Contract or to perform and complete or comply with the other material terms of the Construction Contract.
 - 14.5. *Contract Documents*—All the documents that comprise the agreement between the Owner and Contractor.
15. If this Bond is issued for an agreement between a contractor and subcontractor, the term Contractor in this Bond will be deemed to be Subcontractor and the term Owner will be deemed to be Contractor.
16. Modifications to this Bond are as follows: **“None”**

PAYMENT BOND

<p>Contractor Name: [Full formal name of Contractor] Address <i>(principal place of business)</i>: [Address of Contractor's principal place of business]</p>	<p>Surety Name: [Full formal name of Surety] Address <i>(principal place of business)</i>: [Address of Surety's principal place of business]</p>
<p>Owner Name: Town of Emmitsburg, Maryland Mailing address <i>(principal place of business)</i>: 300A Seton Avenue, Emmitsburg, Maryland 21727</p>	<p>Contract Description <i>(name and location)</i>: New Creamery Road Sewage Pump Station, 17700 Creamery Road, Emmitsburg, Maryland 21727 Contract Price: [Amount from Contract] Effective Date of Contract: [Date from Contract]</p>
<p>Bond Bond Amount: [Amount] Date of Bond: [Date] <i>(Date of Bond cannot be earlier than Effective Date of Contract)</i> Modifications to this Bond form: <input type="checkbox"/> None <input type="checkbox"/> See Paragraph 18</p>	
<p>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.</p>	
Contractor as Principal	Surety
<i>(Full formal name of Contractor)</i>	<i>(Full formal name of Surety) (corporate seal)</i>
By: _____ <i>(Signature)</i>	By: _____ <i>(Signature)(Attach Power of Attorney)</i>
Name: _____ <i>(Printed or typed)</i>	Name: _____ <i>(Printed or typed)</i>
Title: _____	Title: _____
Attest: _____ <i>(Signature)</i>	Attest: _____ <i>(Signature)</i>
Name: _____ <i>(Printed or typed)</i>	Name: _____ <i>(Printed or typed)</i>
Title: _____	Title: _____
<p><i>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.</i></p>	

1. The Contractor and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors, and assigns to the Owner to pay for labor, materials, and equipment furnished for use in the performance of the Construction Contract, which is incorporated herein by reference, subject to the following terms.
2. If the Contractor promptly makes payment of all sums due to Claimants, and defends, indemnifies, and holds harmless the Owner from claims, demands, liens, or suits by any person or entity seeking payment for labor, materials, or equipment furnished for use in the performance of the Construction Contract, then the Surety and the Contractor shall have no obligation under this Bond.
3. If there is no Owner Default under the Construction Contract, the Surety's obligation to the Owner under this Bond 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.
4. When the Owner has satisfied the conditions in Paragraph 3, the Surety shall promptly and at the Surety's expense defend, indemnify, and hold harmless the Owner against a duly tendered claim, demand, lien, or suit.
5. The Surety's obligations to a Claimant under this Bond will arise after the following:
 - 5.1. Claimants who do not have a direct contract with the Contractor
 - 5.1.1. have furnished a written notice of non-payment to the Contractor, stating with substantial accuracy the amount claimed and the name of the party to whom the materials were, or equipment was, furnished or supplied or for whom the labor was done or performed, within ninety (90) days after having last performed labor or last furnished materials or equipment included in the Claim; and
 - 5.1.2. have sent a Claim to the Surety (at the address described in Paragraph 13).
 - 5.2. Claimants who are employed by or have a direct contract with the Contractor have sent a Claim to the Surety (at the address described in Paragraph 13).
6. If a notice of non-payment required by Paragraph 5.1.1 is given by the Owner to the Contractor, that is sufficient to satisfy a Claimant's obligation to furnish a written notice of non-payment under Paragraph 5.1.1.
7. When a Claimant has satisfied the conditions of Paragraph 5.1 or 5.2, whichever is applicable, the Surety shall promptly and at the Surety's expense take the following actions:
 - 7.1. Send an answer to the Claimant, with a copy to the Owner, within sixty (60) days after receipt of the Claim, stating the amounts that are undisputed and the basis for challenging any amounts that are disputed; and
 - 7.2. Pay or arrange for payment of any undisputed amounts.
 - 7.3. The Surety's failure to discharge its obligations under Paragraph 7.1 or 7.2 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.

8. 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.
9. 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.
10. The Surety shall not be liable to the Owner, Claimants, or others for obligations of the Contractor that are unrelated to the Construction Contract. The Owner shall not be liable for the payment of any costs or expenses of any Claimant under this Bond, and shall have under this Bond no obligation to make payments to or give notice on behalf of Claimants, or otherwise have any obligations to Claimants under this Bond.
11. The Surety hereby waives notice of any change, including changes of time, to the Construction Contract or to related subcontracts, purchase orders, and other obligations.
12. No suit or action 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.
13. 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.
14. When this Bond has been furnished to comply with a statutory or other legal requirement in the location where the construction was to be performed, any provision in this Bond conflicting with said statutory or legal requirement 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.
15. Upon requests by any person or entity appearing to be a potential beneficiary of this Bond, the Contractor and Owner shall promptly furnish a copy of this Bond or shall permit a copy to be made.
16. Definitions
 - 16.1. *Claim*—A written statement by the Claimant including at a minimum:
 - 16.1.1. The name of the Claimant;
 - 16.1.2. The name of the person for whom the labor was done, or materials or equipment furnished;
 - 16.1.3. 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;
 - 16.1.4. A brief description of the labor, materials, or equipment furnished;

- 16.1.5. The date on which the Claimant last performed labor or last furnished materials or equipment for use in the performance of the Construction Contract;
 - 16.1.6. The total amount earned by the Claimant for labor, materials, or equipment furnished as of the date of the Claim;
 - 16.1.7. The total amount of previous payments received by the Claimant; and
 - 16.1.8. The total amount due and unpaid to the Claimant for labor, materials, or equipment furnished as of the date of the Claim.
- 16.2. *Claimant*—An individual or entity having a direct contract with the Contractor or with a subcontractor of the Contractor to furnish labor, materials, or equipment for use in the performance of the Construction Contract. The term Claimant also includes any individual or entity that has rightfully asserted a claim under an applicable mechanic’s lien or similar statute against the real property upon which the Project is located. The intent of this Bond 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.
- 16.3. *Construction Contract*—The agreement between the Owner and Contractor identified on the cover page, including all Contract Documents and all changes made to the agreement and the Contract Documents.
- 16.4. *Owner Default*—Failure of the Owner, which has not been remedied or waived, to pay the Contractor as required under the Construction Contract or to perform and complete or comply with the other material terms of the Construction Contract.
- 16.5. *Contract Documents*—All the documents that comprise the agreement between the Owner and Contractor.
17. If this Bond is issued for an agreement between a contractor and subcontractor, the term Contractor in this Bond will be deemed to be Subcontractor and the term Owner will be deemed to be Contractor.
18. Modifications to this Bond are as follows: **[Describe modification or enter “None”]**

CERTIFICATE OF OWNER’S ATTORNEY AND AGENCY CONCURRENCE

Notes to User: This exhibit consists of two certificates, on a single page, to be attached to the Contract and signed upon execution. The first is a certificate to be signed by the Owner’s attorney and the second is the concurrence to be signed by the State Engineer. This page is to be inserted after the Agreement between Owner and Contractor for Construction Contract (Stipulated Price) (EJCDC C-520, 2018) in the Construction Contract Documents.

CERTIFICATE OF OWNER’S ATTORNEY

PROJECT NAME:

CONTRACTOR NAME AND CONTRACT NUMBER:

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

Name

Date

AGENCY CONCURRENCE

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

Agency Representative

Date

Name

SECTION III

FEDERAL REQUIREMENTS AND CONTRACT DOCUMENTS

STANDARD GENERAL CONDITIONS OF THE CONSTRUCTION CONTRACT

Prepared By



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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

- 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

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.

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.

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.

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.

- 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

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.

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

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.

- 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

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.

- 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.

- 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

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.

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

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;

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

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

- 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

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

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

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.

- 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);

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

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.

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.

- 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;

- 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.

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.

- 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.

- 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.

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.

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.

- 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.

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

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.

- 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

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.

- 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.

- 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.

- 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.

- 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.

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.

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.

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.

- 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:

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.

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

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

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

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

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.

- 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, expeditors, timekeepers, clerks, and other personnel employed by Contractor, whether at the Site or in Contractor's principal or branch office for general administration of the Work and not specifically included in the agreed upon schedule of job classifications referred to in Paragraph 13.01.B.1 or specifically covered by Paragraph 13.01.B.4. The payroll costs and other compensation excluded here are to be considered administrative costs covered by the Contractor's fee.
- 2. 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

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

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.

- 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,

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,

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

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.

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;

- 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

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

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.

- 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,

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.

- 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,

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

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.

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.

SUPPLEMENTARY CONDITIONS OF THE CONSTRUCTION CONTRACT

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

The address system used in these Supplementary Conditions is the same as the address system used in the General Conditions, with the prefix "SC" added—for example, “Paragraph SC-4.05.”

ARTICLE 1—DEFINITIONS AND TERMINOLOGY

~~No suggested Supplementary Conditions in this Article.~~

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

The Change Order form to be used on this Project is EJCDC C-941 (2018). Agency approval is required before Change Orders are effective.

SC-1.01.A.30 Add the following language at the end of the Paragraph 1.01.A.30:

For the purposes of Rural Development, this term is synonymous with the term “Applicant” as defined in 7 CFR 1780.7 (a) (1), (2) and (3) and is an entity receiving financial assistance from the federal programs.

SC-1.01.A.50 Add the following language at the end of the Paragraph 1.01.A.50:

The Work Change Directive form to be used on this Project is EJCDC C-940 (2018). Agency approval is required before a Work Change Directive is issued.

SC-1.01.A.51 Add the following new paragraph immediately after Paragraph 1.01.A.50:

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

SC-1.01.A.52 Add the following new paragraph with the title “American Iron and Steel Definitions” immediately after Paragraph 1.01.A.51:

52.a *American Iron and Steel (AIS)* – Requirements mandated by Section 746 of Title VII of the Consolidated Appropriations Act of 2017 (Division A – Agriculture, Rural Development, Food and Drug Administration, and Related Agencies Appropriations Act, 2017) and subsequent statutes mandating domestic preference for “iron and steel products,” meaning the following products, if made primarily of iron or steel: lined or unlined pipes and fittings, manhole covers and other municipal castings, hydrants, tanks, flanges, pipe clamps and restraints, valves, structural steel, reinforced precast concrete, and

Construction Materials. AIS requirements apply in each of the several states, the District of Columbia, and each federally recognized Tribe, but not the U.S. Territories.

- 52.b *Coating* – A covering that is applied to the surface of an object. If a Coating is applied to the external surface of a domestic iron or steel component, and the application takes place outside of the United States, said product would be considered a compliant product under the AIS requirements. Any Coating processes that are applied to the external surface of Iron and Steel components that would otherwise be AIS compliant would not disqualify the product from meeting the AIS requirements regardless of where the Coating processes occur, provided that final assembly of the project occurs in the United States. This exemption only applies to Coatings on the external surface of Iron and Steel components. It does not apply to Coatings or linings on internal surfaces of Iron and Steel products, such as the lining of lined pipes. All Manufacturing Processes for lined pipes, including the application of pipe lining, must occur in the United States for the product to be compliant with AIS requirements.
- 52.c *Construction Materials* – Those articles, materials, or supplies made primarily of iron and/or steel, that are permanently incorporated into the project, not including mechanical and/or electrical components, equipment and systems. Some of these products may overlap with what is also considered “structural steel”. Note: Mechanical and electrical components, equipment and systems are not considered Construction Materials. See definitions of Mechanical Equipment and Electrical Equipment.
- 52.d *Contractor’s Certification* – Documentation submitted by the Contractor upon Substantial Completion of the Contract that all Iron and Steel projects installed were produced in the United States.
- 58.e *De Minimis* – Various miscellaneous, incidental low-cost components that are essential for, but incidental to, the construction and are incorporated into the physical structure of the project. Examples of *De Minimis* components could include small washers, screws, fasteners (such as “off the shelf” nuts and bolts), miscellaneous wire, corner bead, ancillary tube, signage, trash bins, door hardware etc. Cost for such *De Minimis* components cumulatively may comprise no more than a total of five percent of the total cost of the materials used in and incorporated into a project; the cost of an individual item may not exceed one percent of the total cost of the materials used in the incorporated into a project.
- 52.f *Electrical Equipment* – Typically any machine powered by electricity and includes components that are part of the electrical distribution system. AIS does not apply to Electrical Equipment.
- 52.g *Engineer’s Certification* – Documentation submitted by the Engineer that Drawings, Specifications, and Bidding Documents comply with AIS.
- 52.h *Iron and Steel products* – The following products made primarily of iron or steel: lined or unlined pipes and fittings, manhole covers and other municipal castings, hydrants, tanks, flanges, pipe clamps and restraints, valves, structural steel, reinforced precast concrete, and Construction Materials. Only items on the above list made primarily of iron and steel, permanently incorporated into the project must be Produced in the United States. For

example, trench boxes, scaffolding or equipment, which are removed from the project site upon completion of the project, are not required to be made of U.S. iron or steel.

- 52.i *Manufacturer* – A Supplier, fabricator, distributor, materialman, or vendor is an entity with which the Owner, Contractor or any subcontractor has contracted to furnish materials or equipment to be incorporated in the project by Owner, Contractor or a subcontractor.
- 52.j *Manufacturer’s Certification* – Documentation provided by the Manufacturer stating that the Iron and Steel projects to be used in the project are produced in the United States in accordance with American Iron and Steel (AIS) Requirements. If items are purchased via a Supplier, distributor, vendor, etc. from the Manufacturer directly, then the Supplier, distributor, vendor, etc. will be responsible for obtaining and providing these certifications to the parties purchasing the products.
- 52.k *Manufacturing Processes* – Processes such as melting, refining, pouring, forming, rolling, drawing, finishing, and fabricating. Further, if a domestic Iron and Steel project is taken out of the United States for any part of the manufacturing process, it becomes foreign source material. However, raw materials such as iron ore, limestone and iron and steel scrap are not covered by AIS requirement, and the material(s), if any being applied as a Coating are similarly not covered. Non-Iron or Steel components of an Iron and Steel project may come from non-US sources. For example, for products such as valves and hydrants, the individual non-Iron and Steel components do not have to be of domestic origin. Raw materials, such as iron ore, limestone, scrap iron, and scrap iron, and scrap steel, can come from non-U.S. sources.
- 52.l *Mechanical Equipment* – Typically equipment which has motorized parts and/or is powered by a motor. AIS does not apply to Mechanical Equipment.
- 52.m *Minor Components* – Components within an iron and/or Steel project otherwise compliant with the American Iron and Steel requirements; this waiver is typically used by Manufacturers. It differs from the *De Minimis* definition in that *De Minimis* pertains to the entire project and the minor component definition pertains to a single product. This waiver allows use of non-domestically produced miscellaneous Minor Components comprising up to five percent of the total material cost of an otherwise domestically produced Iron and Steel product. However, unless a separate waiver for a product has been approved, all other Iron and Steel components in said project must still meet the AIS requirements. This waiver does not exempt the whole product from the AIS requirements only Minor Components within said product and the Iron or Steel components of the project must be produced domestically. Valves and hydrants are also subject to the cost ceiling requirements described here. Examples of Minor Components could include items such as pins and spring in valves/hydrants, bands/straps in couplings, and other low-cost items such as small fasteners etc.

- 52.n *Municipal Castings* – Cast iron or Steel infrastructure products that are melted and cast. They typically provide access, protection, or housing for components incorporated into utility owned drinking water, storm water, wastewater, and solid waste infrastructure.
- 52.o *Primarily Iron or Steel* – A project is made of greater than 50 percent Iron or Steel on a materials cost basis. An exception to this definition is reinforced precast concrete (see Definitions). All technical specifications and applicable industry standards (e.g. NIST, NSF, AWWA) must be met. If a product is determined to be less than 50 percent iron and/or steel, the AIS requirements do not apply. For example, the cost of a fire hydrant includes:
- The cost of materials used for the iron portion of a fire hydrant (e.g. bonnet, body and shoe); and
 - The cost to pour and cast to create those components (e.g. labor and energy).
- Not included in the cost are:
- The additional material costs for the non-iron or steel internal workings of the hydrant (e.g. stem, coupling, valve, seals, etc.,) and
 - The cost to assemble the internal workings into the hydrant body.
- 52.p *Produced in the United States* – The production in the United States of the iron or steel products used in the project requires that all manufacturing processes must take place in the United States, with the exception of metallurgical processes involving refinement of steel additives.
- 52.q *Reinforced Precast Concrete* – Reinforced Precast Concrete structures must comply with AIS, regardless of whether it consists of at least 50 percent iron or steel. The reinforcing bar and wire must be produced in the United States and meet the same standards as for any other iron or steel product. Additionally, the casting of the concrete product must take place in the United States. The cement and other raw materials used in concrete production are not required to be of domestic origin. If the reinforced concrete is cast at the construction site, the reinforcing bar and wire are considered construction materials and must be produced in the United States.
- 52.r *Steel* – An alloy that includes at least 50 percent iron, between 0.02 and 2 percent carbon, and may include other elements. Metallic elements such as chromium, nickel, molybdenum, manganese, and silicon may be added during the melting of steel for the purpose of enhancing properties such as corrosion resistance, hardness, or strength. The definition of steel covers carbon steel, alloy steel, stainless steel, tool steel, and other specialty steels.
- 52.s. *Structural Steel* – Rolled flanged shapes, having at least one dimension of their cross-section three inches or greater, which are used in the construction of bridges, buildings, ships, railroad rolling stock, and for numerous other constructional purposes. Such shapes are designated as wide-flange shapes, standard I-beams, channels, angles, tees,

and zees. Other shapes include but are not limited to, H-piles, sheet piling, tie plates, cross ties, and those for other special purposes.

- 52.t *Unclassified Excavation* – Excavation not defined within Standard Specifications' classifications, including, but not limited to, rock, logs, stumps, water, debris. Included in this definition is all excavation of all utility Trenches to subgrade.

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.
- C. *Evidence of Owner's Insurance:* After receipt from Contractor of the signed counterparts of the Agreement and all required bonds and insurance documentation, Owner shall promptly deliver to Contractor copies of the policies of insurance to be provided by Owner in this Contract (if any). Owner may block out (redact) any confidential premium or pricing information contained in any policy or endorsement furnished under this provision.

2.02 *Copies of Documents*

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

Owner shall furnish to Contractor **five (5)** printed copies of the Contract Documents (including one fully signed counterpart of the Agreement), and one copy in electronic portable document format (PDF).

2.06 *Electronic Transmittals*

SC-2.06 Delete Paragraphs 2.06.B and 2.06.C in their entirety and insert the following in their place:

- B. *Electronic Documents Protocol:* The parties shall conform to the following provisions in Paragraphs 2.06.B and 2.06.C, together referred to as the Electronic Documents Protocol ("EDP" or "Protocol") for exchange of electronic transmittals.
1. *Basic Requirements*
 - a. To the fullest extent practical, the parties agree to and will transmit and accept Electronic Documents in an electronic or digital format using the procedures described in this Protocol. Use of the Electronic Documents and any information contained therein is subject to the requirements of this Protocol and other provisions of the Contract.
 - b. The contents of the information in any Electronic Document will be the responsibility of the transmitting party.

- c. Electronic Documents as exchanged by this Protocol may be used in the same manner as the printed versions of the same documents that are exchanged using non-electronic format and methods, subject to the same governing requirements, limitations, and restrictions, set forth in the Contract Documents.
- d. Except as otherwise explicitly stated herein, the terms of this Protocol will be incorporated into any other agreement or subcontract between a party and any third party for any portion of the Work on the Project, or any Project-related services, where that third party is, either directly or indirectly, required to exchange Electronic Documents with a party or with Engineer. Nothing herein will modify the requirements of the Contract regarding communications between and among the parties and their subcontractors and consultants.
- e. When transmitting Electronic Documents, the transmitting party makes no representations as to long term compatibility, usability, or readability of the items resulting from the receiving party's use of software application packages, operating systems, or computer hardware differing from those established in this Protocol.
- f. Nothing herein negates any obligation 1) in the Contract to create, provide, or maintain an original printed record version of Drawings and Specifications, signed and sealed according to applicable Laws and Regulations; 2) to comply with any applicable Law or Regulation governing the signing and sealing of design documents or the signing and electronic transmission of any other documents; or 3) to comply with the notice requirements of Paragraph 18.01 of the General Conditions.

2. *System Infrastructure for Electronic Document Exchange*

- a. Each party will provide hardware, operating system(s) software, internet, e-mail, and large file transfer functions ("System Infrastructure") at its own cost and sufficient for complying with the EDP requirements. With the exception of minimum standards set forth in this EDP, and any explicit system requirements specified by attachment to this EDP, it is the obligation of each party to determine, for itself, its own System Infrastructure.
 - 1) The maximum size of an email attachment for exchange of Electronic Documents under this EDP is **20 MB**. Attachments larger than that may be exchanged using large file transfer functions or physical media.
 - 2) Each Party assumes full and complete responsibility for any and all of 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, for use with respect to this EDP.
- b. Each party 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 the party's 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.

- c. Each party will operate and maintain industry-standard, industry-accepted, ISO-standard, commercial-grade security software and systems that are intended to protect the other party 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. To the extent that a party maintains and operates such security software and systems, it shall not be liable to the other party for any breach of system security.
- d. In the case of disputes, conflicts, or modifications to the EDP required to address issues affecting System Infrastructure, the parties shall cooperatively resolve the issues; but, failing resolution, the Owner is authorized to make and require reasonable and necessary changes to the EDP to effectuate its original intent. If the changes cause additional cost or time to Contractor, not reasonably anticipated under the original EDP, Contractor may seek an adjustment in price or time under the appropriate process in the Contract.
- e. Each party is responsible for its own back-up and archive of documents sent and received during the term of the contract under this EDP, unless this EDP establishes a Project document archive, either as part of a mandatory Project website or other communications protocol, upon which the parties may rely for document archiving during the specified term of operation of such Project document archive. Further, each party remains solely responsible for its own post-Project back-up and archive of Project documents after the term of the Contract, or after termination of the Project document archive, if one is established, for as long as required by the Contract and as each party deems necessary for its own purposes.
- f. If a receiving party receives an obviously corrupted, damaged, or unreadable Electronic Document, the receiving party will advise the sending party of the incomplete transmission.
- g. The parties will bring any non-conforming Electronic Documents into compliance with the EDP. The parties will attempt to complete a successful transmission of the Electronic Document or use an alternative delivery method to complete the communication.

C. *Software Requirements for Electronic Document Exchange; Limitations*

- 1. Each party will 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 software formats required in this section of the EDP.
 - a. 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 adjust its transmission to comply with this EDP.

2. 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.
3. Software and data formats for exchange of Electronic Documents will conform to the requirements set forth in Exhibit A to this EDP, including software versions, if listed.

SC-2.06 Supplement Paragraph 2.06 of the General Conditions by adding the following paragraph:

D. Requests by Contractor for Electronic Documents in Other Formats

1. Release of any Electronic Document versions of the Project documents in formats other than those identified in the Electronic Documents Protocol (if any) or elsewhere in the Contract will be at the sole discretion of the Owner.
2. To extent determined by Owner, in its sole discretion, to be prudent and necessary, release of Electronic Documents versions of Project documents and other Project information requested by Contractor ("Request") in formats other than those identified in the Electronic Documents Protocol (if any) or elsewhere in the Contract will be subject to the provisions of the Owner's response to the Request, and to the following conditions to which Contractor agrees:
 - a. The content included in the Electronic Documents created by Engineer and covered by the Request was prepared by Engineer as an internal working document for Engineer's purposes solely, and is being provided to Contractor on an "AS IS" basis without any warranties of any kind, including, but not limited to any implied warranties of fitness for any purpose. As such, 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 Engineer 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 the Contractor waives any claims against Engineer or Owner arising from use of data in Electronic Documents covered by the Request.
 - c. Contractor shall indemnify and hold harmless Owner and Engineer and their subconsultants from all claims, damages, losses, and expenses, including attorneys' fees and defense costs arising out of or resulting from 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 Engineer, unless such distribution is specifically identified in the Request and is limited to Contractor's subcontractors. Contractor warrants that subsequent use by Contractor's subcontractors complies with all terms of the Contract Documents and Owner's response to Request.
3. In the event that Owner elects to provide or directs the Engineer 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, the Owner shall be reimbursed by Contractor on an hourly basis (at **\$191** per hour) for any engineering costs necessary to create or otherwise prepare the data in a manner deemed appropriate by Engineer.

ARTICLE 3—CONTRACT DOCUMENTS: INTENT, REQUIREMENTS, REUSE

No suggested Supplementary Conditions in this Article.

ARTICLE 4—COMMENCEMENT AND PROGRESS OF THE WORK

4.01 *Commencement of Contract Times; Notice to Proceed*

SC-4.01.A Delete the last sentence of paragraph.

4.05 *Delays in Contractor's Progress*

SC-4.05 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 as scheduled.

Extreme or unusual weather that is typical for a given region, elevation, or season should not be considered abnormal weather conditions. Requests for time extensions due to abnormal weather conditions will be submitted to the Engineer within five days of the end of the abnormal weather condition event. It is the responsibility of the Contractor to provide the information listed in SC 4.05.C.5.b

- 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 **1.5 inches** of precipitation (as rain equivalent, based on the snow/rain conversion indicated in the table entitled Foreseeable Bad Weather Days; such table is hereby incorporated in this SC-4.05.C by reference.
 - ii) Ambient outdoor air temperature at 11:00 a.m. is equal to or less than the following low temperature threshold: **7 degrees Fahrenheit**; or, at 3:00 p.m. the ambient outdoor temperature is equal to or greater than the following high temperature threshold: **95 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 **EMMITSBURG 2 SE, MD US** weather monitoring station at **Elev: 403 ft. Lat: 39.6762° N Lon: -77.2844° W**.
 - 3) Contractor shall anticipate the number of foreseeable bad weather days per month indicated in the table in Exhibit **B—Foreseeable Bad Weather Days**.
 - 4) In each month, every bad weather day exceeding the number of foreseeable bad weather days established in the table in Exhibit **B—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.

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

5.03 *Subsurface and Physical Conditions*

SC-5.03 Add the following new paragraphs immediately after Paragraph 5.03.D:

- E. The following table lists the reports of explorations and tests of subsurface conditions at or adjacent to the Site that contain Technical Data, and specifically identifies the Technical Data in the report upon which Contractor may rely:

Report Title	Date of Report	Technical Data
Boring Logs and Laboratory Results	07/17/2019	Borings, Particle Size Distribution Reports, Bearing Ratio Test Reports, Uniaxial Compression of Rock Core included as Appendix A to Technical Specifications

- F. The following table lists the 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 specifically identifies the Technical Data upon which Contractor may rely:

Drawings Title	Date of Drawings	Technical Data
Site Demolition Plan – Dwg. C1	01/25/2023	Existing surface/subsurface structures (except Underground Facilities)

5.06 *Hazardous Environmental Conditions*

SC-5.06 Add the following new paragraphs immediately after Paragraph 5.06.A.3:

4. The following table lists the reports known to Owner relating to Hazardous Environmental Conditions at or adjacent to the Site, and the Technical Data (if any) upon which Contractor may rely:

Report Title	Date of Report	Technical Data
		No Technical Reports Available

5. The following table lists the drawings known to Owner relating to Hazardous Environmental Conditions at or adjacent to the Site, and Technical Data (if any) contained in such Drawings upon which Contractor may rely:

Drawings Title	Date of Drawings	Technical Data
		No Technical Reports Available

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).

Add the following paragraphs immediately after Paragraph 6.01.B:

1. The correction period specified as one year after the date of Substantial Completion in Paragraph 15.08.A of the General Conditions is hereby revised to be **2** years after Substantial Completion.

2. After Substantial Completion, Contractor shall furnish a warranty bond issued in the form of EJCDC® C-612, Warranty Bond (2018). The warranty bond must be in a bond amount of **10** percent of the final Contract Price. The warranty bond period will extend to a date **2** years after Substantial Completion of the Work. Contractor shall deliver the fully executed warranty bond to Owner prior to or with the final application for payment, and in any event no later than 11 months after Substantial Completion.
3. The warranty bond must be issued by the same surety that issues the performance bond required under Paragraph 6.01.A of the General Conditions.

6.02 *Insurance – General Provisions*

SC-6.02 Add the following subparagraph immediately after Paragraph 6.02.B:

1. Contractor may obtain worker’s compensation insurance from an insurance company that has not been rated by A.M. Best, provided that such company (a) is domiciled in the state in which the Project is located, (b) is certified or authorized as a worker’s compensation insurance provider by the appropriate state agency, and (c) has been accepted to provide worker’s compensation insurance for similar projects by the state within the last 12 months.

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: **N/A**
- E. *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	\$
Bodily injury by disease—aggregate	\$
Employer’s Liability	
Each accident	\$ 1,000,000
Each employee	\$ 1,000,000

Workers' Compensation and Related Policies	Policy limits of not less than:
Policy limit	\$ 1,000,000
Stop-gap Liability Coverage	
For work performed in monopolistic states, stop-gap liability coverage must be endorsed to either the worker's compensation or commercial general liability policy with a minimum limit of:	\$

- 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.
 - 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
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
[or]	
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	\$ 10,000,000
General Aggregate	\$ 10,000,000

- 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 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	\$ 2,000,000

- 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	\$ 2,000,000

- O. *Railroad Protective Liability Insurance:* Prior to commencing any Work within 50 feet of railroad-owned and controlled property, Contractor shall (1) endorse its commercial general liability policy with ISO CG 24 17, removing the contractual liability exclusion for work within 50 feet of a railroad, (2) purchase and maintain railroad protective liability insurance meeting the following requirements, (3) furnish a copy of the endorsement to Owner, and (4) submit a copy of the railroad protective policy and other railroad-required documentation to the railroad, and notify Owner of such submittal.

~~[Insert additional specific requirements, commonly set by the railroad, here.]~~

Railroad Protective Liability Insurance	Policy limits of not less than:
Each Claim	\$ N/A
Aggregate	\$ N/A

- P. *Unmanned Aerial Vehicle Liability Insurance:* If Contractor uses unmanned aerial vehicles (UAV—commonly referred to as drones) at the Site or in support of any aspect of the Work, Contractor shall obtain UAV liability insurance in the amounts stated; name Owner, Engineer, and all individuals and entities identified in the Supplementary Conditions as additional insureds; and provide a certificate to Owner confirming Contractor’s compliance with this requirement. Such insurance will provide coverage for property damage, bodily injury or death, and invasion of privacy.

Unmanned Aerial Vehicle Liability Insurance	Policy limits of not less than:
Each Claim	\$ 500,000
General Aggregate	\$ 500,000

- Q. *Other Required Insurance:* **N/A**

Builder’s Risk and Other Property Insurance

SC-6.04 Supplement Paragraph 6.04 of the General Conditions with the following provisions immediately after Paragraph 6.03.E:

- F. *Builder’s Risk Requirements:* The builder’s risk insurance must:
1. be written on a builder’s risk “all risk” policy form that at a minimum includes insurance for physical loss or damage to the Work, temporary buildings, falsework, and materials and equipment stored and in transit, and must not exclude the coverage of the following risks: fire; windstorm; hail; flood; earthquake, volcanic activity, and other earth movement; lightning; riot; civil commotion; terrorism; vehicle impact; aircraft; smoke; theft; vandalism and malicious mischief; mechanical breakdown, boiler explosion, and artificially generated electric current; collapse; explosion; debris removal; demolition occasioned by enforcement of Laws and Regulations; and water damage (other than that caused by flood).
 - a. Such policy will include an exception that results in coverage for ensuing losses from physical damage or loss with respect to any defective workmanship, methods, design, or materials exclusions.
 - b. If insurance against mechanical breakdown, boiler explosion, and artificially generated electric current; earthquake, volcanic activity, and other earth movement; or flood, are not commercially available under builder’s risk policies, by endorsement or otherwise, such insurance will be provided through other insurance policies acceptable to Owner and Contractor.
 2. cover, as insured property, at least the following: (a) the Work and all materials, supplies, machinery, apparatus, equipment, fixtures, and other property of a similar

nature that are to be incorporated into or used in the preparation, fabrication, construction, erection, or completion of the Work, including Owner-furnished or assigned property; (b) spare parts inventory required within the scope of the Contract; and (c) temporary works which are not intended to form part of the permanent constructed Work but which are intended to provide working access to the Site, or to the Work under construction, or which are intended to provide temporary support for the Work under construction, including scaffolding, form work, fences, shoring, falsework, and temporary structures.

3. cover expenses incurred in the repair or replacement of any insured property (including but not limited to fees and charges of contractors, engineers, and architects).
4. extend to cover damage or loss to insured property while in temporary storage at the Site or in a storage location outside the Site (but not including property stored at the premises of a manufacturer or Supplier). If this coverage is subject to a sublimit, such sublimit will be a minimum of \$250,000.
5. extend to cover damage or loss to insured property while in transit. If this coverage is subject to a sublimit, such sublimit will be a minimum of \$250,000.
6. allow for the waiver of the insurer's subrogation rights, as set forth in this Contract.
7. allow for partial occupancy or use by Owner by endorsement, and without cancellation or lapse of coverage.
8. include performance/hot testing and start-up, if applicable.
9. be maintained in effect until the Work is complete, as set forth in Paragraph 15.06.D of the General Conditions, or until written confirmation of Owner's procurement of property insurance following Substantial Completion, whichever occurs first.
10. include as named insureds the Owner, Contractor, Subcontractors (of every tier), and any other individuals or entities required by this Contract to be insured under such builder's risk policy. For purposes of Paragraphs 6.04, 6.05, and 6.06 of the General Conditions, and this and all other corresponding Supplementary Conditions, the parties required to be insured will be referred to collectively as "insureds." In addition to Owner, Contractor, and Subcontractors of every tier, include as insureds the following:
 - a. **N/A**
11. include, in addition to the Contract Price amount, the value of the following equipment and materials to be installed by the Contractor but furnished by the Owner or third parties:
 - a. **N/A**
12. If debris removal in connection with repair or replacement of insured property is subject to a coverage sublimit, such sublimit will be a minimum of \$100,000.
13. ~~In addition to the coverage sublimits stated above, the following coverages are also subject to sublimits, as follows:~~
13. "Deleted"

- SC-6.04 Supplement Paragraph 6.04 of the General Conditions with the following provision immediately after Paragraph 6.04.F:
- G. *Coverage for Completion Delays:* The builder's risk policy will include, for the benefit of Owner, loss of revenue and soft cost coverage for losses arising from delays in completion that result from covered physical losses or damage. Such coverage will include, without limitation, fixed expenses and debt service for a minimum of 12 months with a maximum deductible of 30 days, compensation for loss of net revenues, rental costs, and attorneys' fees and engineering or other consultants' fees, if not otherwise covered.
- SC-6.04 Supplement Paragraph 6.04 of the General Conditions with the following provisions immediately after 6.04.G:
- H. *Builder's Risk and Other Property Insurance Deductibles:* The purchaser of any required builder's risk, installation floater, or other property insurance will be responsible for costs not covered because of the application of a policy deductible.

ARTICLE 7—SC-6.04 CONTRACTOR'S RESPONSIBILITIES

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 **8 am and 5 pm**.
 2. Owner's legal holidays are **New Year's Eve , New Year's Day, Martin Luther King Jr Day, Good Friday, Memorial Day, Juneteenth Day, Independence Day, Labor Day, Columbus Day, Veteran's Day, Thanksgiving Day, Thanksgiving Friday, Christmas Eve, and Christmas Day.**
- SC-7.03 Amend the first and second sentences of Paragraph 7.03.C to state "...all Work at the Site must be performed during regular working hours, **Monday** through **Friday**. Contractor will not perform Work on a Saturday, Sunday, or any legal holiday."
- SC-7.03 Delete Paragraph 7.03.C in its entirety, and insert the following:
- C. In the absence of any Laws or Regulations to the contrary, Contractor may perform the Work on holidays, during any or all hours of the day, and on any or all days of the week, at Contractor's sole discretion.
- SC-7.03 Add the following new paragraph immediately after Paragraph 7.03.C:
- D. **Contractor** shall be responsible for the cost of any overtime pay or other expense incurred by the 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.

SC-7.03 Add the following new subparagraph immediately after Paragraph SC-7.03.D:

1. For purposes of administering the foregoing requirement, additional overtime costs are defined as **Hours must be tracked with a reason for any work beyond the first regularly scheduled 40 hours during the work week. Overtime costs are defined as 1.5x normal hourly rate for all work over 40 hours per week.**

7.04 *Services, Materials, and Equipment*

SC-7.04.D – Add the following new paragraph immediately after Paragraph 7.04.C:

- D. All Iron and Steel products must meet American Iron and Steel requirements.

SC-7.04.E – Add the following new paragraph immediately after Paragraph 7.04.D.

- E. For projects utilizing a *De Minimis* waiver, Contractor shall maintain an itemized list of non-domestically produced iron or steel incidental components and ensure that the cost is less than 5% of total materials cost for project.

7.05 *“Or Equals”*

SC-7.05.A Amend the third sentence of paragraph by striking out the following words:

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

SC-7.05.A.1.a.3 – Amend the last sentence of Paragraph a.3 by striking out “and;” and adding a period at the end of Paragraph a.3.

SC-7.05.A.1.a.4 – Delete paragraph in its entirety and insert “Deleted.”

SC-7.05.B – Add the following at the end of paragraph:

Contractor shall include a Manufacturer’s Certification letter for compliance with American Iron and Steel requirements in support data, if applicable. Refer to Manufacturer’s Certificate Letter provided in these Contract Documents.

7.06 *Substitutes*

SC-7.06.A.3.a.2 – Remove “and” from the end of paragraph.

SC-7.06.A.3.a.3 – Add “; and” to the end of paragraph.

SC-7.06.A.3.a.4 – Add the following new paragraph immediately after Paragraph 7.06.A.3.a.3

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

7.07 *Concerning Subcontractors and Suppliers*

SC-7.07.A – Amend by adding the following to the end of the paragraph:

The total amount of work subcontracted by the Contractor shall not exceed fifty percent of the Contract price without prior approval from the Owner, Engineer and Agency.

SC-7.07.B – Delete paragraph in its entirety and insert “Deleted”

SC-7.07.E – Delete the second sentence of paragraph and insert the following in its place:

Owner may not require that Contractor use a specific replacement.

7.10 *Taxes*

SC-7.10 Add a new paragraph immediately after Paragraph 7.10.A:

- A. Owner is exempt from payment of sales and compensating use taxes of the State of **Maryland** and of cities and counties thereof on all materials to be incorporated into the Work.
1. Owner will furnish the required certificates of tax exemption to Contractor for use in the purchase of supplies and materials to be incorporated into the Work.
 2. Owner's exemption does not apply to construction tools, machinery, equipment, or other property purchased by or leased by Contractor, or to supplies or materials not incorporated into the Work.

7.12 *Record Documents*

SC-7.12.A – Amend paragraph by adding the following after “written interpretations and clarifications,”:
Manufacturers’ Certifications,

7.16 *Owner-Authorized Changes in the Work*

SC.7.16.A.1.c – Amend paragraph by deleting the last period and adding:

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

SC-7.16.C.9 – Add new paragraph immediately after Paragraph 7.16.C.8:

9. Engineer’s review and approval of a Shop Drawing or Sample shall include review of Manufacturers’ Certifications in order to document compliance with American Iron and Steel requirements, as applicable.

7.17 *Owner-Authorized Changes in the Work*

SC.7.17.F – Add new paragraph immediately after Paragraph 7.17.E:

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

ARTICLE 8—OTHER WORK AT THE SITE

No suggested Supplementary Conditions in this Article.

ARTICLE 9—OWNER’S RESPONSIBILITIES

No suggested Supplementary Conditions in this Article.

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 Engineer'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. *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.
 2. *Safety Compliance:* Comply with Site safety programs, as they apply to RPR, and if required to do so by such safety programs, receive safety training specifically related to RPR's own personal safety while at the Site.
 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.
 - c. Assist in obtaining from Owner additional details or information, when required for Contractor's proper execution of the Work.
 4. *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.
 - c. Observe whether any Work in place should be uncovered for observation, or requires special testing, inspection or approval.
 5. *Inspections and Tests*

- a. Observe Contractor-arranged inspections required by Laws and Regulations, including but not limited to those performed by public or other agencies having jurisdiction over the Work.
 - b. Accompany visiting inspectors representing public or other agencies having jurisdiction over the Work.
6. *Payment Requests:* Review Applications for Payment with Contractor.
7. *Completion*
- a. Participate in Engineer's visits regarding Substantial Completion.
 - b. Assist in the preparation of a punch list of items to be completed or corrected.
 - c. 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 of items to be completed or corrected by Contractor.
 - d. Observe whether items on the final punch list have been completed or corrected.
- D. The RPR will not:
1. Authorize any deviation from the Contract Documents or substitution of materials or equipment (including "or-equal" items).
 2. Exceed limitations of Engineer's authority as set forth in the Contract Documents.
 3. Undertake any of the responsibilities of Contractor, Subcontractors, or Suppliers.
 4. Advise on, issue directions relative to, or assume control over any aspect of the means, methods, techniques, sequences or procedures of construction.
 5. Advise on, issue directions regarding, or assume control over security or safety practices, precautions, and programs in connection with the activities or operations of Owner or Contractor.
 6. Participate in specialized field or laboratory tests or inspections conducted off-site by others except as specifically authorized by Engineer.
 7. Authorize Owner to occupy the Project in whole or in part.

ARTICLE 11—CHANGES TO THE CONTRACT

No suggested Supplementary Conditions in this Article.

11.01 Change Orders

SC-11.02.C – Add new paragraph immediately after Paragraph 11.02.B:

- C. The Engineer or Owner shall contact the Agency for concurrence on each Change Order prior to issuance. All Contract Change Orders must be concurred on (signed) by Agency before they are effective.

11.02 Work Change Directives

SC-11.03.A.2 – Add new Paragraph 11.03.A.2 immediately after Paragraph 11.03.A, which shall be renamed Paragraph 11.03.A.1:

2. The Engineer or Owner shall contact the Agency for concurrence on each Work Change Directive prior to issuance. Once authorized by Owner, a copy of each Work Change Directive shall be provided by Engineer to Agency.

11.05 Owner-Authorized Changes in the Work

SC-11.05.B – Add the following at the end of Paragraph 11.05.B:

For Owner-authorized changes in the Work, the Contractor will provide the Manufacturer's Certification(s) for materials subject to American Iron and Steel requirements except when sole-source is specified, in which case the Engineer will provide the Manufacturer's Certification(s).

11.09 Change Proposals

SC-11.09.B.2.c. – Add new paragraph immediately after Paragraph 11.09.B.2.b:

- c. Change orders involving materials subject to American Iron requirements shall include supporting data (name of Manufacturer, city and state where the product was manufactured, description of product, signature of authorized Manufacturer's representative) in the Manufacturer's Certification letter, as applicable.

ARTICLE 12—CLAIMS

No suggested Supplementary Conditions in this Article.

ARTICLE 13—COST OF WORK; ALLOWANCES, UNIT PRICE WORK

13.01 *Cost of the Work*

SC-13.01 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 for Construction Equipment.

SC-13.01 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 any tool or equipment whose current price if it were purchased new at retail would be less than \$500.

13.02 *Allowances*

SC-13.02.C – Delete Paragraph 13.02.C in its entirety and insert “Deleted”.

13.03 *Unit Price Work*

SC-13.03 Delete Paragraph 13.03.E in its entirety and insert the following in its place:

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 extended price of a particular item of Unit Price Work amounts to 20~~[number]~~ percent or more of the Contract Price (based on estimated quantities at the time of Contract formation) and the variation in the quantity of that particular item of Unit Price Work actually furnished or performed by Contractor differs by more than 20 ~~[number]~~ percent 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

~~No suggested Supplementary Conditions in this Article.~~

SC-14-03.G Add new paragraph immediately after Paragraph 14.03.F

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

ARTICLE 15—PAYMENTS TO CONTRACTOR, SET OFFS; COMPLETIONS; CORRECTION PERIOD

15.01 Progress Payments

SC-15.01.B.4 Add the following language at the end of subparagraph 15.01.B.4:

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

SC-15.01.B.5 - Add new paragraph after 15.01.B.4:

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

SC-15.01.B.6 - Add new paragraph immediately after Paragraph 15.01.B.5

6. By submitting an Application for Payment based in whole or in part on furnishing equipment or materials, Contractor certifies that such equipment and materials are compliant with American Iron and Steel requirements. Manufacturer's Certification letter for materials satisfy this requirement. Refer to Manufacturer's Certification Letter provided in these Contract Documents.

SC-15.01.C.2.d – Add the following new paragraph immediately after Paragraph 15.02.C.2.c:

- d. The materials presented for payment in an Application for Payment comply with American Iron and Steel requirements.

SC-15.01.D.1 – Delete the paragraph in its entirety and insert the following in its place:

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

15.02 Contractor's Warranty of Title

SC-15.02.A – Amend the paragraph by striking out the following text: "7 days after".

15.03 Substantial Completion

SC-15.03.A – Modify the paragraph by adding the following after the last sentence of Paragraph 15.03.A

Contractor shall also submit the General (Prime) Contractor's Certification of Compliance certifying that to the best of the Contractor's knowledge and belief all substitutes, equals, and all

Iron and Steel projects proposed in the Shop Drawings, Change Orders, and Partial Payment Estimates, and those installed for the Project, are either Produced in the United States or are the subject of an approved Agriculture, Rural Development, Food and Drug Administration, and Related Agencies Appropriations Act, 2017) and subsequent statutes mandating domestic preference.

SC-15.03 Add the following new subparagraph to Paragraph 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, 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.

15.08 *Correction Period*

SC-15.08 Add the following new Paragraph 15.08.G:

- G. The correction period specified as one year after the date of Substantial Completion in Paragraph 15.08.A of the General Conditions is hereby revised to be the number of years set forth in SC-6.01.B.1; or if no such revision has been made in SC-6.01.B, then the correction period is hereby specified to be 2 years after Substantial Completion.

ARTICLE 16—SUSPENSION OF WORK AND TERMINATION

No suggested Supplementary Conditions in this Article.

ARTICLE 17—FINAL RESOLUTIONS OF DISPUTES

17.02 *Arbitration*

SC-17.02 Add the following new paragraph immediately after Paragraph 17.01.

17.02 *Arbitration*

- A. All matters subject to final resolution under this Article will be settled by arbitration administered by the American Arbitration Association in accordance with its Construction Industry Arbitration Rules (subject to the conditions and limitations of this Paragraph SC-17.02). Any controversy or claim in the amount of \$100,000 or less will be settled in accordance with the American Arbitration Association's supplemental rules for Fixed Time and Cost Construction Arbitration. This agreement to arbitrate will be specifically enforceable under the prevailing law of any court having jurisdiction.
- B. The demand for arbitration will be filed in writing with the other party to the Contract and with the selected arbitration administrator, and a copy will be sent to Engineer for information. The demand for arbitration will be made within the specific time required in Article 17, or if no specified time is applicable within a reasonable time after the matter in question has arisen, and in no event will any such demand be made after the date when institution of legal or equitable proceedings based on such matter in question would be barred by the applicable statute of limitations.

- C. The arbitrator(s) must be licensed engineers, contractors, attorneys, or construction managers. Hearings will take place pursuant to the standard procedures of the Construction Arbitration Rules that contemplate in-person hearings. The arbitrators will have no authority to award punitive or other damages not measured by the prevailing party's actual damages, except as may be required by statute or the Contract. Any award in an arbitration initiated under this clause will be limited to monetary damages and include no injunction or direction to any party other than the direction to pay a monetary amount.
- D. The Arbitrators will have the authority to allocate the costs of the arbitration process among the parties, but will only have the authority to allocate attorneys' fees if a specific Law or Regulation or this Contract permits them to do so.
- E. The award of the arbitrators must be accompanied by a reasoned written opinion and a concise breakdown of the award. The written opinion will cite the Contract provisions deemed applicable and relied on in making the award.
- F. The parties agree that failure or refusal of a party to pay its required share of the deposits for arbitrator compensation or administrative charges will constitute a waiver by that party to present evidence or cross-examine witness. In such event, the other party shall be required to present evidence and legal argument as the arbitrator(s) may require for the making of an award. Such waiver will not allow for a default judgment against the non-paying party in the absence of evidence presented as provided for above.
- G. No arbitration arising out of or relating to the Contract will include by consolidation, joinder, or in any other manner any other individual or entity (including Engineer, and Engineer's consultants and the officers, directors, partners, agents, employees or consultants of any of them) who is not a party to this Contract unless:
 - 1. the inclusion of such other individual or entity will allow complete relief to be afforded among those who are already parties to the arbitration;
 - 2. such other individual or entity is substantially involved in a question of law or fact which is common to those who are already parties to the arbitration, and which will arise in such proceedings;
 - 3. such other individual or entity is subject to arbitration under a contract with either Owner or Contractor, or consents to being joined in the arbitration; and
 - 4. the consolidation or joinder is in compliance with the arbitration administrator's procedural rules.
- H. The award will be final. Judgment may be entered upon it in any court having jurisdiction thereof, and it will not be subject to modification or appeal, subject to provisions of the Laws and Regulations relating to vacating or modifying an arbitral award.
- I. Except as may be required by Laws or Regulations, neither party nor an arbitrator may disclose the existence, content, or results of any arbitration hereunder without the prior written consent of both parties, with the exception of any disclosure required by Laws and Regulations or the Contract. To the extent any disclosure is allowed pursuant to the exception, the disclosure must be strictly and narrowly limited to maintain confidentiality to the extent possible.

17.03 *Attorneys' Fees*

SC-17.03 Add the following new paragraph immediately after Paragraph 17.02. [Note: If there is no Paragraph 17.02, because neither arbitration nor any other dispute resolution process has been specified here in the Supplementary Conditions, then revise this to state "Add the following new Paragraph immediately after Paragraph 17.01" and revise the numbering accordingly].

17.03 *Attorneys' Fees*

- A. For any matter subject to final resolution under this Article, the prevailing party shall be entitled to an award of its attorneys' fees incurred in the final resolution proceedings, in an equitable amount to be determined in the discretion of the court, arbitrator, arbitration panel, or other arbiter of the matter subject to final resolution, taking into account the parties' initial demand or defense positions in comparison with the final result.

ARTICLE 18—MISCELLANEOUS

SC-18.11 – Add the following new paragraph immediately after Paragraph 18.10:

18.11 *Tribal Sovereignty*

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

SC-19 – Add the following new Article 19 immediately after Article 18.

ARTICLE 19 – FEDERAL REQUIREMENTS

19.01 *Agency Not a Party*

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

19.02 *Contract Approval*

- A. Owner and Contractor will furnish Owner's attorney such evidence as required so that Owner's attorney can complete and execute the "*Certificate of Owner's Attorney*" before Owner submits the executed Contract Documents to Agency for approval.
- B. Agency concurrence is required on both the Bid and the Contract before the Contract is effective.

19.03 *Conflict of Interest*

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

19.04 *Gratuities*

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

19.05 *Small, Minority and Women's Businesses*

- A. If Contractor intends to let any subcontracts for a portion of the work, Contractor will take all necessary affirmative steps to assure that minority businesses, women's business enterprises, and labor surplus area firms are used when possible. Affirmative steps will include:
 - 1. Placing qualified small and minority businesses and women's business enterprises on solicitation lists;
 - 2. Assuring that small and minority businesses, and women's business enterprises are solicited whenever they are potential sources;
 - 3. Dividing total requirements, when economically feasible, into smaller tasks or quantities to permit maximum participation by small and minority businesses, and women's business enterprises;
 - 4. Establishing delivery schedules, where the requirement permits, which encourage participation by small and minority businesses, and women's business enterprises;

5. Using the services and assistance, as appropriate, of such organizations as the Small Business Administration and the Minority Business Development Agency of the Department of Commerce.

19.06 *Anti-Kickback*

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

19.07 *Clean Air Act (4. U.S.C. 7401-7671q.) and the Federal Water Pollution Control Act (33 U.S.C. 1251-1387), as amended*

- A. Contractor to agree to comply with all applicable standards, orders or regulations issued pursuant to the Clean Air Act (43 U.S.C. 7401-7671q) and the Federal Water Pollution Control Act as amended (33 U.S.C. 1251-1387). Violations must be reported to the federal awarding agency and the Regional Office of the Environmental Protection Agency (EPA).

19.08 *Equal Employment Opportunity*

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

19.09 *Byrd Anti-Lobbying Amendment (31 U.S.C. 1352)*

- A. Contractors that apply or bid for an award exceeding \$100,000 must file the required certification (RD Instruction 1940-Q Exhibit A-1). The Contractor certifies to the Owner and every subcontractor certifies to the Contractor that it will not and has not used federal appropriated funds to pay any person or organization for influencing or attempting to influence an officer or employee of any agency, a member of Congress, officer or employee of Congress, or an employee of any agency, a member of Congress in connection with obtaining the Contract if it is covered 31 U.S.C. 1352. The Contractor and every subcontractor must also disclose any lobbying with non-federal funds that takes place in connection with obtaining any federal award. Such disclosures are forwarded from tier to tier up to the Owner. Necessary certification and disclosure forms shall be provided by Owner.

19.10 Environmental Requirements

- A. When constructing a Project involving trenching and/or other related earth excavations, Contractor shall comply with the following environmental conditions.
1. *Wetlands* – When disposing of excess, spoil, or other Construction Materials on public or private property, Contractor shall not fill in or otherwise convert wetlands.
 2. *Floodplains* – When disposing of excess, spoils, or other Construction Materials on public or private property, Contractor shall not fill in or otherwise convert 100-year floodplain areas (Standard Flood Hazard Area) delineated on the latest Federal Emergency Management Agency Floodplain Maps, or other appropriate maps, e.g., alluvial soils on NRCS Soil Survey Maps.
 3. *Historic Preservation* – Applicants shall ensure that Contractors maintain a copy of the following inadvertent discovery plan onsite for review:
 - a. If during the course of any ground disturbance related to any Project, any post review discovery, including but not limited to, any artifacts, foundations, or other indications of past human occupation of the area are uncovered, shall be protected by complying with 36 CFR § 800.13 (b)(3) and (c) and shall include the following:
 - i. All Work, including vehicular traffic, shall immediately stop within a 50 ft. radius around the area of discovery. The Contractor shall ensure barriers are established to protect the area of discovery and notify the Engineer to contact the appropriate RD personnel. The Engineer shall engage a Secretary of Interior (SOI) qualified professional archeologist to quickly assess the nature and scope of the discovery; implement interim measures to protect the discovery from looting and vandalism; and establish broader barriers if further historic and/or precontact properties, can reasonably be expected to occur.
 - ii. The RD personnel shall notify the appropriate RD environmental staff member, the Federal Preservation Officer (FPO), and State Historic Preservation Office (SHPO) immediately, Indian tribe(s) or Native Hawaiian Organization (NHOs) that have an interest in the area of discovery shall be contacted immediately. The SHPO may require additional tribes or NHOs who may have an interest in the area of discovery also be contacted. The notification shall include an assessment of the discovery provided by the SOI qualified professional archeologist.
 - iii. When the discovery contains burial sites or human remains, the Contractor shall immediately notify the appropriate RD personnel who will contact the RD environmental staff member, FPO, and the SHPO. The relevant law enforcement authorities shall be immediately contacted by onsite personnel to reduce delay times, in accordance with tribal, state, or local laws

including 36 CFR Part 800.13; 43 CFR Part 10, Subpart B; and the Advisory Council on Historic Preservation's Policy Statement Regarding treatment of Burial Sites, Human Remains, or Funerary Objects (February 23, 2007).

- iv. When discovery contains burial sites or human remains, all construction activities, including vehicular traffic shall stop within a 100 ft. radius of the discovery and barriers shall be established. The evaluation of human remains shall be conducted at the site of discovery by a SOI qualified professional. Remains that have been removed from their primary context and where that context may be in question may be retained in a secure location, pending further decisions on treatment and disposition. RD may expand this radius based on the SOI professional's assessment of the discovery and establish broader barriers if further subsurface burial sites, or human remains can reasonable be expected to occur. RD, in consultation with the SHPO and interested tribes or NHOs, shall develop a plan for the treatment of native human remains.
 - v. Work may continue in other areas of the undertaking where no historic properties, burial site, or human remains are present. If the inadvertent discovery appears to be a consequence of illegal activity such as looting, the onsite personnel shall contact the appropriate legal authorities immediately if the landowner has not already done so.
 - vi. Work may not resume in the area of the discovery until a notice to proceed has been issued by RD. RD shall not issue the notice to proceed until it has determined that the appropriate local protocols and consulting parties have been consulted.
 - vii. Inadvertent discoveries on federal and tribal land shall follow the processes required by the federal or tribal entity.
4. *Endangered Species* – Contractor shall comply with the Endangered Species Act, which provides for the protection of endangered and/or threatened species and critical habitat. Should any evidence of the presence of endangered and/or threatened species or their critical habitat be brought to the attention of Contractor, Contractor will immediately report this evidence to Owner and a representative of Agency. Construction shall be temporarily halted pending the notification process and further directions issued by Agency after consultation with the U.S. Fish and Wildlife Service.
5. *Mitigation Measures* – The following environmental mitigation measures are required on this project: (Insert mitigation measures from the Letter of Condition here).

19.11 *Contract Work Hours and Safety Standards Act (40 U.S.C. 3701-3708)*

- A. Where applicable, for contracts awarded by the Owner in excess of \$100,000 that involve the employment of mechanics or laborers, the Contractor will comply with 40 U.S.C. 3702 and 3704, as supplemented by Department of Labor regulations (29 CFR Part 5). Under 40 U.S.C. 3702 of the Act, the Contractor will compute wages every mechanic and laborer on the basis of a standard work week of 40 hours. Work in excess of the standard work week is permissible provided that the worker is compensated at a rate of not less than one and a half times the basic rate of pay for all hours worked in excess of 40 hours in the work week. The requirements of 40 U.S.C. 3704 are applicable to construction work and provide that no laborer or mechanic will be required to work in surroundings or under working conditions which are unsanitary, hazardous or dangerous. These requirements do not apply to the purchases of supplies or materials or articles ordinarily available on the open market, contracts for transportation or transmission of intelligence.

19.12 *Debarment and Suspension (Executive Orders 12549 and 12689)*

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

19.13 *Procurement of Recovered Materials*

- A. The Contractor will comply with 2 CFR Part 200.322, "Procurement of Recovered Materials".

19.14 *American Iron and Steel*

- A. Section 746 of Title VII of the Consolidated Appropriations Act of 2017 (Division A – Agriculture, Rural Development, Food and Drug Administration, and Related Agencies Appropriations Act, 2017) and subsequent statutes mandating domestic preference applies an American Iron and Steel requirement to this project. All iron and steel products used in this project must be produced in the United States. The term "iron and steel products" means the following products made primarily of iron or steel: lined or unlined pipes and fittings, manhole covers and other municipal castings, hydrants, tanks, flanges, pipe clamps and restraints, valves, structural steel, reinforced precast concrete, and Construction Material.
- B. The following waivers apply to this Contract:
1. *De Minimis*,
 2. Minor Components,
 3. Pig iron and direct reduced iron, and
 4. (add project specific waivers as applicable).

EXHIBIT A—SOFTWARE REQUIREMENTS FOR ELECTRONIC DOCUMENT EXCHANGE

Item	Electronic Documents	Transmittal Means	Data Format	Note (1)
a.1	General communications, transmittal covers, meeting notices and responses to general information requests for which there is no specific prescribed form.	Email	Email	
a.2	Meeting agendas, meeting minutes, RFI's and responses to RFI's, and Contract forms.	Email w/ Attachment	PDF	(2)
a.3	Contactors Submittals (Shop Drawings, "or equal" requests, substitution requests, documentation accompanying Sample submittals and other submittals) to Owner and Engineer, and Owner's and Engineer's responses to Contractor's Submittals, Shop Drawings, correspondence, and Applications for Payment.	Email w/ Attachment	PDF	
a.4	Correspondence; milestone and final version Submittals of reports, layouts, Drawings, maps, calculations and spreadsheets, Specifications, Drawings and other Submittals from Contractor to Owner or Engineer and for responses from Engineer and Owner to Contractor regarding Submittals.	Email w/ Attachment or LFE	PDF	
a.5	Layouts and drawings to be submitted to Owner for future use and modification.	Email w/ Attachment or LFE	DWG	
a.6	Correspondence, reports and Specifications to be submitted to Owner for future word processing use and modification.	Email w/ Attachment or LFE	DOC	
a.7	Spreadsheets and data to be submitted to Owner for future data processing use and modification.	Email w/ Attachment or LFE	EXC	
a.8	Database files and data to be submitted to Owner for future data processing use and modification.	Email w/ Attachment or LFE	DB	
Notes				
(1)	All exchanges and uses of transmitted data are subject to the appropriate provisions of Contract Documents.			
(2)	Transmittal of written notices is governed by Paragraph 18.01 of the General Conditions.			
Key				
Email	Standard Email formats (.htm, .rtf, or .txt). Do not use stationery formatting or other features that impair legibility of content on screen or in printed copies			
LFE	Agreed upon Large File Exchange method (FTP, CD, DVD, hard drive)			
PDF	Portable Document Format readable by Adobe® Acrobat Reader Version 2020 or later compatible with Bluebeam Revu 2020			
DWG	Autodesk® AutoCAD .dwg format Version 2020			
DOC	Microsoft® Word .docx format Version 365			
EXC	Microsoft® Excel .xls or .xml format Version 365			
DB	Microsoft® Access .mdb format Version 365			

EXHIBIT B—FORESEEABLE BAD WEATHER DAYS

Month	Number of Foreseeable Bad 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	2	2	0
February	2	1	0
March	2	0	0
April	2	0	0
May	2	0	0
June	2	0	0
July	2	0	3
August	2	0	1
September	1	0	0
October	1	0	0
November	1	0	0
December	2	0	0

Notes:

- 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.

NOTICE TO PROCEED

Owner: Town of Emmitsburg, Maryland Owner's Project No.: 001
Engineer: RK&K, LLP Engineer's Project No.: 19082
Contractor: _____ Contractor's Project No.: _____
Project: _____
Contract Name: _____
Effective Date of Contract: _____

Owner hereby notifies Contractor that the Contract Times under the above Contract will commence to run on **[date Contract Times are to start]** pursuant to Paragraph 4.01 of the General Conditions.

On that date, Contractor shall start performing its obligations under the Contract Documents. No Work will be done at the Site prior to such date.

In accordance with the Agreement: ~~[Select one of the following two alternatives, insert dates or number of days, and delete the other alternative.]~~

~~The date by which Substantial Completion must be achieved is **[date for Substantial Completion, from Agreement]**, and the date by which readiness for final payment must be achieved is **[date for readiness, from Agreement]**.~~

~~[or]~~

The number of days to achieve Substantial Completion is 450 days from the date stated above for the commencement of the Contract Times, resulting in a date for Substantial Completion of **[date, calculated from commencement date above]**; and the number of days to achieve readiness for final payment is 480 days from the commencement date of the Contract Times, resulting in a date for readiness for final payment of **[date, calculated from commencement date above]**.

Before starting any Work at the Site, Contractor must comply with the following:

[Note any access limitations, security procedures, or other restrictions]

Owner: Town of Emmitsburg, Maryland
By (signature): _____
Name (printed): _____
Title: _____
Date Issued: _____
Copy: Engineer

8'-0"

2" (TYP)

PURPLE BORDER

FULL COLOR CITY SEAL



TOWN OF EMMITSBURG, MARYLAND

PROJECT NAME

PUBLIC WORKS DEPARTMENT

ARCHITECT/ENGINEER:

Contract No. :

For Additional Information

CONTRACTOR:

Call: 301-600-6300

4'-0"

4" x 4" POSTS

3/4" EXTERIOR PLYWOOD

NOTE:

ALL COSTS OF FURNISHING, ERECTING AND MAINTAINING THE "IMPROVEMENT SIGN", INCLUDING POSTS, WILL NOT BE PAID FOR SEPARATELY BUT SHALL BE INCLUDED IN THE "LUMP SUM" BID. CONTRACTOR TO PROVIDE 1 SIGN(S).

PURPLE LETTERS ON LUMINOUS WHITE BACKGROUND

3'-0"

3'-0"

EX. GRADE



RUMMEL, KLEPPER & KAHL, LLP
CONSULTING ENGINEERS
BALTIMORE, MARYLAND

Contractor's Application for Payment

Owner: _____	Owner's Project No.: _____
Engineer: _____	Engineer's Project No.: _____
Contractor: _____	Contractor's Project No.: _____
Project: _____	
Contract: _____	
Application No.: _____	Application Date: _____
Application Period: From _____ to _____	

1. Original Contract Price	\$ -
2. Net change by Change Orders	\$ -
3. Current Contract Price (Line 1 + Line 2)	\$ -
4. Total Work completed and materials stored to date (Sum of Column G Lump Sum Total and Column J Unit Price Total)	\$ -
5. Retainage	
a. _____ X \$ - Work Completed	\$ -
b. _____ X \$ - Stored Materials	\$ -
c. Total Retainage (Line 5.a + Line 5.b)	\$ -
6. Amount eligible to date (Line 4 - Line 5.c)	\$ -
7. Less previous payments (Line 6 from prior application)	
8. Amount due this application	\$ -
9. Balance to finish, including retainage (Line 3 - Line 4)	\$ -

Contractor's Certification

The undersigned Contractor certifies, to the best of its knowledge, the following:

(1) All previous progress payments received from Owner on account of Work done under the Contract have been applied on account to discharge Contractor's legitimate obligations incurred in connection with the Work covered by prior Applications for Payment;

(2) Title to all Work, materials and equipment incorporated in said Work, or otherwise listed in or covered by this Application for Payment, will pass to Owner at time of payment free and clear of all liens, security interests, and encumbrances (except such as are covered by a bond acceptable to Owner indemnifying Owner against any such liens, security interest, or encumbrances); and

(3) All the Work covered by this Application for Payment is in accordance with the Contract Documents and is not defective.

Contractor: _____

Signature: _____ **Date:** _____

Recommended by Engineer	Approved by Owner
By: _____	By: _____
Title: _____	Title: _____
Date: _____	Date: _____
Approved by Funding Agency	
By: _____	By: _____
Title: _____	Title: _____
Date: _____	Date: _____

Progress Estimate - Lump Sum Work

Contractor's Application for Payment

Owner: _____	Owner's Project No.: _____
Engineer: _____	Engineer's Project No.: _____
Contractor: _____	Contractor's Project No.: _____
Project: _____	
Contract: _____	

Application No.: _____ Application Period: From _____ to _____ Application Date: _____

A	B	C	D	E	F	G	H	I
Item No.	Description	Scheduled Value (\$)	Work Completed		Materials Currently Stored (not in D or E) (\$)	Work Completed and Materials Stored to Date (D + E + F) (\$)	% of Scheduled Value (G / C) (%)	Balance to Finish (C - G) (\$)
			(D + E) From Previous Application (\$)	This Period (\$)				
Original Contract								
			-			-		-
						-		-
						-		-
						-		-
						-		-
						-		-
						-		-
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						-		-
						-		-
						-		-
						-		-
						-		-
						-		-
						-		-
Original Contract Totals		\$ -	\$ -	\$ -	\$ -	\$ -		\$ -

Progress Estimate - Lump Sum Work

Contractor's Application for Payment

Owner: _____
 Engineer: _____
 Contractor: _____
 Project: _____
 Contract: _____

Owner's Project No.: _____
 Engineer's Project No.: _____
 Contractor's Project No.: _____

Application No.: _____ Application Period: From _____ to _____ Application Date: _____

A	B	C	D E		F	G	H	I
Item No.	Description	Scheduled Value (\$)	Work Completed		Materials Currently Stored (not in D or E) (\$)	Work Completed and Materials Stored to Date (D + E + F) (\$)	% of Scheduled Value (G / C) (%)	Balance to Finish (C - G) (\$)
			(D + E) From Previous Application (\$)	This Period (\$)				
Change Orders								
						-		-
						-		-
						-		-
						-		-
						-		-
						-		-
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						-		-
						-		-
						-		-
						-		-
						-		-
Change Order Totals		\$ -	\$ -	\$ -	\$ -	\$ -		\$ -
Original Contract and Change Orders								
Project Totals		\$ -	\$ -	\$ -	\$ -	\$ -		\$ -

Progress Estimate - Unit Price Work

Contractor's Application for Payment

Owner: _____
 Engineer: _____
 Contractor: _____
 Project: _____
 Contract: _____

Owner's Project No.: _____
 Engineer's Project No.: _____
 Contractor's Project No.: _____

Application No.: _____ Application Period: From _____ to _____ Application Date: _____

A	B	C	D	E	F	G	H	I	J	K	L
Bid Item No.	Description	Contract Information				Work Completed		Materials Currently Stored (not in G) (\$)	Work Completed and Materials Stored to Date (H + I) (\$)	% of Value of Item (J / F) (%)	Balance to Finish (F - J) (\$)
		Item Quantity	Units	Unit Price (\$)	Value of Bid Item (C X E) (\$)	Estimated Quantity Incorporated in the Work	Value of Work Completed to Date (E X G) (\$)				
Original Contract											
					-		-		-		-
					-		-		-		-
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					Original Contract Totals	\$	-	\$	-	\$	-

Progress Estimate - Unit Price Work

Contractor's Application for Payment

Owner: _____
 Engineer: _____
 Contractor: _____
 Project: _____
 Contract: _____

Owner's Project No.: _____
 Engineer's Project No.: _____
 Contractor's Project No.: _____

Application No.: _____ Application Period: From _____ to _____ Application Date: _____

A	B	C	D	E	F	G	H	I	J	K	L		
Bid Item No.	Description	Contract Information				Work Completed		Materials Currently Stored (not in G) (\$)	Work Completed and Materials Stored to Date (H + I) (\$)	% of Value of Item (J / F) (%)	Balance to Finish (F - J) (\$)		
		Item Quantity	Units	Unit Price (\$)	Value of Bid Item (C X E) (\$)	Estimated Quantity Incorporated in the Work	Value of Work Completed to Date (E X G) (\$)						
Change Orders													
					-		-		-		-		
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Change Order Totals					\$	-		\$	-	\$	-	\$	-
Original Contract and Change Orders													
Project Totals					\$	-		\$	-	\$	-	\$	-

Stored Materials Summary

Contractor's Application for Payment

Owner: _____	Owner's Project No.: _____
Engineer: _____	Engineer's Project No.: _____
Contractor: _____	Contractor's Project No.: _____
Project: _____	
Contract: _____	

Application No.: _____ Application Period: From _____ to _____ Application Date: _____

A	B	C	D	E	F	Materials Stored			Incorporated in Work			M
Item No. (Lump Sum Tab) or Bid Item No. (Unit Price Tab)	Supplier Invoice No.	Submittal No. (with Specification Section No.)	Description of Materials or Equipment Stored	Storage Location	Application No. When Materials Placed in Storage	Previous Amount Stored (\$)	Amount Stored this Period (\$)	Amount Stored to Date (G+H) (\$)	Amount Previously Incorporated in the Work (\$)	Amount Incorporated in the Work this Period (\$)	Total Amount Incorporated in the Work (J+K) (\$)	Materials Remaining in Storage (I-L) (\$)
Totals						\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -

WORK CHANGE DIRECTIVE NO.: [Number of Work Change Directive]

Owner: Town of Emmitsburg, Maryland	Owner's Project No.:	001
Engineer: RK&K, LLP	Engineer's Project No.:	19082
Contractor:	Contractor's Project No.:	
Project:		
Contract Name: New Creamery Road Sewage Pump Station		
Date Issued:	Effective Date of Work Change Directive:	

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

Description:

[Description of the change to the Work]

Attachments:

[List documents related to the change to the Work]

Purpose for the Work Change Directive:

[Describe the purpose for the change to the Work]

Directive to proceed promptly with the Work described herein, prior to agreeing to change in Contract Price and Contract Time, is issued due to:

Notes to User—Check one or both of the following

Non-agreement on pricing of proposed change. Necessity to proceed for schedule or other reasons.

Estimated Change in Contract Price and Contract Times (non-binding, preliminary):

Contract Price: \$ _____	[increase] [decrease] [not yet estimated].
Contract Time: _____ days	[increase] [decrease] [not yet estimated].

Basis of estimated change in Contract Price:

Lump Sum Unit Price Cost of the Work Other

Recommended by Engineer	Authorized by Owner
By: _____	_____
Title: _____	_____
Date: _____	_____

CHANGE ORDER NO.: [Number of Change Order]

Owner: Town of Emmitsburg, Maryland

Owner's Project No.: 001

Engineer: RK&K, LLP

Engineer's Project No.: 19082

Contractor:

Contractor's Project No.:

Project:

Contract Name: New Creamery Road Pump Station

Date Issued:

Effective Date of Change Order:

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

Description:

[Description of the change]

Attachments:

[List documents related to the change]

Change in Contract Price	Change in Contract Times [State Contract Times as either a specific date or a number of days]
Original Contract Price: \$ _____	Original Contract Times: Substantial Completion: _____ Ready for final payment: _____
[Increase] [Decrease] from previously approved Change Orders No. 1 to No. [Number of previous Change Order] : \$ _____	[Increase] [Decrease] from previously approved Change Orders No.1 to No. [Number of previous Change Order] : Substantial Completion: _____ Ready for final payment: _____
Contract Price prior to this Change Order: \$ _____	Contract Times prior to this Change Order: Substantial Completion: _____ Ready for final payment: _____
[Increase] [Decrease] this Change Order: \$ _____	[Increase] [Decrease] this Change Order: Substantial Completion: _____ Ready for final payment: _____
Contract Price incorporating this Change Order: \$ _____	Contract Times with all approved Change Orders: Substantial Completion: _____ Ready for final payment: _____

Recommended by Engineer (if required)

Accepted by Contractor

By: _____

Title: _____

Date: _____

Authorized by Owner

Approved by Funding Agency (if applicable)

By: _____

Title: _____

Date: _____

FIELD ORDER NO.: [Number of Field Order]

Owner: Town of Emmitsburg, Maryland

Owner's Project No.: 001

Engineer: RK&K, LLP

Engineer's Project No.: 19082

Contractor:

Contractor's Project No.:

Project:

Contract Name: New Creamery Road Sewage Pump Station

Date Issued:

Effective Date of Field Order:

Contractor is hereby directed to promptly perform the Work described in this Field Order, issued in accordance with Paragraph 11.04 of the General Conditions, for minor changes in the Work without changes in Contract Price or Contract Times. If Contractor considers that a change in Contract Price or Contract Times is required, submit a Change Proposal before proceeding with this Work.

Reference:

Specification Section(s):

Drawing(s) / Details (s):

Description:

[Description of the change to the Work]

Attachments:

[List documents supporting change]

Issued by Engineer

By: _____

Title: _____

Date: _____

GENERAL (PRIME) CONTRACTOR'S CERTIFICATION OF COMPLIANCE

Notes to User: This exhibit is the sample General (Prime) Contractor's Certification of Compliance with the American Iron and Steel requirements to be provided by all General (Prime) Contractors to Engineer for delivery to the Owner at Substantial Completion.

GENERAL (PRIME) CONTRACTOR'S CERTIFICATION OF COMPLIANCE WITH PROVISIONS OF THE AMERICAN IRON AND STEEL REQUIREMENTS OF SECTION 746 OF TITLE VII OF THE CONSOLIDATED APPROPRIATIONS ACT OF 2017 (DIVISION A - AGRICULTURE, RURAL DEVELOPMENT, FOOD AND DRUG ADMINISTRATION, AND RELATED AGENCIES APPROPRIATIONS ACT, 2017) AND SUBSEQUENT STATUTES MANDATING DOMESTIC PREFERENCE

DATE:

RE: PROJECT NAME
APPLICANT
CONTRACT NUMBER

I hereby certify that to the best of my knowledge and belief all Iron and Steel products installed for this project by my company and by any and all subcontractors and Manufacturers my company has contracted with for this project comply with Section 746 of Title VII of the Consolidated Appropriations Act of 2017 (Division A - Agriculture, Rural Development, Food and Drug Administration, and Related Agencies Appropriations Act, 2017) and subsequent statutes mandating domestic preference or are the subject of a waiver approved by the Secretary of Agriculture or designee.

Name of Construction Company (PRINT)

By Authorized Representative (SIGNATURE)

Title

MANUFACTURER'S CERTIFICATION OF COMPLIANCE

Notes to User: This exhibit is the sample Manufacturer's Certification of Compliance with the American Iron and Steel requirements to be provided by all Manufacturers of American Iron and Steel covered items, to be submitted by Contractor to the Engineer with the corresponding Shop Drawing submittal for delivery to the Owner at Substantial Completion.

EXAMPLE OF A MANUFACTURER'S CERTIFICATION OF COMPLIANCE WITH PROVISIONS OF THE AMERICAN IRON AND STEEL (AIS) REQUIREMENTS OF SECTION 746 OF TITLE VII OF THE CONSOLIDATED APPROPRIATIONS ACT OF 2017 (DIVISION A - AGRICULTURE, RURAL DEVELOPMENT, FOOD AND DRUG ADMINISTRATION, AND RELATED AGENCIES APPROPRIATIONS ACT, 2017) AND SUBSEQUENT STATUTES MANDATING DOMESTIC PREFERENCE

Date:

Company Name:

Company Address:

Subject: American Iron and Steel (AIS) Certification for Project (X), Owner's Name, and Contract Number

I, (company representative), certify that the (melting, bending, galvanizing, cutting, etc.) processes for (manufacturing or fabricating) the following products and/or material shipped or provided for the subject project is in full compliance with the AIS requirement as mandated by Section 746 of Title VII of the Consolidated Appropriations Act of 2017 (Division A - Agriculture, Rural Development, Food and Drug Administration, and Related Agencies Appropriations Act, 2017) and subsequent statutes mandating domestic preference.

Item, Products and/or Materials, and location of delivery (City, State):

1.

2.

Such processes for AIS took place at the following location:

(City, State)

Authorized Company Representative Signature

Notes: Authorized signature will be Manufacturer's representative, not the material distributor or Supplier. If any of the above compliance statements change while providing materials to this project, please immediately notify the person(s) who is requesting to use your product(s).

CERTIFICATE OF SUBSTANTIAL COMPLETION

Owner:
Engineer:
Contractor:
Project:
Contract Name:

Owner's Project No.:
Engineer's Project No.:
Contractor's Project No.:

This Preliminary Final Certificate of Substantial Completion applies to:

All Work The following specified portions of the Work:

[Describe the portion of the work for which Certificate of Substantial Completion is issued]

Date of Substantial Completion: **[Enter date, as determined by Engineer]**

The Work to which this Certificate applies has been inspected by authorized representatives of Owner, Contractor, and Engineer, and found to be substantially complete. The Date of Substantial Completion of the Work or portion thereof designated above is hereby established, subject to the provisions of the Contract pertaining to Substantial Completion. The date of Substantial Completion in the final Certificate of Substantial Completion marks the commencement of the contractual correction period and applicable warranties required by the Contract.

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

Amendments of contractual responsibilities recorded in this Certificate should be the product of mutual agreement of Owner and Contractor; see Paragraph 15.03.D of the General Conditions.

The responsibilities between Owner and Contractor for security, operation, safety, maintenance, heat, utilities, insurance, and warranties upon Owner's use or occupancy of the Work must be as provided in the Contract, except as amended as follows:

Amendments to Owner's Responsibilities: None As follows:

[List amendments to Owner's Responsibilities]

Amendments to Contractor's Responsibilities: None As follows:

[List amendments to Contractor's Responsibilities]

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

[List attachments such as punch list; other documents]

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

Engineer

By (*signature*): _____

Name (*printed*): _____

Title: _____

NOTICE OF ACCEPTABILITY OF WORK

Owner: _____ Owner's Project No.: _____
Engineer: _____ Engineer's Project No.: _____
Contractor: _____ Contractor's Project No.: _____
Project: _____
Contract Name: _____
Notice Date: _____ Effective Date of the Construction Contract: _____

The Engineer hereby gives notice to the Owner and Contractor that Engineer recommends final payment to Contractor, and that the Work furnished and performed by Contractor under the Construction Contract is acceptable, expressly subject to the provisions of the Construction Contract's Contract Documents ("Contract Documents") and of the Agreement between Owner and Engineer for Professional Services dated **[date of professional services agreement]** ("Owner-Engineer Agreement"). This Notice of Acceptability of Work (Notice) is made expressly subject to the following terms and conditions to which all who receive and rely on said Notice agree:

1. This Notice has been prepared with the skill and care ordinarily used by members of the engineering profession practicing under similar conditions at the same time and in the same locality.
2. This Notice reflects and is an expression of the Engineer's professional opinion.
3. This Notice has been prepared to the best of Engineer's knowledge, information, and belief as of the Notice Date.
4. This Notice is based entirely on and expressly limited by the scope of services Engineer has been employed by Owner to perform or furnish during construction of the Project (including observation of the Contractor's Work) under the Owner-Engineer Agreement, and applies only to facts that are within Engineer's knowledge or could reasonably have been ascertained by Engineer as a result of carrying out the responsibilities specifically assigned to Engineer under such Owner-Engineer Agreement.
5. This Notice is not a guarantee or warranty of Contractor's performance under the Construction Contract, an acceptance of Work that is not in accordance with the Contract Documents, including but not limited to defective Work discovered after final inspection, nor an assumption of responsibility for any failure of Contractor to furnish and perform the Work thereunder in accordance with the Contract Documents, or to otherwise comply with the Contract Documents or the terms of any special guarantees specified therein.
6. This Notice does not relieve Contractor of any surviving obligations under the Construction Contract, and is subject to Owner's reservations of rights with respect to completion and final payment.

Engineer

By *(signature)*: _____
Name *(printed)*: _____
Title: _____

SECTION IV

CONSTRUCTION SPECIFICATIONS

TECHNICAL SPECIFICATIONS

New Creamery Road Sewage Pump Station Town of Emmitsburg, Maryland



Bid Submission



Divisions 1-15

Professional Certification. I hereby certify that these documents were prepared or approved by me, and that I am a duly licensed professional engineer under the laws of the State of Maryland.
License No. 22765 Expiration Date: 07/09/2024



Divisions 16 & 17

Professional Certification. I hereby certify that these documents were prepared or approved by me, and that I am a duly licensed professional engineer under the laws of the State of Maryland.
License No. 50811 Expiration Date: 06/14/2023

JANUARY 2023

Prepared By:



700 East Pratt Street, Suite 500
Baltimore, Maryland 21202

TECHNICAL SPECIFICATIONS

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DESCRIPTION

SECTION

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GENERAL REQUIREMENTS

PART 1 - GENERAL

1.01 DESCRIPTION

- A. These Technical Specifications are hereby made a part of the Contract. In case of any conflict with the Frederick County General Conditions and Standard Specifications for Water Mains, Sanitary Sewers and Related Structures, or other sections of the Contract, these Technical Specifications shall govern.
- B. All work to be performed under this Contract shall be done in strict compliance with the Frederick County General Conditions and Standard Specifications for Water Mains, Sanitary Sewers and Related Structures as amended, insofar as the same may be applicable except as modified herein.

1.02 BACKGROUND

- A. Contract Documents were prepared for the Project by RK&K, 700 East Pratt Street, Suite 500, Baltimore, MD 21202 out of the York, Pennsylvania branch office. Phone 717.600.2220 or 800.787.2755.
- B. The Drawings and written Contract Documents are intended to indicate as clearly as practicable the work to be done. The Contractor must realize; however, that construction details cannot always be accurately anticipated and that in executing the work, field conditions may require reasonable modifications in the details of the Drawings and the work involved. Work under the Contract shall be carried out to meet these field conditions to the satisfaction of the Engineer and in strict conformance with his instructions, the Drawings, conditions and covenants of the Contract Documents in accordance with their true intent and full meaning.

1.03 WORK PERIODS AND HOLIDAYS

- A. The normal time of work for this Contract is limited to 40 hours per week and shall generally be between the hours of 7:00 a.m. and 5:00 p.m., Monday through Friday. The Contractor may elect to work beyond these hours or on weekends provided that all costs incurred by the Owner for additional engineering and costs associated with additional resident project representative (RPR) and Town employee inspection time shall be borne by the Contractor. The Contractor must submit a written request to work outside the normal hours to the inspector for the project and it must be approved by the Town. This request shall be completed five (5) business days in advance of the occurrence for working outside normal hours.
- B. The Owner shall deduct the cost of additional inspection and engineering costs from monies due the Contractor.

- C. If it shall become imperative to perform work at night, the Owner and Engineer shall be informed according to Paragraph 1.03.A a reasonable time in advance of the beginning of such work. Only such work shall be done at night as can be done satisfactorily and in a first class manner. Sufficient temporary lighting and all other necessary facilities for carrying out and inspecting the work and for the safety of personnel shall be provided and maintained at all points where such work is being done.
- D. Unless otherwise specifically permitted, all work that would be subject to damage shall be stopped during inclement, stormy or freezing weather. Only such work as will not suffer injury to workmanship or materials will be permitted. Contractor shall carefully protect his work against damage or injury from the weather, and when work is permitted during freezing weather, he shall provide and maintain approved facilities for heating the materials and for protecting the finished work.
- E. The Town observes the following holidays: New Year's Eve; New Year's Day; Martin Luther King Jr. Day; Good Friday; Memorial Day; Juneteenth Day; Independence Day; Labor Day; Columbus Day; Veteran's Day; Thanksgiving Day; Thanksgiving Friday; Christmas Eve; and Christmas Day.
- F. Permission to Work
 - 1. Except as noted below, the Contractor will not be permitted to do any work which requires the services of the Town's inspection or RPR more than nine hours a day nor on the days on which the abovementioned holidays are observed by the Town or on Saturdays or Sundays, unless otherwise authorized by the Engineer in writing. However, the Contractor with verbal permission of the Engineer, may be permitted to perform clean-up and such other items for which no specific payment is involved on Saturdays.
 - 2. In case of extreme emergency, which may require that the work be done on Saturdays, Sundays, holidays or longer than nine hours per day, the Contractor shall request permission of the Engineer to perform work. If, in the opinion of the Engineer, the work is bona fide, he may grant permission of the Contractor to work such hours as may be necessary. Also, if in the opinion of the Engineer a bona fide emergency exists, he may direct the Contractor to work such hours as may be necessary whether the Contractor requests permission to do so or not.

1.04 DEMOLITION

- A. Exterior Dust Control: To prevent unnecessary spread of dust during performance of exterior demolition work, thoroughly moisten surfaces and debris as required to prevent dust from being a nuisance to the public, neighbors and concurrent performance of other work on the site. Water for use in dust control shall be obtained from the Contractor's own source.

- B. Protection: Exercise care during demolition work to confine demolition operations to those as indicated on the Drawings. The physical means and methods used for protection are at the Contractor's option.
 - 1. Additionally, if public safety is endangered during the progress of the demolition work, provide adequate protective measures to protect public pedestrian and vehicular traffic on streets and walkways.
 - 2. Signs, signals and barricades used shall conform to requirements of Federal, State and local laws, rules, regulations, precautions, orders and decrees.
- C. Materials needed or required for temporary protection in the form of barricades, fences, enclosures, etc., may be pre-used construction materials of sound condition and reasonably clean. However, the condition of same materials shall meet or exceed the requirements of governing agencies or approving bodies as may be involved with the work.
- D. The means and methods of performing demolition (and removal) operations are the sole responsibility of the Contractor. However, equipment used and methods of demolition (and removal) will be subject to approval of the Engineer.

1.05 TRAILERS, STAGING AND MATERIAL/EQUIPMENT STORAGE

- A. Obtaining area(s) for placement of job trailer(s), staging and materials/equipment storage, if needed, is the responsibility of the Contractor. Written permission is required for use of any private properties and Owner approval is required for any proposed use of public street rights-of-ways for location of trailers, parking of equipment, or staging of materials. No special permission is required for temporary storage of materials on streets and/or sewer easements where such materials are being installed.

1.06 CONTRACTOR USE OF PREMISES

- A. General: Limit use of the premises to construction activities in areas indicated; allow for use by the public.
- B. Confine operations to area within property limits. Portions of the site beyond the property limits are not to be disturbed.
- C. Keep driveways and entrances servicing the premises clear and available to the public at all times. Do not use these areas for parking or storage of materials. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on site.

1.07 PROGRESS SCHEDULE

A. General:

1. Scheduling of construction is the responsibility of the Contractor. The Contractor must take all reasonable action to avoid or to mitigate the effects of delays including, but not limited to, rescheduling or resequencing the work, accepting other work, and reassigning personnel. When the Contractor is responsible for any delays, the Owner may order the Contractor to accelerate construction, work overtime, add additional shifts or manpower, work on weekends, or to do anything else reasonably necessary to complete the work on time, at no additional cost to the Owner.
2. The Contractor shall submit to the Owner for review and approval a Baseline Schedule, Monthly Progress Schedules, and any required Recovery Schedules, as outlined in Paragraphs B through F of this section.
3. Failure of the Contractor to comply with the requirements of this section shall be grounds for determination by the Owner that the Contractor is not prosecuting the work with due diligence as to ensure completion of the work within the time specified in the Contract Documents or as agreed upon with the Owner after execution of the Contract. The Owner may terminate the Contractor's right to proceed with the work, or any separable part thereof.
4. The Contractor does not have the unilateral right to complete the work late and pay liquidated or other damages.

B. Baseline Schedule:

1. Within 30 days after the award of the Contract, the Contractor shall submit to the Owner a detailed Baseline Schedule indicating the time allocated by the Contractor for performance of each portion of the work. The schedule shall show commencement of work from the date the Notice to Proceed is issued. The schedule shall show completion of the work within the Contract time as specified in the Contract Documents or as agreed upon with the Owner after execution of the Contract.
2. The submitted Baseline Schedule shall be properly and reasonably sequenced to show the order of performing the various tasks of work. The schedule shall clearly identify the sequencing restraints and the critical activities necessary to complete the work on time and shall list proposed workdays, holidays and any special non-work days.
3. The submitted Baseline Schedule shall list the dollar value for each work item and shall show the Contractor's labor requirements for achieving each work item. The schedule shall also include a list of submittals related to material and equipment fabrication orders, permits, easements and any other work tasks requiring submittals. Each necessary submittal shall be

shown on the schedule as a separate work activity with necessary dates of submittal, anticipated review and response time, anticipated dates of re-submittal if necessary, and anticipated dates for final review and approval. Submittal review and response time shall be a minimum of 21 working days. A longer review and response time may be required for large or complex submittals, at the Engineer's discretion.

4. Within 14 calendar days after the Owner reviews and rejects or conditionally approves the submitted Baseline Schedule, the Contractor shall make all necessary corrections and resubmit the corrected schedule. The Owner may decline to issue Notice to Proceed until the Contractor submits the required schedule and the Owner approves it.

C. Monthly Progress Schedules:

1. Within 30 days after the Owner issues Notice to Proceed, and on monthly basis thereafter, the Contractor shall submit a revised Monthly Progress Schedule accurately updated to reflect all revisions to the previously submitted schedule including actual commencement dates of listed work activities, actual work activities completed to date, and any sequence changes made or planned for the order of work activities and their effect on the critical path for completion of the whole project. The sequencing changes shall show extension of times granted by the Owner and any delays or early completion of work activities.
2. The Contractor shall meet with the Owner, or its designated attendee, at least once a month to discuss in detail the Contractor's updating of the Monthly Progress Schedule and the necessity for revision or correction in the schedule.
3. Within 10 calendar days after the Owner reviews and rejects or conditionally approves the submitted Monthly Progress Schedule, the Contractor shall make all necessary corrections and resubmit the corrected schedule.
4. The Contractor shall submit the required Monthly Progress Schedule whether or not the Contractor submits an application for payment each month. The Owner may decline to process any pending payment requests for this project until the Contractor submits the required schedule and the Owner approves it.

D. Recovery Schedules:

1. Within 10 calendar days after the project falls behind schedule or is alleged by either party to be behind schedule, the Contractor shall furnish to the Owner, at no additional cost, a revised schedule hereinafter called a "Recovery Schedule". The Recovery Schedule shall show how the Contractor will finish the project by the Contract completion date.

2. The Recovery Schedule shall include all of the information required under Paragraphs B, C and E of this section.
- E. Logical Sequencing and Layout of the Submitted Schedules (CPM Schedules):
1. Unless the Contract Documents expressly permit the Contractor to use a schedule other than a Critical Path Method (CPM) schedule, the submitted Baseline Schedule, the subsequent Monthly Progress Schedules, and any required Recovery Schedules shall all be CPM schedules.
 2. CPM schedules are required to assure adequate planning and execution of the work and in evaluating the progress of the work and the impact on the schedule events, which could affect the completion date.
 3. The submitted CPM schedules shall clearly designate the Substantial Completion Date of the project. This is the date when the construction project or specified part thereof is sufficiently completed, in accordance with the Contract Documents, such that the project or specified part thereof can be used to accomplish the purposes for which it was intended.
 4. Logic or network diagrams shall show the order and interdependence of activities and the sequence in which work is to be accomplished as planned by the Contractor. These diagrams must show how the start of a given activity is dependent on preceding activities and how its completion restricts the start of the following activities.
 5. At a minimum, the following information shall be furnished for each work activity:
 - a. Activity number
 - b. Description of activity
 - c. Activity numbers for any predecessor and successor activities
 - d. Relationships with preceding activities
 - e. Activity duration in calendar days
 - f. Percent of activity completed
 - g. Early start date (by calendar date)
 - h. Early finish date (by calendar date)
 - i. Actual start date (by calendar date)
 - j. Actual finish date (by calendar date)
 - k. Float or slack
 6. The Monthly Progress Schedules and any required Recovery Schedules shall show the activities or portion of the activities completed during the reporting period and their total dollar value as basis for the Contractor's periodic request for payment. For each activity, the update shall state the percentage of work actually completed and the progress along the critical path in terms of days ahead or behind the allowable dates.

7. The Monthly Progress Schedules and any required Recovery Schedules shall include a comments section summarizing the updated analysis for the project as a whole, describing problems with work activities, and explaining proposed corrective actions.
 8. Approved change orders shall be reflected as new activities or as change in logic and/or time framing of existing activities. They shall be shown on the updated schedule that immediately follows a receipt of a Change Order Approval from the Owner.
- F. Form of Schedule Submittal:
1. All schedules, including the Baseline Schedule, the Monthly Progress Schedules, and any required Recovery Schedules shall be submitted electronically.

1.08 CODES-RULES-PERMITS-FEES

- A. General: The Contractor shall give all necessary notices, obtain all permits, and pay all governmental taxes, charges, fees and other costs necessary and incidental to the due and lawful prosecution of the work; file all necessary plans, prepare all documents and obtain all necessary approvals of all governmental departments having jurisdiction; obtain all required Certificates of Inspection and Approval for the work, deliver same to the Engineer, and pay all expenses associated with them.
- B. Compliance: All materials furnished, and all work installed shall comply with the rules and regulations of the National Fire Protection Association, with all requirements of local utility companies, with the recommendations of the fire insurance rating organization having jurisdiction and with the requirements of all governmental departments having jurisdiction. Any items or requirements specified or indicated on the drawings in excess of minimum code requirements and permitted under the code shall be provided, unless special permission is obtained from the Engineer to the contrary.
- C. Nonresidential building permit number 436345 was issued by the Frederick County Division of Planning and Permitting, Department of Permits and Inspections on 12/08/2022, expires 12/08/2023. Certification of occupancy is required before building may be occupied. Contractor shall be responsible to obtain any separate electrical, plumbing, fire, and grading permits required. Contractor shall coordinate with the County for finalization of the grading permit based upon the signed ESC Plans. Plans must be maintained and available to County Inspectors on the jobsite. All building permits expire 1 year from the date of issuance except when an extension has been granted. Contractor shall be responsible to login to the citizen portal (<https://planningandpermitting.frederickcountymd.gov/>), prior to expiration of the permit, to submit an extension request. See Appendix B for the Building Permit and Placard.

1.09 PHOTOGRAPHIC REPORTS

- A. The Contractor shall submit each month during construction not less than ten (10) digital photographs (electronic files) to the Owner, as outlined and stipulated hereinafter.
- B. The Owner, or its representative, will designate the origin points of the photographs and the desired scope or perception of the photographs which are intended to give a complete picture of the status of the project. The photographs shall be taken by a person or firm experienced in such work and approved by the Engineer.
- C. The cost of the aforementioned will not be a pay item, but shall be included in the lump sum price bid and no additional compensation to the Contractor will be considered.

1.10 BORINGS AND TEST PITS

- A. Neither the Town of Emmitsburg nor the Engineer warrants or guarantees the conditions and/or materials that will be encountered in the prosecution of the work and/or any part thereof.
- B. Bidders are urged to make their own subsurface exploration upon approval of written application. The cost of this exploration shall be included in the lump sum price bid; no additional compensation to the Contractor will be considered.
- C. Soil borings or test pits for soil determination in improved roads are not to be excavated by the Contractor unless permission is granted by the Town of Emmitsburg.
- D. All known subsurface lines, pipes, conduits and structures are shown on the plans and profiles. These lines are shown based upon the best available plans and maps. The locations have not been verified by test pits and the Town of Emmitsburg assumes no responsibility for the accuracy of the Drawings. In any area where the Contractor must make connections to or cross existing lines, it shall be his responsibility to test pit the lines and verify the locations to his satisfaction. In the event that lines are not found located as shown on the plans, the Contractor shall notify the Engineer so that an evaluation can be made as to the magnitude and methods of any adjustments in the plans.
- E. The Contractor shall be solely responsible for all damage to underground or aboveground lines encountered in any manner during construction. When crossing and working in the vicinity of existing lines, it shall be the Contractor's responsibility to properly support and maintain the operation of the lines. Extreme care must be exercised in excavation and backfill operations. The Contractor shall correct at his own expense all damage caused to existing lines.

1.11 STORAGE AND PROTECTION OF EQUIPMENT AND MATERIALS

- A. The Contractor shall maintain a neat and orderly construction site at all times.
- B. The Contractor shall define the limits of a storage area(s) within the property limits. The Contractor shall be fully responsible for the security of this area(s), including fencing, watchman, and other means of security. Under no circumstances will the Owner be responsible for the security of any property belonging to the Contractor, his subcontractors, or any of his work forces.
- C. All equipment and materials provided and work performed under this Contract shall be protected from the elements and physical damage before and after installation. The Contractor shall be responsible for work, equipment, and materials until inspected, tested and finally accepted.
- D. The Contractor shall adhere to the Manufacturer's recommended storage procedures for all equipment furnished under this Contract. At no time shall the Contractor store material in a manner that contradicts these procedures. Specific types of equipment require storage procedures in addition to the minimum procedures defined by the Manufacturer. The Contractor shall refer to the various sections of these Specifications for these requirements.
- E. During construction, the open ends of work shall be effectively closed with temporary covers or plugs to prevent the entry of foreign material.
- F. Where permanent equipment called for under this Contract is installed before the erection of adequate protective structures, the Contractor, without additional compensation therefore, shall provide approved effective and durable covers for fully protecting such equipment against damage from the elements or from any other cause.
- G. All electrical equipment shall be carefully and effectively covered with waterproofing material such as plastic wrap (6 mil minimum) and rigid barriers for protection at all times from the elements, and/or dust, moisture and impacts resulting from construction activities. All existing electrical equipment to remain shall be provided with a temporary heat source to prevent condensation for the duration of construction.
- H. All structures, machinery, equipment, piping, electric conduit, wiring and accessories and appurtenances shall be adequately supported and safeguarded against all damage or injury during performance of work under this Contract. The Contractor shall be responsible for all damage or injury resulting from his operations and shall repair such damage immediately and to the satisfaction of the Engineer.

- I. The Contractor shall make all arrangements and provisions necessary for the storage of materials and equipment. All excavated material, construction equipment, and materials and equipment to be incorporated into the work shall be placed so as not to injure any part of the work or existing facilities, and so that free access can be achieved at all times to all parts of the work and to all public utility installations in the vicinity of the work. Materials and equipment shall be kept neatly and compactly stored in locations that will cause a minimum of inconvenience to other Contractors, public travel, adjoining owners, tenants, occupants and Owner personnel.
- J. No delivery of materials and equipment will be accepted by the Owner, and all expenses incurred by the Owner in handling materials or equipment which have been consigned or directed to the Owner will be charged to the Contractor.
- K. Following completion of the work, but before final payment, the Contractor shall remove all trailers, paving, stockpiled soil, stone, fencing, and other items used by him/her during the construction of the project and/or contained in his storage areas(s). The Contractor shall be responsible for placing topsoil, seeding and mulching in accordance with the Contract Drawings.

1.12 INTENT

- A. It is the intent of the Drawings and Specifications to provide the Contractor with such information and instructions as may be necessary to complete this contract and to provide a complete and workable installation. The Contractor shall perform all work in accordance with the lines, grades, cross sections and dimensions shown on the plans. The Contractor shall furnish, unless otherwise provided in these plans and specifications, all materials, implements, machinery, equipment, tools, supplies, transportation and labor necessary for the prosecution and completion of the work. All materials and equipment installed as part of the permanent installation shall be new. It is intended that the Drawings and Specifications shall supplement each other. However, where variances occur between the Drawings and the Specifications or within the Document itself, the item or arrangement of better quality, greater quantity or higher cost shall be included in the Contract price. The Engineer will decide on the item and manner in which the work shall be installed.
- B. Completeness: Any apparatus, appliance, material or work not shown on the Drawings but mentioned in the Specifications, or vice-versa, or any incidental accessories necessary to make the work complete and perfect in all respects and ready for operation, even if not particularly specified, shall be provided by the Contractor without additional expense to the Town of Emmitsburg.
- C. Schematics may not be shown to scale on Drawings, but the work shown on the schematic shall be provided by the Contractor without additional cost to the Town of Emmitsburg.

- D. Adequacy: With submission of bid, the Contractor shall give written notice to the Engineer of any materials or apparatus believed inadequate or unsuitable; in violation of laws, ordinances, rules or regulations of Authorities having jurisdiction; and any necessary items of work omitted. In the absence of such written notice, it shall be understood that the Contractor has included the cost of all required items in his/her proposal and that he/she will be responsible for the approved satisfactory functioning of the entire system without extra compensation.

1.13 VIBRATION

- A. It shall be the responsibility of the Contractor to protect and isolate from the existing structures all vibrations resulting from equipment operation. Insofar as practical, all mechanical and electrical equipment and its installation shall be vibration free. Under no circumstances shall any vibration be transmitted to the structures. Vibration isolators used in the installation shall be subject to the Engineer's approval.

1.14 GUARANTEE

- A. The Contractor hereby guarantees all of the work including all components, for a period of at least two (2) years after the date of Substantial Completion thereof by the Owner, as follows:
 1. Against all faulty or imperfect materials and against all imperfect, careless and/or unskilled workmanship.
 2. That the equipment and each and every part thereof shall operate with proper care and attention in a satisfactory and efficient manner, and in accordance with the requirements of these Contract Documents.
 3. That the structure, above and below grade, shall be entirely watertight and leak-proof at every joint and point of penetration for pipes, hatches, doors, etc.
 4. The Contractor agrees to replace with proper workmanship and materials, and to re-execute, correct, or repair, without cost to the Owner, any work which may be found to be improper and/or which does not operate in a satisfactory manner or fails to perform as specified.
 5. The guarantee obligations assumed by the Contractor under these Contract Documents shall not be held or taken to be in any way impaired because of the specifications, indication or approval by or on behalf of the Owner of any articles, materials, means, combinations or things used or to be used in the construction, performance and completion of the work or any part thereof.

6. No use or acceptance by the Owner of the work or any part thereof, nor any failure to use the same, nor any repairs, adjustments, replacements or corrections made by the Owner due to the Contractor's failure to comply with any of his obligations under the Contract Documents, shall impair in any way the guarantee obligations assumed by the Contractor under these Contract Documents.
7. The Contractor shall also, during this two-year guarantee period, be responsible for the proper operation and adjustment of all systems, equipment, apparatus or devices installed by him.
8. During the guarantee period, the Contractor shall respond to the site for required repair or replacement work within 48 hours of notification.

1.15 NAMEPLATES

- A. The Contractor shall provide and install corrosion-resistant metal nameplates, with data engraved or stamped, for permanent attachment on all equipment. The data shall include the manufacturer, product name, model number, serial number, capacity, size, operating and power characteristics, and other essential data, as applicable for the particular equipment. The nameplates shall be permanently fastened to the equipment in a location that is accessible and visible, in a manner suitable for the particular equipment.
- B. In addition to the manufacturer's nameplates, pumps shall be permanently identified by name and number corresponding to the as-built drawings with nameplates which shall be engraved and laminated black-on-white finish phenolic nameplates. Data and installation shall be approved by the Engineer. Nameplate letters shall be minimum 2-inch high etched white letters and beveled white trim. Nameplates for instrument panels shall be provided with 3/8-inch high letters. Identifying characters shall be not less than 2-inches high and shall be painted. Decals, Rotex, or Dymo field applied labels will not be acceptable. All nameplate data shall be reproduced in the Operating and Maintenance Manuals.

PART 2 - PRODUCTS

(NOT USED)

PART 3 - EXECUTION

(NOT USED)

END OF SECTION

SECTION 01200
PROJECT MEETINGS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. This Section specifies administrative and procedural requirements for project meetings including but not limited to:
 - 1. Preconstruction Conference.
 - 2. Progress Meetings.
- B. Construction schedules are specified in another Division 1 Section.

1.03 PRECONSTRUCTION CONFERENCE

- A. At the Owner's discretion, Owner may schedule a preconstruction conference and organizational meeting no later than fifteen (15) days after execution of the Agreement and prior to commencement of construction activities.
- B. Attendees: The Owner, Contractor, and Engineer.
- C. Agenda: Discuss items of significance that could affect progress including such topics as:
 - 1. Tentative construction schedule
 - 2. Critical Work sequencing
 - 3. Designation of responsible personnel
 - 4. Procedures for processing field decisions and Change Orders
 - 5. Procedures for processing Applications for Payment
 - 6. Distribution of Contract Documents
 - 7. Submittal of Shop Drawings, Product Data and Samples
 - 8. Preparation of record documents
 - 9. Use of the premises
 - 10. Office, Work and storage areas
 - 11. Equipment deliveries and priorities
 - 12. Safety procedures
 - 13. First aid

14. Security
15. Housekeeping
16. Working hours
17. Public Works Employment Verification Act requirements

D. Engineer will moderate meeting, record minutes and distribute copies of same to meeting attendees.

1.04 PROGRESS MEETINGS

A. Engineer will conduct progress meetings at the Project site as necessary. Any progress meetings will be scheduled as required.

B. Attendees: In addition to representatives of the Owner and Engineer, each subcontractor, supplier or other entity concerned with current progress or involved in planning, coordination or performance of future activities shall be represented at these meetings by persons familiar with the Project and authorized to conclude matters relating to progress.

C. Agenda: Review and correct or approve minutes of the previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to the current status of the Project.

1. Contractor's Construction Schedule: Review progress since the last meeting. Determine where each activity is in relation to the Contractor's Construction Schedule, whether on time or ahead or behind schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.

2. Review the present and future needs of each entity present, including such items as:

- a. Interface requirements
- b. Time
- c. Sequences
- d. Deliveries
- e. Off-site fabrication problems
- f. Access
- g. Site utilization
- h. Temporary facilities and services
- i. Hours of Work
- j. Hazards and risks
- k. Housekeeping
- l. Quality and Work standards
- m. Change Orders
- n. Documentation of information for payment requests

- o. Documentation relative to Public Works Employment Verification Act
- D. Reporting: After each progress meeting date, Engineer will distribute copies of minutes of the meeting to each party present and to other parties who should have been present.
 - 1. Schedule Updating: Revise the construction schedule after each progress meeting where revisions to the schedule have been made or recognized.

PART 2 - PRODUCTS

(NOT USED)

PART 3 – EXECUTION

(NOT USED)

END OF SECTION

SECTION 01300

SUBMITTALS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. This Section specifies administrative and procedural requirements for submittals required for performance of Work, including:
 - 1. Contractor's construction schedule
 - 2. Submittal schedule
 - 3. Shop drawings
 - 4. Product data
- B. Administrative Submittals: Refer to other Division 1 Sections and other Contract Documents for requirements for administrative submittals.

1.03 SUBMITTAL PROCEDURES

- A. Ten days after notice to proceed, the Contractor shall submit a submittal schedule listing as near as practicable by specification section number, all submittals required and approximate date submittal will be forwarded. No submittals will be reviewed by the Engineer until the submittal schedule has been submitted and approved.
- B. Submittals are generally defined as all drawings, diagrams, illustrations, catalog cut sheets, product data sheets, brochures, schedules, bills of material, and other data, certified correct for construction, which are prepared by the Contractor, his subcontractors, suppliers or distributors, or equipment fabricators or manufacturers, and which illustrate the manufacture, fabrication, construction, installation of the work, or a portion thereof.
- C. The Contractor's attention is specifically directed to the fact that working drawings are required, and shall be submitted, for each and every element of the work including, but not limited to, excavation support systems, reinforced concrete formwork systems, reinforcing steel details, concrete pours, construction joints, waterstops, structural steel and miscellaneous metals, masonry work, roofing

systems, each and every item of mechanical and electrical equipment, electrical conduit systems showing proposed field assembly, piping regardless of size or whether fabricated on or off the project site, and all other shop drawings which may be necessary, in the opinion of the Engineer, to comply with the all-inclusive intent of this requirement. Each submittal shall be assigned a sequential number; Submittal No. 1, 2, 3, 4, etc. for purposes of easy identification, and shall retain its assigned number, with appropriate subscript, on all required resubmissions. Changing manufacturers or models during the course of the submittal process shall not be cause for assigning a new submittal number. Once an item of work has been assigned a submittal number, that item of work shall retain the same number, for the duration of the project.

The following stamp shall be affixed to each submittal and appropriately completed.

CHECKED AND APPROVED FOR SUBMISSION	
(CONTRACTOR'S NAME)	
JOB	_____
CONTRACT NO.	_____
DATE	_____ BY _____
SUBMITTAL NUMBER	_____
ITEM	_____
CONTRACT REFERENCES:	
SPECIFICATION	_____
DRAWING	_____

Resubmittals shall be labeled with the letter "R" followed by the number of the resubmission. Example: The Contractor's tenth submittal, being resubmitted for the first time shall be numbered Submittal No. 10R1, resubmitted for the second time shall be numbered Submittal No. 10R2, etc. If a submittal is "approved as noted" and/or additional or supplemental information is requested, the additional information should be labeled with the original submittal number followed by the letter "A" and then sequential lettering for subsequent supplemental information submittals. Example: A resubmittal of Submittal 12 is submitted as Submittal No. 12R1, which is "approved as noted" with a comment to provide a color chart. The color chart shall be submitted as Submittal No. 12R1A.

- D. All shop drawings shall be in conformity with the Contract Drawings and Special Provisions. All shop drawings except diagrams, illustrations, brochures and schedules shall be to appropriate scale, but in no case smaller than 1/4" = 1'-0", and shall give all dimensions required for manufacture, fabrication, assembly, installation and incorporation in the work. All shop drawings shall be complete, accurate and distinct, and shall show outline and section views, details, kinds of materials to be used, the kind of machine work and finish to be applied, and the installed locations of the said materials, equipment, accessories, appurtenances and related items.

Shop drawings showing field assembly of piping and/or conduit systems shall incorporate sufficient views, sections, plans and elevations to show each and every fitting, specialty, and item of equipment, including locations and spacing of hangers and supports. Piping and/or conduit systems 2-inches in diameter and smaller may be shown as a single line. Equipment and specialties installed within and/or connected to piping and conduit systems shall be cross referenced to equipment and specialty shop drawings by submittal identification number, manufacturer name, and catalog or model number. Such cross reference data may be shown at each individual equipment or specialty item on the system assembly drawing or, at the Contractor's option, may be incorporated in a coded bill of materials prepared integral with, and as a part of, the applicable shop drawing.

- E. Electrical shop drawings include, but are not necessarily limited to, complete terminal identification diagrams and schedules, complete point-to-point interconnection diagrams, and complete single line and elementary wiring diagrams for all power, signal and control systems, together with panel layout drawings. Diagrams shall be oriented to display the general arrangement and location of wiring and equipment which is seen when facing the appropriate panels for maintenance and adjustment purposes, i.e.; for panels wired and serviced from the front, diagrams shall depict a front view, and for panels wired and serviced from the rear, diagrams shall depict a rear view. Mirror image diagrams are prohibited. Terminal point and wire identification on all shop drawings shall be identical to related terminal point and wire identification on equipment and panels, and absolutely no deviation from this requirement will be permitted.
- F. After checking and verifying all field measurements, the Contractor shall submit to the Engineer, for approval, electronic copies of all submittals, which shall have been checked by and stamped with the approval of the Contractor and identified as shown herein. The information shown on the submittals shall be complete with respect to dimensions, design criteria, materials of construction and other requirements as specified or shown in the Contract Documents to enable the Engineer to review the information as required. Machinery outline drawings alone are not acceptable. All submittals covering related items of equipment or integrated systems of equipment shall be submitted at the same time in order that their complete operation can be adequately reviewed. Partial submissions will not be reviewed, but will be retained for subsequent review after related submittals have been submitted. At the time of each submission, the Contractor shall call to the Engineer's attention, in writing, any deviations that the submittals may have from the requirements of the Contract Documents.
- G. The Engineer will be allowed three weeks for the initial review. Allow additional time if processing must be delayed to permit coordination with subsequent submittals. The Engineer will promptly advise the contractor when a submittal being processed must be delayed for coordination. The Engineers review and approval shall be only for conformance with the design concept of the project and for compliance with the information given in the Contract Documents. The approval of a separate item as such shall not indicate approval of the assembly in which the item functions. The Contractor shall make any corrections required by the Engineer and shall resubmit

the required number of corrected copies of each submittal until approved. The Contractor shall direct specific attention to revisions called for by the Engineer on previous submissions.

- H. A maximum of two submissions of each submittal will be reviewed, checked, and approved or commented upon without charge to the Contractor. Any additional submissions which are ordered by the Engineer to fulfill the stipulations of the Contract Documents, and which are required by virtue of the Contractor's neglect or failure to comply with the requirements of the Contract Documents or to make those modifications and/or corrections ordered by the Engineer in the review of the first two submissions of each submittal, will be reviewed and checked as deemed necessary by the Engineer, and the cost of such review and checking, as determined by the Owner, and based upon a maximum rate of \$275.00 per hour will be deducted from the Contractor's monthly invoices or from monies retained under the provisions of the Contract Documents. It is therefore incumbent upon the Contractor to make all modifications and/or corrections, and/or to cause such modifications and/or corrections to be made by his subcontractors, suppliers, distributors, equipment fabricators and/or manufacturers, as may be required by the Engineer in an accurate, complete, and timely fashion.
- I. The Engineer's approval of submittals shall not relieve the Contractor from his responsibility for any deviations from the requirements of the Contract Documents unless the Contractor has in writing called the Engineer's attention to such deviations at the time of submission and the Engineer has given written approval to the specific deviation, nor shall any approval by the Engineer relieve the Contractor from responsibility for errors or omissions in the submittals. Submittals shall be submitted with sufficient time provided for checking, return to the Contractor, and/or resubmission as required. The words "APPROVED" or "APPROVED AS NOTED" or words of similar import placed by the Engineer on a submittal means that all items and details of the submittal are fully approved with the exception of those items or details that are specifically marked for further action. When the submission is marked "EXCEPTIONS NOTED" it means that the material or product can probably fulfill the intent of the plans and specifications but that enough questions or comments have arisen to require a corrected or updated submission. If the material submitted represents a product that is totally unsatisfactory and probably will not under any circumstances meet contract requirements, it will be marked "REJECTED" and will not be reconsidered by the Engineer. The withholding of an approval by the Engineer of any submittal in its entirety, including required certifications, shall under no circumstances constitute a basis for delay in arranging for and proceeding with the manufacturing, fabricating, delivering and installing, in accordance with the Contract, of those items or details in such submittals which may have been approved.
- J. Upon receipt of submittal approval, the Contractor shall provide an electronic copy of all approved submittals to the Owner and Engineer in Portable Document Format (PDF). PDFs shall be submitted within 20 calendar days of Contractor receiving approval.

- K. The Contractor's attention is specifically directed to the fact that no work shall be fabricated, nor equipment or materials ordered, nor any construction performed, prior to approval by the Engineer of submittals applicable thereto.

Construction performed in violation of this requirement will be neither approved nor certified for payment until applicable submittals have been approved. If the Engineer so directs, the Contractor shall disassemble, raze, and remove any such construction performed prior to approval by the Engineer of submittals applicable thereto, and the Contractor will be allowed neither additional compensation nor extension of Contract time thereto.

If the Contractor orders or causes to be ordered or delivered any equipment, machinery or materials in violations of this requirement, he/she does so at his/her own risk, and such equipment, machinery or materials shall neither be installed in the work nor stored on the site of the work. If, after submission and review of applicable submittals, the Engineer determines that any such equipment, machinery or materials do not meet the requirements of the Contract Documents, such equipment, machinery or materials will be rejected, and the Contractor will be allowed neither additional compensation nor extension of time therefore.

The Contractor's attention is specifically and especially directed to the fact that because manufacturer's standards and procedures are subject to unilateral changes over which the Owner has no control, the stipulations herein are applicable, and will be enforced, even for those elements of equipment, machinery, and/or materials which may be specified by manufacturer and model or catalog number in these Contract Documents.

1.04 CERTIFICATION OF MATERIALS AND INSTALLATIONS

- A. The Contractor shall furnish certification from each manufacturer, or from an approved testing laboratory, that all material used in the work is in accordance with these and all referenced specifications. Upon completion of the work, and before acceptance by the Owner, the Contractor shall furnish the Owner with a certificate from each of the manufacturers that the equipment and material furnished by him has been erected and installed in a satisfactory manner and is ready for continuous service and operation.
- B. Machinery and equipment for which manufacturer certification is specified will not be accepted, nor payment made therefore, without such certification. The Engineer reserves the right, however, to reject such certification when in his judgment, equipment and materials have been improperly installed or show evidence of unsatisfactory operation.

C. Certification shall be prepared as follows:

“Having inspected the following items of equipment (Insert here serial number and complete description of equipment) at rest and in operation, and having made all requisite service adjustments and calibrations, I hereby certify that the above listed items have been properly installed, serviced, adjusted and calibrated and are ready for continuous operation under specified conditions of service when maintained in accordance with the manufacturer’s published instructions attached hereto.

_____ “
Date Name

1.05 AS-BUILT DRAWINGS

- A. The Contractor shall keep one copy of all Contract Documents, including shop drawings, at the site, in good order, and annotated to show all changes made during the construction process. These as-built drawings shall be available to the Engineer and shall be delivered to the Engineer upon completion of the project. If the Contractor fails to maintain and submit the as-built drawings as required herein, final payment with respect to the Contract as a whole will be withheld until proper as-built drawings have been furnished to the Engineer, or the Town of Emmitsburg may, at its option, Contract for independent correction of shop drawings to as-built conditions, and the cost of such contracted services will be deducted from monies retained under the provisions of the Contract Documents.
- B. The Contractor shall furnish, in quadruplicate, ¼-inch per foot minimum scale charts of all piping arrangements, as approved, giving the number and location of all control valves, their functions, and section of piping they control. These schematics shall be bound for filing and shall also be neatly folded and bound as a part of the "Operating and Maintenance Manuals".
- C. The Contractor shall also furnish one copy of all final as-built shop drawings, conduit routing plans, and wiring diagrams and electrical schematics for the Motor Control Center, Pump Control Panel, and Generator. All shop drawings, diagrams, and schematics shall be 22-inches by 34-inches in size.

PART 2 - PRODUCTS

(NOT USED)

PART 3 – EXECUTION

(NOT USED)

END OF SECTION

01300-6

SECTION 01516

TEMPORARY SANITARY FACILITIES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.02 REQUIREMENTS INCLUDED

- A. Furnish, install and maintain temporary sanitary facilities for use through construction period; remove on completion of Work.

1.03 COSTS OF INSTALLATION AND OPERATION

- A. Obtain and pay for permits as required by governing authorities.
- B. Pay costs of temporary sanitary facilities, including costs of installation, maintenance and removal.
- C. Pay service charges for use of portable units.

PART 2 - PRODUCTS

2.01 GENERAL

- A. Materials may be new or used, but must be adequate for purpose intended, and must not create unsanitary conditions nor violate code requirements.

2.02 TOILET FACILITIES

- A. Portable toilets. Locate a minimum of one toilet at each work site.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Place portable toilets in conformance with applicable laws, codes and regulations.

3.02 MAINTENANCE

- A. Maintain facilities in a clean, operable, sanitary condition.

3.03 REMOVAL

- A. Remove portable units following Substantial Completion.

END OF SECTION

SECTION 01700

PROJECT CLOSEOUT

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. This Section specifies administrative and procedural requirements for project closeout including but not limited to:
 - 1. Inspection procedures.
 - 2. Project record document submittal.
 - 3. Operating and maintenance manual submittal.
 - 4. Facility start-up, demonstration period and operator training.
 - 5. Final cleaning.
- B. Closeout requirements for specific construction activities are included in the appropriate Specification Sections.

1.03 SUBSTANTIAL COMPLETION

- A. Preliminary Procedures: Before requesting inspection for certificate of Substantial Completion, complete the following:
 - 1. Complete all work required by the Contract Documents including:
 - a. Installation of new influent sewer.
 - b. Installation and testing of replacement force main piping.
 - c. Installation of new force main air release valve and vault.
 - d. Installation of new force main combination air valve.
 - e. Installation and testing of new pump station, including pumps, piping and valves.

- f. Installation of new precast concrete building including HVAC equipment.
 - g. Installation of all hoisting equipment.
 - h. Installation of all doors and access hatches.
 - i. Installation of new influent sewage grinder.
 - j. Installation of all electrical equipment including generator, conduit, wiring, control panels, lighting, etc.
 - k. Installation of new wetwell and new wetwell corrosion liner.
 - l. Completion of all painting.
 - m. Facility startup activities.
 - n. All other work required to provide the new pump station construction in its entirety to be fully operational.
2. In the Application for Payment that coincides with, or first follows, the date Substantial Completion is claimed, show 100 percent completion for the portion of the Work claimed as substantially complete. Include supporting documentation for completion as indicated in these Contract Documents and a statement showing an accounting of changes to the Contract Sum.
- a. If 100 percent completion cannot be shown, include a list of incomplete items, the value of incomplete construction, and reasons the Work is not complete.
3. Advise Owner of pending insurance change-over requirements.
4. Submit specific warranties, workmanship bonds, maintenance agreements, final certifications and similar documents.
5. Obtain and submit releases enabling the Owner unrestricted use of the Work and access to services and utilities; include occupancy permits, operating certificates and similar releases.
6. Deliver tools, spare parts, extra stock, and similar items. whether fabricated on or off the project site, and all other shop drawings which may be necessary, in the opinion of the Engineer, to comply with the all-inclusive intent of this requirement.
7. Make final change-over of permanent locks and transmit keys to the Owner. Advise the Owner's personnel of change-over in security provisions.

8. Submit Operations and Maintenance Data for approval. Issuance of substantial completion certificate is conditioned on approval.
 9. Complete start-up testing of systems, and instruction of the Owner's operating and maintenance personnel. Discontinue or change over and remove temporary facilities from the site, along with construction tools, mock-ups, and similar elements.
 10. Complete final clean up requirements, including touch-up painting. Touch-up and otherwise repair and restore marred exposed finishes.
- B. Inspection Procedures: On receipt of a request for inspection, the Engineer will either proceed with inspection or advise the Contractor of unfilled requirements. The Engineer will prepare the Certificate of Substantial Completion following inspection, or advise the Contractor of construction that must be completed or corrected before the certificate will be issued.
1. The Engineer will repeat inspection when requested and assured that the Work has been substantially completed.
 2. Results of the completed inspection will form the basis of requirements for final acceptance.

1.04 FINAL PAYMENT

- A. Preliminary Procedures: Before requesting final inspection for final payment, complete the following. List exceptions in the request.
1. Complete all remaining work required by the Contract Documents including:
 - a. 30-day demonstration period.
 - b. Operator training.
 - c. Final as-built drawings.
 - d. O&M Manuals.
 - e. Installation certifications for all required equipment.
 2. Submit the final payment request with releases and supporting documentation not previously submitted and accepted. Include certificates of insurance for products and completed operations where required.
 3. Submit an updated final statement, accounting for final additional changes to the Contract Sum.

4. Submit a certified copy of the Engineer's final inspection list of items to be completed or corrected, stating that each item has been completed or otherwise resolved for acceptance, and the list has been endorsed and dated by the Engineer.
 5. Submit final meter readings for utilities, a measured record of stored fuel, and similar data as of the date of Substantial Completion, or when the Owner took possession of and responsibility for corresponding elements of the Work.
 6. Submit consent of surety to final payment.
 7. Submit a final liquidated damages settlement statement.
 8. Submit evidence of final, continuing insurance coverage complying with insurance requirements.
- B. Reinspection Procedure: The Engineer will reinspect the Work upon receipt of notice that the Work, including inspection list items from earlier inspections, has been completed, except items whose completion has been delayed because of circumstances acceptable to the Engineer.
1. Upon completion of reinspection, the Engineer will prepare a certificate of final acceptance or advise the Contractor of Work that is incomplete or of obligations that have not been fulfilled but are required for final acceptance.
 2. If necessary, reinspection will be repeated.

1.05 RECORD DOCUMENT SUBMITTALS

- A. General: Do not use record documents for construction purposes; protect from deterioration and loss in a secure, fire-resistive location; provide access to record documents for the Engineer's reference during normal working hours.
- B. As-Built Drawings:
1. The Contractor shall keep one copy of all Contract Documents, including shop drawings, at the site, in good order, and annotated to show all changes made during the construction process. These as-built drawings shall be available to the Engineer, and shall be delivered to the Engineer upon completion of the project. If the Contractor fails to maintain and submit the as-built drawings as required herein, final payment with respect to the Contract as a whole will be withheld until proper as-built drawings have been furnished to the Engineer, or the Owner may, at its option, Contract for independent correction of shop drawings to as-built conditions, and the cost of such contracted services will be deducted from monies retained under the provisions of the Contract Documents.

2. The Contractor shall furnish, in quadruplicate, 1/4-inch per foot minimum scale charts of all piping arrangements, as approved, giving the number and location of all control valves, their functions, and section of piping they control. These schematics shall be bound for filing, and shall also be neatly folded and bound as a part of the "Operating and Maintenance Manuals".
 3. The Contractor shall also furnish one copy of all final as-built shop drawings, conduit routing plans, and wiring diagrams and electrical schematics for the Pump Control Panel, and Generator. All shop drawings, diagrams, and schematics shall be 22-inches by 34-inches in size.
 4. The Contractor shall provide two full size (24" x 36") paper copies of the final as-built drawings. In addition, the Contractor shall submit one CD containing an electronic copy of the as-built drawings as a Portable Document Format (PDF) file.
- C. Record Specifications: Maintain one complete copy of the Project Manual, including addenda, and one copy of other written construction documents such as Change Orders and modifications issued in printed form during construction. Mark these documents to show substantial variations in actual Work performed in comparison with the text of the Specifications and modifications. Give particular attention to substitutions, selection of options and similar information on elements that are concealed or cannot otherwise be readily discerned later by direct observation. Note related record drawing information and Product Data.
1. Upon completion of the Work, submit record Specifications to the Engineer for the Owner's records.
- D. Miscellaneous Record Submittals: Refer to other Specification Sections for requirements of miscellaneous record-keeping and submittals in connection with actual performance of the Work. Immediately prior to the date or dates of Substantial Completion, complete miscellaneous records and place in good order, properly identified and bound or filed, ready for continued use and reference. Submit to the Engineer for the Owner's records.

1.06 OPERATION AND MAINTENANCE MANUALS

- A. Upon completion of the work, the Contractor shall furnish for the Engineer's review, one set of Operation and Maintenance Manuals for the pumping station. Manuals shall include operating and maintenance information on all systems and items of equipment per the following table:

SECTION	DESCRIPTION
08220	FRP Doors
08310	Access Hatches
11310	Base-Mounted Pumping System
11330	Influent Sewage Grinder
14100	Monorail Crane System
14110	Davit Arm Personnel Mast
14600	Portable Equipment Hoist
15110	Valves
15130	Sluice Gate
15400	Plumbing
15500	Heating and Ventilation Equipment
15700	Minisplit Heat Pump Air Conditioning System
16500	Lighting
16530	Emergency Lighting
16230	Emergency Generator System
17100	Motor Control Center
17110	Variable Frequency Drives
17300	Instrumentation
17400	Programmable Controller System

- B. The data shall consist of catalogs, brochures, bulletins, charts, schedules, shop drawings corrected to as-built conditions and assembly drawings and wiring diagrams describing location, operation, maintenance, lubrication, operating weight, and other information necessary for the Engineer to establish an effective operating and maintenance program. All information provided shall be of the most current publications and literature supplied by the Manufacturers. Outdated or irrelevant information will not be accepted. Multiple items listed on a single page, which are not relevant, will be clearly crossed out. The following data shall also be included:
1. Title page and table of contents shall be printed on the Contractor's company letterhead and shall state the name and address of the station with the project number. These pages shall be inserted inside clear plastic sleeves.
 2. Four 8-inch by 10-inch color photographs of the facility, views as directed by the County. Each Photograph shall be provided on photo quality paper and inserted into clear plastic sleeve. Photos shall be taken near the completion of the project, when all temporary measures and Contractor Equipment are removed, and final site improvements, including landscaping, are completed.
 3. Two unique 8-inch by 10-inch color photographs of each piece of equipment in place. Each photograph shall be provided on photo quality paper and inserted into a clear plastic sleeve. Photos of equipment shall be taken at an orientation such that the permanent equipment marker is visible. When this is not practical, a temporary identification marker shall be provided and

included in the photo for each piece of equipment. Equipment photos shall be taken after equipment is permanently installed, with associated piping and appurtenances.

4. "Equipment Warranty" section, to be inserted in the first volume (following station photos), shall include a master log sheet stating equipment type, manufacturer's name, supplier's name, warranty length, and start and end dates. Copies of all warranties shall be included in this section for quick reference. This section shall also include materials not required for inclusion for the O&M Manuals that provide extended warranties, e.g., FRP doors, wetwell liner system, etc.
5. Literature and cutsheets for inclusion shall be printed double sided. Only prints, schematics or diagrams shall be single sided.
6. "Name Plate" data of all equipment.
7. Performance curves and performance data for the pumps and equipment installed.
8. Initial parameter settings for all equipment, as well as corresponding factory default settings. Initial parameter settings for equipment that differ from factory default settings shall be emphasized.
9. Approved shop drawings, including required certifications.
10. Manufacturers' cut sheets and dimension drawings of each piece of equipment, and details of all replacement parts.
11. Manufacturers' erection, operation and lubrication instructions for all equipment and apparatus.
12. Complete as-built wiring diagrams of all individual pieces of equipment and systems including one-line diagram; schematic or elementary diagrams; complete point-to-point interconnection diagrams; and interconnection and terminal board identification diagrams.
13. Complete underground piping and conduit layout and interconnecting drawings.
14. Manufacturer's certifications for specified equipment.
15. A list of all local manufacturers' representatives.
16. Complete parts list with parts assembly drawing (by exploded view), names and addresses of spare parts suppliers, recommended list of spare parts to be kept "in stock" and sample order forms for ordering spare parts. Lead time required for ordering parts shall be estimated and provided.

17. Instructions with easily understood schematics or diagrams for disassembling and assembling the equipment for overhaul or repair.
 18. The manual shall also include detailed written procedures to be used for all modes of operation including any precautions for personal safety or for prevention of damage to the equipment (mechanical or electrical). This includes initial start-up, interim operation when necessary, normal operation, emergency operation, shutdown and restarting. Required operating checks, calibration and field performance measurements shall be described.
 19. Preventive maintenance measures and their frequency shall be listed in tabular form. A troubleshooting chart containing symptoms, probable cause, and remedies shall be included. A lubricating schedule listing equipment (parts), frequency and lubricant (including equivalent major brand lubricants) shall be provided. In addition, a lubrication schedule shall be included for periods when the equipment is in standby or in storage.
 20. Section dividers shall be provided, with labels that are non-removable.
- C. Operation and Maintenance information shall be bound in loose leaf 3-ring binders with black plastic-coated covers. Binders shall be 4-inch thick maximum, high quality, turned edge construction with piano metal hinges and rings that stay closed and not allow pages to fall out. Binders shall be Binder Tek Model ARCH3 for 3-inch binders, ARCH4 for 4-inch binders, or approved equal. Binders shall be organized sequentially with section dividers for each applicable specification section as listed in the Special Provisions table of contents.
- D. Shop drawings 11-inches by 17-inches in size shall be folded to approximately 11-inches by 8-½ inches with drawing title box exposed along either edge. Drawings descriptive of a single item of equipment shall be grouped together.
- E. All shop drawings included in the binders shall be those copies previously submitted for review and approval and shall bear the Engineer's stamp of approval and comments as originally noted thereon.
- F. Subsequent to the Engineer's approval of the Operation and Maintenance Manuals, the Contractor shall submit four complete sets of manuals for distribution by the Engineer. In addition, the Contractor shall submit either two (2) CD's or thumb drives as preferred by the Owner, each containing an electronic copy of the entire Operation and Maintenance Manuals as a Portable Document Format (PDF) file. CD's (or thumb drives) shall contain individual files for each specification section, matching the section dividers of the Operation and Maintenance Manuals. Operation and Maintenance Manuals shall be delivered to the Engineer in white binder boxes suitable for storing the specified binders. Each binder storage box shall have an interior measurement of 12-inches by 12¼-inches by 18½-inches and shall include a lift off lid. Binder storage boxes shall be Model No. 0073301 as manufactured by Bankers Box® or approved equal.

- G. Final inspection and/or beneficial occupancy will positively not be undertaken until approved Operation and Maintenance Manuals have been submitted and approved. Partial approvals will not be made.

1.07 FACILITY START-UP, DEMONSTRATION PERIOD AND OPERATOR TRAINING

- A. When specified in individual sections of these Specifications, upon completion of all work for a particular section, the Contractor shall furnish at no extra cost to the Owner, the necessary manufacturer's engineers, representatives, technicians, skilled labor and helpers and shall perform all startup activities as required. During startup, the manufacturer's designated personnel shall fully inspect, test, calibrate, lubricate, operate and certify the equipment for which they are responsible.
- B. When a manufacturer's representative is not required to perform startup activities for a particular piece of equipment, the Contractor shall perform any required startup activities in strict accordance with the manufacturer's instructions.
- C. If the Operation and Maintenance Manuals specified hereinafter are not available at the time of the startup, the Contractor shall provide one copy of the manufacturer's operating literature for each system or item of equipment. Installation and operating sheets or booklets normally shipped with equipment may be used for this purpose.
- D. Prior to starting up and operating any and all equipment installed in the pumping station, the Contractor shall notify the Owner. All lubrication and starting up of the equipment shall be done in the presence of and to the complete satisfaction of authorized representatives of the Bureau of Utilities, and in accordance with all manufacturer's recommendations. All temporary measures, utilities, resources, and equipment, including all associated permits and approvals, necessary for start-up and demonstration of equipment, including the use of fire hydrants, shall be the Contractor's responsibility and available prior to start-up activities.
- E. The Contractor shall schedule the startup for a time mutually agreeable with the Engineer and the Owner, and shall provide a minimum of one week notice prior to the desired date. The Contractor shall submit a start-up and testing schedule for review and approval by the Engineer and the Owner. Start-up and testing activities shall not commence until the schedule is approved.
- F. After all startup activities have been completed, the Contractor shall be responsible for the operation of the completed pumping station on a demonstrational basis for a period of thirty (30) days.
- G. Prior to beginning the 30-day demonstration period, the Contractor shall complete the following:
 - 1. All shop drawings shall be submitted and approved.
 - 2. All Equipment Guarantee Certification Forms and manufacturer's certifications shall be completed and submitted, and all witness testing conducted and completed as required.

3. All startup activities shall be completed.
 4. All test reports shall be submitted and approved.
 5. All project photographs shall be submitted.
 6. All Operation and Maintenance Manuals shall be submitted and approved.
 7. A final walk-through of the facility shall be conducted by the Contractor with the Owner and Engineer in order to generate the punchlist for the project. Provide the Owner and Engineer two weeks' notice prior to the desired date.
 8. Any items on the punchlist that are designated as requiring completion prior to the 30-day demonstration period shall be completed.
 9. Any item on the punchlist not designated as requiring completion prior to the 30-day demonstration period shall be completed prior to the end of the 30-day demonstration period.
 10. The facility shall be thoroughly cleaned, and any finishes requiring touchup shall be completed.
- H. After all of the above items have been successfully completed, the Contractor shall receive notice from the Owner that he may begin the 30-day demonstration period.
- I. During the 30-day demonstration period, the Contractor shall maintain the bypass pumping system in place and operational in the event that there is a problem with the permanent systems installed.
- J. During the 30-day demonstration period, the Contractor shall respond to all bypass pumping system and/or station control system alarms and rectify the situation, as necessary.
- K. During the 30-day demonstration period, the Contractor shall conduct all required training for the newly installed equipment. Training activities shall be performed separately from manufacturer's startup activities, and shall be held on separate days unless approved otherwise. Coordinate schedule of training with Owner and provide a minimum of two weeks' notice.
- L. If problems occur during the 30-day demonstration period that are designated by the Owner and Engineer to be of significant magnitude, the problems shall be satisfactorily corrected, and the 30-day demonstration period shall restart from the beginning.

- M. After successful completion of the 30-day demonstration period, all required training, all punchlist work, and all final cleanup, the Contractor shall schedule a follow up walk-through with the Owner and Engineer to verify compliance with all requirements.
- N. After compliance has been demonstrated for all requirements, the Owner shall approve the removal of the bypass pumping system and associated Contractor demobilization.

PART 2 - PRODUCTS

(NOT USED)

PART 3 - EXECUTION

3.01 FINAL CLEANING

- A. General: General cleaning during construction is required by the General Conditions.
- B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to the condition expected in a normal, cleaning and maintenance program. Comply with manufacturer's instructions.
 - 1. Complete the following cleaning operations before requesting inspection for final acceptance.
 - a. Remove labels that are not permanent labels.
 - b. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compound and other substances that are noticeable vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials.
 - c. Clean exposed exterior and interior hard-surfaced finishes to a dust-free condition, free of stains, films and similar foreign substances. Restore reflective surfaces to their original reflective condition. Leave concrete floors broom clean.
 - d. Wipe surfaces of mechanical and electrical equipment. Remove excess lubrication and other substances. Clean plumbing fixtures to a sanitary condition. Clean light fixtures and lamps.

- e. Clean the site, including landscape development areas, of rubbish, litter and other foreign substances. Sweep paved areas broom clean; remove stains, spills and other foreign deposits. Rake grounds that are neither paved nor planted, to a smooth even-textured surface.
- C. Removal of Protection: Remove temporary protection and facilities installed for protection of the Work during construction.
- D. Compliance: Comply with regulations of authorities having jurisdiction and safety standards for cleaning. Do not burn waste materials. Do not bury debris or excess materials on the Owner's property. Do not discharge volatile, harmful or dangerous materials into drainage systems. Remove waste materials from the site and dispose of in a lawful manner. Where extra materials of value remaining after completion of associated Work have become the Owner's property, arrange for disposition of these materials as directed by the Owner.

END OF SECTION

SECTION 02221

BUILDING DEMOLITION

PART 1 - GENERAL

1.01 SUMMARY

- A. This Section includes demolition and removal of a building and site improvements, removal of below-grade construction, disconnecting, capping or sealing, and removal of site utilities, and salvaging items for reuse by the Owner.

1.02 MATERIALS OWNERSHIP

- A. Unless otherwise indicated or specifically requested, demolition waste becomes property of the Contractor.
- B. The Owner reserves the right to salvage any equipment not specifically named and the Contractor shall verify same with authorized Town of Emmitsburg staff before removing. All equipment to be salvaged shall be delivered to the Town of Emmitsburg WWTP facility, located at 16683 Creamery Road.
- C. Historic items, relics, antiques, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, and other items of interest or value to the Owner that may be uncovered during demolition remain the property of the Owner. Carefully salvage in a manner to prevent damage and promptly return to the Owner.

1.03 SUBMITTALS

- A. Proposed Protection Measures: Submit informational data, including drawings, that indicates the measures proposed for protecting individuals and property, for environmental protection, for dust control, and for noise control. Indicate proposed locations and construction of barriers.
- B. Adjacent Buildings: Detail special measures proposed to protect adjacent buildings, if any, to remain.
- C. Schedule of Building Demolition Activities: Detailed sequence of demolition work, with starting and ending dates for each activity.
- D. Inventory: Submit a list of items to be removed and salvaged and delivered to the Owner prior to start of demolition.
- E. Pre-demolition Photographs or Video: Show existing conditions of adjoining construction and site improvements, including finish surfaces, which might be misconstrued as damage caused by building demolition operations.

F. Permits for Disposal of Debris

1. Arrange for legal disposal of debris and obtain written agreements with the owners of the property where the debris will be deposited.
2. Submit two copies of each agreement releasing the Owner from all responsibility in connection with the disposal of the debris.

1.04 QUALITY ASSURANCE

- A. Regulatory Requirements: Comply with governing EPA notification regulations before beginning demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.
- B. Standards: Comply with ANSI A10.6 and NFPA 241.

1.05 PROJECT CONDITIONS

- A. Buildings to be demolished will be vacated and their use discontinued before start of the Work.
- B. Do not close or obstruct walkways, exits, or other points of access used by occupants of adjacent facilities without written permission from authorities having jurisdiction.
- C. Owner assumes no responsibility for buildings and structures to be demolished. Conditions existing at time of inspection for bidding purpose will be maintained by the Owner as far as practical.
- D. Hazardous Materials: Other than as identified on the drawing notes, it is not expected that hazardous materials will be encountered in the Work. If materials suspected of containing hazardous materials are encountered other than as identified in the drawing notes, do not disturb; immediately notify the Owner.

1.06 COORDINATION

- A. Arrange demolition schedule so as not to interfere with operations of Town of Emmitsburg facilities.

PART 2 - PRODUCTS

(NOT USED)

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Review project record documents of existing construction. Owner does not guarantee that existing conditions are same as those indicated in project record documents.
- B. Inventory and record the condition of items to be removed and salvaged. Provide photographs or video of conditions that might be misconstrued as damage caused by salvage operations.
- C. Perform an engineering survey of condition of building to determine whether removing any element might result in structural deficiency or unplanned collapse of any portion of structure or adjacent structures during building demolition operations.

3.02 PREPARATION

- A. Existing Utilities: Locate, identify, disconnect, and seal or cap off indicated utilities serving buildings and structures to be demolished. Arrange to shut off indicated utilities with utility companies.
- B. If removal, relocation, or abandonment of utility services will affect adjacent properties, then provide temporary utilities that bypass buildings and structures to be demolished and that maintain continuity of service to other buildings and structures.
- C. Cut off pipe or conduit a minimum of 24 inches below grade. Cap, valve, or plug and seal remaining portion of pipe or conduit after bypassing according to requirements of authorities having jurisdiction.
- D. Temporary Shoring: Provide and maintain interior and exterior shoring, bracing, or structural support to preserve stability and prevent unexpected movement or collapse of construction being demolished. Strengthen or add new supports when required during progress of demolition.
- E. Salvaged Items: Clean salvaged items of dirt and demolition debris, pack or crate items after cleaning and identify contents of containers. Store items in a secure area until delivery to the Owner. Transport items to storage area designated by Owner. Protect all items from damage during transport and storage.

3.03 PROTECTION

- A. Existing Facilities: Protect adjacent walkways, building entries, and other building facilities during demolition operations. Maintain exits from existing buildings.

- B. Existing Utilities: Maintain utility services to remain and protect from damage during demolition operations.
- C. Do not interrupt existing utilities serving adjacent occupied or operating facilities unless authorized in writing by Owner and authorities having jurisdiction.
- D. Provide temporary services during interruptions to existing utilities, as acceptable to Owner and authorities having jurisdiction. Provide at least 72 hours' notice to occupants of affected buildings if shutdown of service is required during changeover.
- E. Temporary Protection: Erect temporary protection, such as walks, fences, railings, canopies, and covered passageways, where required by authorities having jurisdiction and as indicated. Protect existing site improvements, appurtenances, and landscaping to remain. Erect a plainly visible fence around drip line of individual trees or around perimeter drip line of groups of trees to remain. Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain. Provide protection to ensure safe passage of people around building demolition area and to and from occupied portions of adjacent buildings and structures. Protect walls, windows, roofs, and other adjacent exterior construction that are to remain and that are exposed to building demolition operations. Erect and maintain dustproof partitions and temporary enclosures to limit dust, noise, and dirt migration to occupied portions of adjacent buildings.
- F. Remove temporary barriers and protections where hazards no longer exist. Where open excavations or other hazardous conditions remain, leave temporary barriers and protections in place.

3.04 DEMOLITION, GENERAL

- A. General: Demolish indicated existing building and site improvements completely. Use methods required to complete the work within limitations of governing regulations and as follows:
 - 1. Do not use cutting torches until work area is cleared of flammable materials. Maintain portable fire-suppression devices during and after flame-cutting operations. Maintain fire watch and adequate ventilation during and for an extended period after flame cutting operations.
 - 2. Locate building demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
- B. Site Access and Temporary Controls: Conduct building demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities. Do not close or obstruct streets, walks, walkways, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction. Provide

alternate routes around closed or obstructed traffic ways if required by authorities having jurisdiction.

- C. Use water mist and other suitable methods to limit spread of dust and dirt. Comply with governing environmental-protection regulations. Do not use water when it may damage adjacent construction or create hazardous or objectionable conditions, such as ice, flooding, and pollution.
- D. Explosives: Use of explosives is not permitted.

3.05 DEMOLITION BY MECHANICAL MEANS

- A. Proceed with demolition of structural framing members systematically, from higher to lower level. Complete building demolition operations above each floor or tier before disturbing supporting members on the next lower level.
- B. Remove debris from elevated portions of the building by chute, hoist, or other device that will convey debris to grade level in a controlled descent. Remove structural framing members and lower to ground by method suitable to minimize ground impact and dust generation.
- C. Below-Grade Construction: Demolish foundation walls and other below-grade construction.
- D. Existing Utilities: Demolish existing utilities and below-grade utility structures that are within 10 feet outside footprint indicated for new construction. Abandon utilities outside this area. Fill abandoned utility structures with a minimum of 6 inches of concrete.

3.06 SITE RESTORATION

- A. Below-Grade Areas: Rough grade below-grade areas ready for further excavation or new construction.
- B. Site Grading: Uniformly rough grade area of demolished construction to a smooth surface, free from irregular surface changes. Provide a smooth transition between adjacent existing grades and new grades.
- C. Promptly repair damage to adjacent buildings caused by demolition operations.

3.07 DISPOSAL OF DEMOLISHED MATERIALS

- A. Remove demolition waste materials from Project site and legally dispose of them in an EPA-approved landfill acceptable to authorities having jurisdiction. Do not allow demolished materials to accumulate on-site, and remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
- B. Do not burn demolished materials.

3.08 CLEANING

- A. Clean adjacent structures and improvements of dust, dirt, and debris caused by building demolition operations. Return adjacent areas to condition existing before building demolition operations began.

END OF SECTION

SECTION 02240

DEWATERING

PART 1 - GENERAL

1.01 SUMMARY

- A. The work to be performed under this section includes, but is not limited to, the furnishing of all materials, labor, tools and equipment necessary to provide construction dewatering to keep all excavations and structures free from water during excavation and construction.

1.02 PERFORMANCE REQUIREMENTS

- A. Design, furnish, install, test, operate, monitor, and maintain dewatering system of sufficient scope, size, and capacity to control surface water and groundwater flows into excavations and permit construction to proceed on dry, stable subgrades.
 - 1. Dewatering plans, including detailed shop drawings, shall be prepared, sealed and signed by a qualified Professional Engineer registered in the State of Maryland.
 - 2. Maintain dewatering operations to ensure erosion control, stability of excavations and constructed slopes, that excavation does not flood, and that damage to subgrades and permanent structures is prevented.
 - 3. Prevent groundwater and surface water from entering excavations.
 - 4. Accomplish dewatering without damaging existing buildings, pavements, utilities, and other improvements adjacent to excavations.
 - 5. Remove dewatering system when no longer needed.

1.03 SUBMITTALS

- A. Shop Drawings for Information Only: Show arrangement, locations, and details of wells and well points; locations of headers and discharge lines; and means of discharge and disposal of water. Shop drawings shall be prepared, sealed and signed by a qualified Professional Engineer for dewatering systems.
 - 1. Include layouts of piezometers and flow-measuring devices for monitoring performance of dewatering system.
 - 2. Include a written report outlining control procedures to be adopted if dewatering problems arise.

- B. Qualification Data: For the Professional Engineer and the dewatering system installer.
- C. Photographs or videotape, sufficiently detailed, of existing conditions of adjoining improvements that might be misconstrued as damage caused by dewatering operations.
- D. Record drawings identifying and locating any capped utilities and other subsurface conditions performed during dewatering, including locations and capping depth of wells and well points.
- E. Field Test Reports: Before starting excavation, submit test results and computations demonstrating that the dewatering system is capable of meeting performance requirements.

1.04 PROJECT CONDITIONS

- A. Existing Utilities: Do not interrupt utilities serving the existing pumping station or other facilities unless permitted in writing by the Engineer and then only after arranging to provide temporary utility services according to requirements indicated.
- B. Project Site Information: Geotechnical soil borings obtained in the project site area during design, if any, are available for information purposes only. The soil borings, and opinions expressed in any accompanying reports, are those of the geotechnical engineer and represent interpretations of subsoil conditions, tests and results of analyses conducted by the geotechnical engineer for design purposes only. The Owner and Engineer will not be responsible for interpretations or conclusions drawn from this data. The Contractor shall make his own test borings and conduct other exploratory operations as necessary for providing dewatering systems.
- C. Survey adjacent structures and improvements, employing a qualified Professional Engineer or Land Surveyor, and establish exact elevations at fixed points to act as benchmarks. Clearly identify benchmarks and record existing elevations. During dewatering, regularly resurvey benchmarks, maintaining an accurate log of surveyed elevations for comparison with original elevations. Promptly notify the Engineer if changes in elevations or positions occur or if cracks, sags, or other damage is evident in adjacent improvements.

PART 2 - PRODUCTS

(NOT USED)

PART 3 - EXECUTION

3.01 PREPARATION

- A. Protect structures, utilities, pavements, and other facilities and improvements from damage caused by settlement, lateral movement, undermining, washout, and other hazards that could develop during dewatering operations.
 - 1. Prevent surface water and subsurface or groundwater from entering excavations, from ponding on prepared subgrades, and from flooding site and surrounding area.
 - 2. Protect subgrades and foundation soils from softening and damage by rain or water accumulation.
- B. Install dewatering systems to ensure minimum interference with roads, streets, alleys, walks, driveways, residences and other adjacent occupied or used facilities. Do not close or obstruct roads, streets, alleys, walks, driveways and other adjacent occupied or used facilities without permission of the Owner and authorities having jurisdiction.
- C. Promptly repair damages to adjacent facilities or improvements caused by dewatering operations at no additional cost to the Owner.

3.02 INSTALLATION

- A. Install dewatering system utilizing wells, well points, or similar methods complete with pump equipment, standby power and pumps, filter material gradation, valves, appurtenances, water disposal, and surface-water controls.
- B. Before excavating below groundwater level, place system into operation to lower water to specified levels. Operate system continuously until drains, sewers and structures have been constructed and fill materials placed, or until dewatering is no longer required.
- C. Provide an adequate system to lower and control groundwater to permit excavation, construction of structures, and placement of fill materials on dry subgrades. Install sufficient dewatering equipment to drain water-bearing strata above and below bottom of foundations, drains, sewers and other excavations. Do not permit open-ump pumping that leads to loss of fines, soil piping, subgrade softening, and slope instability.
- D. Reduce hydrostatic head in water-bearing strata below subgrade elevations of foundations, drains, sewers, and other excavations. Maintain piezometric water level a minimum of 24-inches below surface of excavation.
- E. Dispose of water removed by dewatering in a manner that avoids endangering public health, property, and portions of work under construction or completed.

Dispose of water in a manner that avoids inconvenience to others. Provide sumps, sedimentation tanks, and other flow-control devices as required by authorities having jurisdiction.

- F. Provide standby equipment on-site, installed and available for immediate operation, to maintain dewatering on continuous basis if any part of the system becomes inadequate or fails. If dewatering requirements are not satisfied due to inadequacy or failure of dewatering system, restore damaged structures and foundation soils at no additional expense to the Owner.
- G. Remove dewatering system upon completion of dewatering. Plug or fill well holes with sand or cut off and cap wells a minimum of 36-inches below overlying construction.

3.03 OBSERVATION WELLS

- A. Provide, take measurements, and maintain at least the minimum number of observation wells or piezometers necessary and additional observation wells as may be required by authorities having jurisdiction.
- B. Observe and record daily elevation of ground water and piezometric water levels in observation wells.
- C. Repair or replace, within 24 hours, observation wells that become inactive, damaged, or destroyed. Suspend construction activities in areas where observation wells are not functioning properly until reliable observations can be made. Add or remove water from observation well risers to demonstrate that observation wells are functioning properly.
- D. Fill observation wells, remove piezometers, and fill holes when dewatering is completed.

END OF SECTION

SECTION 02260

EXCAVATION SUPPORT AND PROTECTION

PART 1 - GENERAL

1.01 SUMMARY

- A. The work to be performed under this section includes, but is not limited to, the furnishing of all materials, labor, tools and equipment necessary to provide temporary structure and excavation support and protection systems.

1.02 PERFORMANCE REQUIREMENTS

- A. Design, furnish, install, monitor, and maintain excavation support and protection systems capable of supporting excavation sidewalls and of resisting soil and hydrostatic pressure and superimposed and construction loads.
 - 1. Excavation support and protection plans, including detailed shop drawings, design calculations, and a comprehensive engineering analysis, shall be designed, sealed and signed by a qualified Professional Engineer registered in the State of Maryland.
 - 2. Prevent groundwater and surface water from entering excavations.
 - 3. Install excavation support and protection systems without damaging existing buildings, pavements, utilities, and other improvements within or adjacent to excavations.
- B. Contractor to conduct, as needed, additional subsurface explorations and associated laboratory testing to verify conditions and assumptions used for the design of the excavation support and protection.
- C. The Contractor shall make every effort to avoid damage to all structures and utilities in the area of the proposed construction. The Contractor is responsible for vibration damage to any structures or utilities.

1.03 SUBMITTALS

- A. Shop Drawings, design calculations, and engineering analysis for Information Only: Prepared, sealed and signed by a qualified Professional Engineer for excavation support and protection systems.
- B. Qualification Data: For the Professional Engineer and the excavation support and protection system installer.

- C. Photographs or videotape, sufficiently detailed, of existing conditions of adjoining improvements that might be misconstrued as damage caused by the absence of, the installation of, or the performance of excavation support and protection systems.
- D. All test borings and soil data obtained by the Contractor.

1.04 PROJECT CONDITIONS

- A. Existing Utilities: Do not interrupt utilities serving the existing pumping station or other facilities unless permitted in writing by the Engineer and then only after arranging to provide temporary utility services according to requirements indicated.
- B. Project Site Information: Geotechnical soil borings obtained in the project site area during design, if any, are available for information purposes only. The soil borings, and opinions expressed in any accompanying reports, are those of the geotechnical engineer and represent interpretations of subsurface conditions, tests and results of analyses conducted by the geotechnical engineer for design purposes only. The Owner and Engineer will not be responsible for interpretations or conclusions drawn from this data. The Contractor shall make his own test borings and conduct other exploratory operations as necessary for providing excavation support and protection.
- C. Survey adjacent improvements, employing a qualified Professional Engineer or Land Surveyor, and establish exact elevations at fixed points to act as benchmarks. Clearly identify benchmarks and record existing elevations. During installation of excavation support and protection systems, regularly resurvey benchmarks, maintaining an accurate log of surveyed elevations and positions for comparison with original elevations and positions. Promptly notify the Engineer if changes in elevations or positions occur or if cracks, sags, or other damage is evident in adjacent improvements.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. General: Provide materials that are either new or in serviceable condition.
- B. Structural Steel: ASTM A36, A690, or A992.
- C. Steel Sheet Piling: ASTM A328, A572, or A690; with continuous interlocks.
- D. Wood Lagging: Lumber, mixed hardwood, nominal rough thickness of 4 inches.
- E. Cast-In-Place Concrete: ACI 301, of compressive strength required for the application, in accordance with the design.
- F. Reinforcing Bars: ASTM A615, Grade 60, deformed.

PART 3 - EXECUTION

3.01 PREPARATION

- A. Shore, support and protect structures, utilities, pavements, and other facilities and improvements from damage caused by settlement, lateral movement, undermining, washout, and other hazards that could develop during excavation support and protection system operations.
- B. Install excavation support and protection systems to ensure minimum interference with roads, streets, alleys, walks, driveways, residences and other adjacent occupied or used facilities. Do not close roads, streets, alleys, walks, driveways, residences and other adjacent occupied or used facilities without permission of the Owner and authorities having jurisdiction.
- C. Locate excavation support and protection systems clear of permanent construction, so that forming and finishing of concrete surfaces, or setting of precast concrete structures, is not impeded.
- D. Monitor excavation support and protection systems daily during excavation progress and for as long as excavation remains open. Promptly correct bulges, breakage, or other evidence of movement to ensure that excavation support and protection systems remain stable.
- E. Promptly repair damages to adjacent facilities or improvements caused by installing excavation support and protection systems at no additional cost to the Owner.

3.02 SOLDIER BEAMS AND LAGGING

- A. Install steel soldier beams before starting excavation. Space soldier beams at regular intervals not to exceed allowable flexural strength of wood lagging. Accurately align exposed faces of flanges to vary not more than 2 inches from a horizontal line and not more than 1:120 out of vertical alignment.
- B. Install wood lagging within flanges of soldier beams as excavation proceeds. Trim excavation as required to install lagging. Fill voids behind lagging with soil, and compact.
- C. Install wales horizontally at centers as designed and secure to soldier beams.

3.03 SHEET PILING

- A. Before starting excavation, install one-piece sheet piling lengths and tightly interlock to form a continuous barrier. Limit vertical offset of adjacent sheet piling to 60 inches. Accurately align exposed faces of sheet piling to vary not more than 2 inches from a horizontal line and not more than 1:120 out of vertical alignment. Cut tops of sheet piling to uniform elevation at top of excavation.

3.04 BRACING

- A. Locate bracing to clear permanent construction work. If necessary to move brace, install new brace before moving original brace. Install internal bracing, if required, to prevent spreading or distortion of braced frames. Maintain bracing until structural elements are supported by other bracing or until permanent construction is able to withstand lateral earth and hydrostatic pressures.

3.05 METHODS

- A. The Contractor may, at his option, furnish and install other supporting systems for the excavation of the pumping station provided the design of such systems is approved by the Owner and the design performed is signed and sealed by a Professional Engineer registered in the State of Maryland. The Contractor shall be responsible for the maintenance of the excavation support system for the full term of the contract. All costs shall be included in the lump sum bid and no separate payment will be made.

3.06 REMOVAL AND REPAIRS

- A. Remove excavation support and protection systems when construction has progressed sufficiently to support excavation and bear soil and hydrostatic pressures. Remove in stages to avoid disturbing underlying soils or damaging structures, pavements, facilities and utilities.
- B. Promptly repair or replace, as approved by the Engineer, adjacent work or improvements damaged or displaced by removing excavation support and protection systems at no additional cost to the Owner.

END OF SECTION

SECTION 02280

CONSTRUCTION VIBRATION MONITORING

PART 1 - GENERAL

1.01 SUMMARY

- A. The work to be performed under this section includes, but is not limited to, monitoring the existing pumping station, valve vault, and generator pad structures for vibration during all construction operations to complete the new sewage pump station construction. Locations to be monitored include the existing Creamery Road Sewage Pump Station and associated structures.

1.02 SUBMITTALS

- A. Description of the surveying equipment to be used.
- B. Detail showing actual seismograph locations.
- C. Description of the vibration monitoring equipment to be used.
- D. Pre-Construction Survey Report.
- E. Seismic Monitoring Data Report.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. The Contractor shall provide a minimum of one seismograph to measure and record ground motion caused by construction under the Contract. The seismograph shall be attached or located immediately adjacent to the nearest structure or as approved by the Engineer. The seismograph equipment shall be an Everlet seismograph, GeoSonic 3000 LC seismograph, or equivalent, capable of producing a permanent record of the three components of ground motion in terms of particle velocity. The instrument shall be capable of internal dynamic calibration. The Contractor shall submit the latest manufacturer's calibration for the specific machine to be used in the field to the Engineer at least 10-days prior to the field work beginning. The manufacturer's calibration should be within the last 6-months. The record of each construction activity shall consist of the seismograph records identified by instrument number, location of the instrument positively identified, date, time and location of the construction activities, and all other data necessary for the proposed construction. These records, as a formal report, shall be made available to the Engineer as required.

PART 3 - EXECUTION

3.01 PREPARATION

- A. The Contractor shall make every effort to avoid damages to all structures in the area of the proposed construction. The Contractor is responsible for vibration damages to any structures.

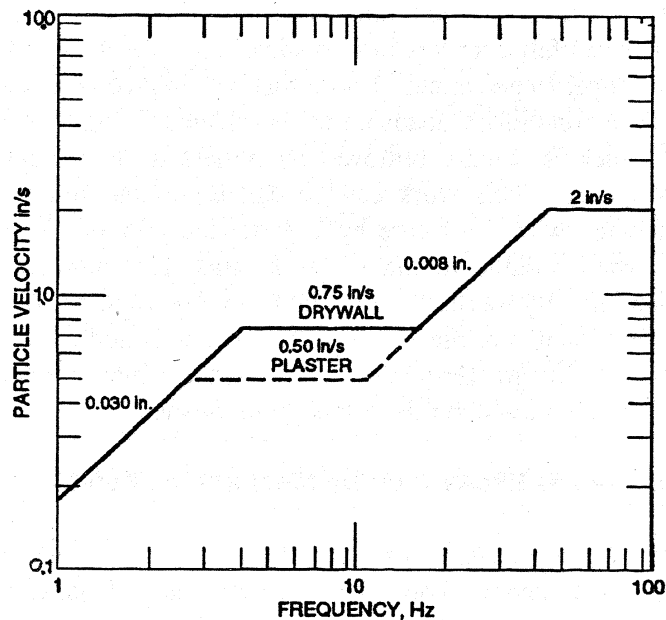
3.02 PRE-CONSTRUCTION SURVEY

- A. Data must be obtained by the Contractor during the pre-construction survey to establish a base for determining effects of construction, excavating, and other construction activities on nearby structures.
- B. All structural and cosmetic defects shall be thoroughly documented in writing, with annotated photographs and videos.
- C. At least 10 days prior to any excavation or construction activities, the general plan for the seismic monitoring shall be submitted to the Engineer for review and approval.
- D. Prior to starting, the Contractor shall retain the services of a qualified Professional Engineer licensed in the State of Maryland with experience in pre-construction condition surveys to make a detailed inspection of all structures within the monitoring scope or as designated by the Engineer.
- E. The inspection report shall include notes, sketch measurements, photographs, video and a DVD (with audio sound track) of all structures prior to the start of construction. The audio description of the inspection shall include the date, time, weather conditions, address/stationing/location, brief description of the facility and description of physical conditions encountered. The inspection should also include documentation of existing damage and other factors (both inside and outside) which could be affected by construction activity. Photographs shall be a minimum of 8" x 10" in size and in color. The report shall also recommend any adjustments to the Peak Particle Velocity (PPV) contained in this specification.

3.03 SEISMIC MONITORING

- A. Seismic monitoring is required for all construction operations with a distance of 25-ft of existing structures or as directed by the Engineer. These operations include, but are not limited to, pile driving, jack hammering, excavation, compaction, and utility installation.
- B. The Contractor shall submit the qualifications of the individual or subcontractor responsible for the seismic monitoring to the Engineer for approval. The individual or subcontractor responsible for the vibration monitoring shall also be present during the pre-construction survey of all structures within the influence area of the project.

- C. Qualifications: The supervisor of the seismic monitoring work shall be either a professional geologist or professional engineer with a minimum of 5 years' experience of similar scope, size, and complexity. The supervisor of the seismic work shall submit a resume with a minimum of five projects of similar scope, size, and complexity for the Engineers review and approval at least 10 days prior to start of the work. The field technician for the seismic monitoring shall have experience with at least three projects of similar scope, size, and complexity in addition to having a BS in Engineering or Geology. The field technician's resume shall be submitted for review and approval of the Engineer.
- D. Peak particle velocity (PPV) at existing adjacent structures shall not exceed that shown in the OSM Method 3 Figure below. Peak particle velocity is defined as the vector sum of the three velocity components in three mutually perpendicular directions, measured at any point by an instrument approved by the Engineer. The criteria for drywall shall be used for all structures except those that actually are constructed of plaster and otherwise noted above. These limits may be adjusted by the Engineer based on any evidence of damage to structure.
- E. All data submitted by the Contractor shall be presented in tabular and graphical form. The record for each instrument shall consist of the seismograph records identified by instrument number, location of the instrument positively identified, date and time.
- F. All construction operations should be monitored in accordance with the Office of Surface Mining (OSM) Method 3 and the following figure.



END OF SECTION

SECTION 02300

EARTHWORK

PART 1 - GENERAL

1.01 SUMMARY

- A. The work to be performed under this section includes, but is not limited to, the furnishing of all materials, labor, tools and equipment necessary to complete:
 - 1. Test Pits
 - 2. Structure Excavation
 - 3. Borrow Excavation
 - 4. Select Backfill
 - 5. Trench Excavation, Backfill, and Compaction
 - 6. Subgrade Preparation
- B. All excavation work performed under this contract is UNCLASSIFIED, and includes excavation and removal of all soil, shale, rock, boulders, wood, lumber, fill, sheeting & shoring, conduits, pipe and other materials encountered of whatever nature.

1.02 DESCRIPTION

- A. Test pits shall include, but not necessarily be limited to, excavation to determine the exact location and/or elevation of underground structures, utilities, and other obstructions; the backfill and compaction of the excavation; and the stabilization of the surface.
- B. Structure excavation shall include, but not necessarily be limited to, excavation for all concrete structures as shown on the Contract Drawings.
- C. Borrow excavation shall include, but not necessarily be limited to, furnishing, excavating, hauling, and depositing of approved materials for backfills when sufficient quantities of suitable materials are not available from onsite excavations, and shall include all work for backfills and subgrade preparations. Borrow excavation shall be at no additional cost to the Owner.
- D. Select backfill shall include, but not necessarily be limited to, furnishing and placing satisfactory foundation bedding and backfill materials for wetwells, valve vaults, pipes, manholes, and other structures.

- E. Trench excavation, backfill, and compaction shall include, but not necessarily be limited to, the excavation, backfill and compaction of trenches for sanitary sewers, force mains, drains, water service lines, and other underground utility systems shown on the Contract Drawings.
- F. Subgrade preparation shall include, but not necessarily be limited to, preparation, protection, and maintenance of the subgrade before construction of any succeeding courses or structure foundations.
- G. All material excavated, regardless of its nature or composition, shall be classified as UNCLASSIFIED. Excavation shall include the removal of all loose or disturbed soil, rock, weathered rock, rocks of all types, boulders, lumber, fill, sheeting & shoring, conduits, pipe and all other obstacles encountered of whatever nature. The cost of excavation shall be considered as incidental and no additional payment will be made for the removal of obstacles encountered.

1.03 QUALITY ASSURANCE

- A. Backfilled areas shall not suffer from ponding or settlement in excess of 0.10 feet for a period of one year from the date of final acceptance. Backfilled areas which settle in excess of this limitation shall be removed and replaced with suitable material at no additional cost to the Owner. Structures, paving, utilities, and other site improvements damaged by such settlement shall be removed and replaced at no additional cost to the Owner.
- B. Backfill and fill material shall be subject to in-place moisture/density testing, which shall be performed by an independent soil testing laboratory, arranged and paid for by the Contractor and approved by the Engineer. Should testing determine that the required density is not being met, or the material is outside the specified moisture range, the Contractor shall re-excavate, rework, and/or re-compact the particular layer or section until the required density and/or moisture is attained.

1.04 SUBMITTALS

- A. Submit material test results from a qualified testing agency in accordance with ASTM D2487 and certificates of suitability for each on-site and borrow soil material proposed for fill and backfill.
- B. Submit for approval a list of compaction equipment that the Contractor intends to use on the project, the recommendations of the equipment manufacturer as to the maximum lift thickness, which can be placed with that equipment, and the method of compaction to be used with this equipment.
- C. Submit for approval the sources of all material in Paragraph 2.01 to be used for this project.

D. Delivery Tickets

The Contractor shall submit delivery tickets with each load of material specified in Paragraph 2.01 brought to the site showing the following information:

1. Name and location of supplier or source.
2. Type and amount of material delivered.
3. Test information on the material as required by the specifications.

PART 2 - MATERIALS

2.01 SUITABLE MATERIAL

All excavated material from within the limits of the project, which is to be used for the construction of embankments or fill or used for backfilling, shall be approved by the Engineer.

A. Backfill adjacent to pipe and associated structures in area from subgrade of trench to two (2) feet above the crown of pipe or top of structure shall consist of 100 percent material passing the 1-inch sieve, or in accordance with pipe manufacturer's recommendations. Material above this point shall not contain stones or any other particles exceeding one half the lift thickness in any dimension and a maximum dry density no less than 105 pounds per cubic foot in accordance with AASHTO T-180.

B. Select Backfill

Material shall be AASHTO M145 Soil Classification Groups A-1-a, A-1-b, A-2-4, A-2-5, or A-3 and a maximum dry density no less than 110 pounds per cubic foot in accordance with AASHTO T-180.

C. Satisfactory Soils

AASHTO M145 Soil Classification Groups A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-3 or A-4; or a combination of these groups, and a maximum dry density of at least 100 pounds per cubic foot in accordance with AASHTO T-180.; free of rock or gravel larger than one half the lift thickness in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter.

D. Stone Fill

Stone fill under cast-in-place or precast concrete structures or as noted on plans shall be gravel, crushed stone or crushed gravel meeting the gradation requirements for Crusher Run Aggregate CR-6 or AASHTO M43 Number 57 Aggregate as indicated on the plans.

2.02 UNSUITABLE MATERIAL

- A. The following excavated materials will be unsuitable for reuse in fills and backfills.
 - 1. Material having a maximum dry density of less than 100 pounds per cubic foot in accordance with AASHTO T-180.
 - 2. Refuse and putrescent items.
 - 3. Organic material, wood, lumber and other deleterious material.
 - 4. Any material which, in the opinion of the Engineer, is unsatisfactory.
- B. Unsatisfactory Soils: AASHTO M145 Soil Classification Groups A-5, A-6 and A-7; or a combination of these groups; and any soils not maintained within 2-percent of optimum moisture content at time of compaction.

2.03 USE OF EXCAVATED MATERIAL

- A. All suitable material excavated from test pits shall be used, as far as practicable, for backfill. The Contractor shall properly store or stockpile and protect all materials that are to be reused in the work. Boulders, logs, wood, lumber or any other unforeseen obstacles encountered shall be removed. All unsuitable material shall be removed from the excavation and disposed of off-site by the Contractor at no additional cost to the Owner.

2.04 TESTS

- A. The Contractor shall hire an independent inspection agency and testing laboratory for inspection and testing of soils and compaction. The agency's responsibilities shall include:
 - 1. Inspection of exposed subgrade prior to preparation of site.
 - 2. Testing and approving all materials used for fill and/or backfill and borrow.
 - 3. Maintaining accurate records in regard to excavation and fill or backfill for ordered undercutting or over-excavation.
 - 4. Approving all backfilling procedures and mechanical compaction equipment.
 - 5. Verifying compaction by in-place density tests. Tests to be submitted to the Engineer for review. A minimum of one (1) density test per AASHTO T-310 shall be performed for each 5,000 square feet of lift or pavement area or more often if directed by the inspection agency. At least one density test per AASHTO T-310 shall be performed per lift in structural areas or more often if directed by the inspection agency.

6. Observe and inspect all proof rolling operations with a minimum of four passes of a fully loaded dump truck, or equivalent, to determine whether additional excavation and backfilling is required. Inspect and test excavation for structure footings to determine that the design bearing pressures are available and that no loose or soft pockets exist beneath the bearing surface. Approve the bearing surfaces or recommend undercutting and structural fills as necessary.
 7. Submitting weekly written reports as to the status of the backfill or fill.
 8. Submit a final report indicating that the backfill or fill meets the requirements of the Specifications.
 9. Determine all earthwork quantities for which unit price payments apply.
- B. It shall be the responsibility of the Contractor to notify the inspection agency three (3) days prior to the beginning of work so that the inspection agency can have a soils technician on the site during the work. The Contractor shall pay for all costs of this inspection service.

2.05 FILTER FABRIC

- A. Undercut areas to be backfilled with stone only shall use a filter fabric that permits subsurface drainage. Filter fabric shall be Maryland SHA Class SE non-woven Geosynthetic, or approved equal, with the following minimum properties determined according to ASTM D4759 and referenced standard test methods:
1. Grab Tensile Strength: 200 lb; ASTM D4632
 2. Puncture Strength: 80 lb; ASTM D6241
 3. Permittivity: 0.20 sec-1; ASTM D4491
 4. Apparent Opening Size: 0.30 mm; ASTM D4751
 5. Trapezoid Tear Strength: 80 lb; ASTM D4533
- B. Filter fabric for all other areas shall be Maryland SHA Class ST woven Geosynthetic, or approved equal, with the following minimum properties determined according to ASTM D4759 and referenced standard test methods:
1. Grab Tensile Strength: 300 lb; ASTM D4632
 2. Grab Tensile Elongation: 15% (Machine Direction); ASTM D4632
 3. Puncture Strength: 110 lb; ASTM D4833
 4. Permittivity: 0.05 sec-1; ASTM D4491

5. Apparent Opening Size: 0.15 mm; ASTM D4751
6. Trapezoid Tear Strength: 110 lb; ASTM D4533

PART 3 - EXECUTION

3.01 TRENCH EXCAVATION AND BACKFILL

A. Trench Excavation

1. The Contractor shall excavate, protect, and refill all excavation that may be necessary for completing the work under the contract. Unless otherwise specified, excavation shall be open cut, except that short sections of a trench may be tunneled if, in the opinion of the Engineer, the pipe can be safely and properly installed and backfill can be properly consolidated in such tunnel sections. No extra compensation will be allowed for tunneling instead of open cut. Sheet piling, shoring, interlocking sheet piling, hand excavation or other suitable methods shall be done as may be necessary for the protection of the work and for the safety of personnel.
2. Trenches shall be excavated to the necessary width and depth.
3. The sides of trenches shall be practically plumb and will be permitted to be sloped only with the written approval of the Engineer. Bell-holes shall be excavated in the bottom and side of trenches to permit the proper making of joints.
4. In paved areas, the Contractor shall remove the paving for such width only as is necessary for the excavation of the trench, as shown on standard trench details, and in case the Contractor removes the paving for a greater width than is deemed necessary, or in case the Contractor removes or disturbs any paving on account of settlement, slides or caves, or in making excavation outside the lines of the work without the written order of the Engineer, the Contractor shall replace at his/her own expense such paving, or the Owner may retain from any monies due or to become due to the Contractor, the cost of permanently replacing the paving so removed.
5. The Contractor shall support the sides and ends of all excavations or structures, whenever necessary.
6. All sheeting in excavations shall be withdrawn as the refilling is being done, except where the Engineer shall permit the sheeting and shoring be left in place at the Contractor's expense and upon his/her request. The Contractor shall cut off any sheeting left in place at least eighteen (18) inches below finished grade and shall remove the material cut off.

7. Wherever necessary, in quicksand or soft ground, or for the protection of any structure or property, sheeting shall be driven, to such depth below the bottom of the trench as may be required.
8. The Contractor is responsible for the stability, safety and integrity of the existing adjacent structures or underground pipes, and for any corrective measures or repairs required to restore the damaged structures to the condition, which existed prior to the start of work.
9. The Contractor shall be responsible for the condition of all excavations made by him/her. All slides and caves shall be removed without extra compensation, at whatever time and under whatever circumstance they may occur.
10. The excavation of all trenches shall be fully completed at least twenty (20) feet in advance of pipe laying unless otherwise authorized. The Engineer may at any time require the refilling of open trenches over completed pipe line, if in the Engineer's judgment such action is necessary, and the Contractor shall thereby have no claim for extra compensation, even though to accomplish said refilling the Contractor is compelled temporarily to stop excavation or other work at any place. If work is stopped on any trench, for any reason except by order of the Engineer, and the excavation is left open for an unreasonable length of time in advance of construction, the Contractor shall, if so directed, refill such trench at his/her own cost, and shall not again open said trench until the Contractor is ready to complete the pipe laying therein. If the Contractor shall refuse or fail to refill such trench completely within forty-eight (48) hours after said notice, the Owner shall be authorized to do the work and the expense thereof shall be charged to the Contractor.
11. All excavations shall be kept free of water below the subgrade of the work while work is in progress. Water removed from excavations shall be disposed of in accordance with approved erosion and sediment control practices.
12. The Contractor shall complete excavations in earth as nearly as practicable to the neat lines of the facilities to be built therein. All irregularities and cavities in the bottom of trenches or tunnels shall be filled up to the required level with clean earth or other approved material, firmly compacted, before pipelines are laid therein, and without extra compensation unless said cavities have been formed by the direction of the Engineer, and their excavation classed as excavation below sub-grade.

B. Trench Backfill

1. Material meeting the requirements of Paragraph 2.01 shall be carefully deposited in the trench by methods which will not damage or disturb the pipe or structures and shall be solidly tamped around the pipe or structure. The volume from the bottom of the trench to the spring line of the pipe shall be

placed in four (4) inch compacted layers. The volume from the spring line of the pipe to a point twelve (12) inches below road sub-base, or to grade, where the pipe is not laid in a road, shall be refilled in six (6) inch compacted layers. All tamping of material from the bottom of the trench to the spring line shall be done by pneumatic hand tampers; or if the material is composed largely of coarse aggregate, use hand tampers to insure protection of the pipe. Above this point, mechanical tampers capable of exerting a blow of 250-foot pounds per square foot of area of tamping face shall be employed.

2. The moisture content of the material being compacted shall be within plus or minus two (2) percentage points of optimum, as determined by AASHTO T-180 Method C and meet the following requirements:

Maximum Laboratory Dry Density (Lbs. per Cu. Ft.)	Minimum Field Compaction Requirements (% of Max. Lab. Dry Density)
105 minimum	Paved Areas 95, Unpaved Areas 92

Material containing an excess of moisture shall be processed and dried or permitted to dry until the moisture content is within the specified range.

3. The Engineer may make compaction tests of the backfilled trenches at any time during construction or upon completion of the backfill operations. If the results of any tests show that backfills do not meet the specified compaction requirements, the Contractor shall at his/her own expense, correct the condition in such portions of the trench represented by the unsatisfactory test results.
4. The top twelve (12) inches below the existing roadway subgrade for all trenches located in paved areas and shoulders shall be backfilled with well-compacted graded aggregate sub-base course. Trench backfill from the top of the compacted sub-base course to the existing roadway surface shall be maintained for a minimum of 30 days before permanent repairs are made.
5. All excavations not in paved areas shall be restored to the condition that existed prior to beginning work and maintained for a period of one year following the date of conditional acceptance.
6. The Contractor shall, at his/her own expense, maintain all backfilled excavations in proper condition. Just prior to the termination date for maintaining excavations, the trench surfaces shall be given a final reshaping where necessary. All depressions appearing in the backfilled excavations shall be properly refilled. If the Contractor fails to make repairs within forty-eight (48) hours after receipt of written notice from the Owner, the Owner may refill said depression or protect with signs and lanterns wherever necessary without giving additional notice to the Contractor and the cost of so doing will be retained from any monies due or to become due the

Contractor under the Contract. The Contractor shall be responsible for any injury or damage that may result from lack of maintenance of any refilled excavation at any time previous to the end of the mentioned termination dates.

7. All unauthorized excavations made by the Contractor shall be immediately backfilled in accordance with the requirements of the specifications at the Contractor's expense.
8. After completion of backfilling, all material not used therein, shall be removed and disposed of in such a manner, and at such point as shall be approved, and all roads, sidewalks, and other places on the line of the work shall be left free, clean and in good order. Said cleaning up shall be done by the Contractor without extra compensation, and, if he/she fails to do such work within a reasonable time after receipt of notice, it will be performed by the Owner, and the cost will be retained out of the monies due or to become due the Contractor under the contract.

C. Excavation Below Trench Subgrade and Refill

1. Unsuitable or other material encountered at or below the excavation limits which in the judgment of the Engineer should be removed, shall be removed to the extent directed; and all spaces created by the removal of any and all material shall be backfilled with thoroughly compacted stone fill.
2. In general, this item of work will be performed when the planned subgrade is in rock and a cushion is deemed necessary or where the planned subgrade is an unsuitable or unstable area. In any event, the work will be performed only upon the written direction of the Engineer.

3.02 STRUCTURE EXCAVATION AND BACKFILL

A. Structure Excavation

1. Structure excavation shall consist of the excavation of all earth, rock, boulders and all other materials encountered regardless of type, which the Contractor may encounter while excavating for structures. Support sides of excavation as necessary. All excavations contiguous to existing pavements and structures shall be sheeted, shored, braced and supported in a substantial manner to prevent settlement, movement or damage.
2. All suitable material shall be used for backfilling or reserved for the construction of embankments and fills. All unsuitable material shall be removed, at the Contractor's expense, from the limits of the work. No excavated material shall be deposited at any time so as to endanger partly finished structures either by direct pressure, or indirectly by overloading banks contiguous to the operation, or by any other means.

3. Trenches and foundation pits for structures or structure footings shall be excavated to the lines and grades, or elevations, indicated on the Plans, and shall be of sufficient size to permit the construction of the structures, or structure footings, as shown.
4. Where structures or structure footings are to be carried to rock, the rock shall be cut to a firm surface, either level or stepped, and serrated as indicated on the Plans. All thin strata and loose material shall be removed. All structure and structure footings, which are to be carried to rock shall be carried a minimum of six (6) inches into solid rock for the full area of the structure or structure footings.
5. Where structure or structure footings are to rest on material other than rock or piles, special care shall be taken so as not to disturb the bottom of the excavation. Should environmental conditions or construction traffic disturb the subgrade soils, the Contractor must restore the subgrade to a stable condition, as determined by the Engineer, prior to placing structure or footing.
6. Structure excavations shall be kept dewatered by such methods, as the Contractor deems necessary, subject to the approval of the Engineer. Where pumping is required a sufficient number of pumps of adequate size shall be employed to keep the excavation free of water until the foundation work is completed. The pumping and drainage operations shall be subject to the approval of the Engineer at all times. Water removed from the excavations shall be disposed of in such a manner as to not cause injury to public health, private property, street surfaces, or to any portion of the work completed or in progress, and in accordance with approved erosion and sediment control practices.

B. Structure Backfill

1. Where required, it shall be the Contractor's responsibility to obtain borrow excavation to complete backfilling to the elevations, lines and grades indicated on the Contract Drawings. If necessary, borrow excavation shall be obtained from an off-site location at no additional cost to the Owner.
2. All excavated material not required or suitable for backfill or other designated purposes shall be removed from within the limits of the work and disposed of by the Contractor.
3. To equalize external pressures against structures, backfill material shall be placed and compacted uniformly around the perimeter of the structure.

4. No backfill shall be placed against any new concrete or masonry structure until all of the provisions for curing, dampproofing, and waterproofing have been complied with, and until the compression test cylinders indicate that the concrete has obtained a minimum 2500 psi compressive strength.
5. Backfill material shall be placed in uniform layers not more than eight (8) inches thick and compacted to the specified density. Each layer shall be uniformly compacted to the specified density before the next layer is placed and processed.
6. The moisture content of the material being compacted shall be within plus or minus two (2) percentage points of optimum, as determined by AASHTO T-180 C and meet the following requirements.

Maximum Laboratory Dry Density (Lbs. per Cu. Ft.)	Minimum Field Compaction Requirements (% of Max. Lab. Dry Density)
105 minimum	95

Material containing an excess of moisture shall be processed and dried or permitted to dry until the moisture content is within the specified range. Material which is too dry shall be wetted until the moisture content is within the specified range.

3.03 TEST PIT EXCAVATION AND BACKFILL

- A. The Contractor shall not proceed with a test pit until the Contractor has determined, based upon available information, the location of all underground utilities in the vicinity of the test pit, nor shall the Contractor proceed with excavation of the test pit without the Engineer's approval. The Contractor shall excavate the test pits in such a manner that existing underground utilities are not damaged by his/her operations. Should any damage to existing utilities or structures occur as a result of the Contractor's operations, he/she shall, at his/her own expense, restore such utilities or structures to a condition equal to or better than that, which existed before the damage was done.
- B. The Contractor shall work on one test pit at a time. The Contractor shall conduct his/her work as to enable the Engineer to inspect and accurately locate the utilities within the test pits. All measurements of utility locations and elevations, and all probing will be made by the Contractor.
- C. Excavation shall be performed by using both power equipment and hand tools. Power equipment shall be utilized to the maximum extent possible; however, to protect existing utilities and adjacent foundations, a part of the total excavation shall be excavated with hand tools.

- D. Test pits shall be wide enough to allow the Engineer to stand in the excavation to investigate the exposed utilities. The length of each test pit will depend upon the location of the existing utilities.
- E. The contract drawings show, in addition to the pipe work and structures to be built, certain information regarding the location of pipes and other structures, which exist along the lines of work, both at and below the surface of the ground. The Owner and Engineer assume no responsibility for the accuracy and completeness of the information given on the contract drawings with regard to existing pipes and structures, and if the Contractor relies upon the information thus given in prosecuting the work, the Contractor does so at his/her own risk. The Contractor must verify the information given to his/her own satisfaction.
- F. Test pits shall be backfilled in accordance with the applicable provisions of Paragraph 3.01.B, "Trench Backfill".

3.04 EXCAVATION AND GRADING

- A. Excavation and grading shall be carried to the lines, grades, and slopes shown on the Plans. All earth slopes shall be finished to neat, regular lines conforming to the Plans and typical sections. The work shall be done in proper sequence in relation to all other operations involved.
- B. All available, suitable topsoil existing in areas where excavations or embankments are to be made shall be removed by the Contractor before excavation operations in any particular area are begun and used for topsoil on the completed site. The Contractor shall note however, that topsoil, which cannot be placed in its final position as it is being removed, shall be stockpiled in an approved location until such time as it can be incorporated in the final construction.
- C. Drainage facilities shall be installed in such sequence as to maintain the construction areas in a well-drained condition at all times during the process of excavation.
- D. Any bed or ledge rock, or boulders encountered at the planned subgrade shall be removed to a depth of at least three inches below the proposed lower limit of the subgrade for the full cross-sectional width of the required excavation. The removed material shall be replaced with material equal to select backfill or stone fill as approved by the Engineer.
- E. All existing masonry foundations and walls encountered during excavation operations which interfere with new construction, shall be removed to at least one (1) foot below finished grade. All spaces resulting from the removal of existing masonry shall be backfilled with approved material.

3.05 BORROW EXCAVATION

- A. If there is insufficient suitable material within the limits of the work for backfill and finished grading, borrow material will be required at the Contractor's expense.
- B. The Contractor shall notify the Engineer ten (10) days in advance of the opening of any borrow pit so that soil analysis and cross-sections (when required) may be made. Unless written permission from the Engineer is given to the Contractor to do otherwise, it is to be understood that after a pit is once opened, the material excavated is to be used only for the specific purpose and project intended.
- C. Overburden unsuitable for incorporation in the work shall be stripped and disposed of at the Contractor's expense. If the disposal area is in sight of the project, all unsuitable material shall be placed in the disposal areas, trimmed, shaped and sloped to drain.
- D. Approved materials provided under this item shall be incorporated in the work in conformity with the requirements of all the Contract Documents.
- E. After the required quantity of material has been obtained from the borrow pit, the pit shall be trimmed and shaped so as to present a neat appearance. All slopes shall be trimmed on a "one to one" or flatter slope, and all parts of the pit shall be effectively drained.

3.06 BACKFILL FOR UNDERCUT AREAS

- A. When excavations are made lower than the planned bottom of a structure or pipe, the bottom shall be raised by the placement of stone fill material. Undercut areas backfilled with stone fill shall be wrapped (all sides) with filter fabric in accordance with above requirements; placed with mechanical equipment or manually, depending on the volume of material involved.
- B. If areas of foundation are soft, composed of mud, or are in the Engineer's judgment unfit to receive pipe, conduit, structure, concrete, or masonry, such unacceptable material shall be removed and replaced with stone fill material at no additional cost to the Owner.

END OF SECTION

SECTION 02530
SANITARY SEWERS

PART 1 - GENERAL

1.01 DESCRIPTION

- A. This section includes requirements for providing sanitary sewer and drain pipe and fittings, and precast concrete manholes, as indicated, in accordance with the Contract Documents.

1.02 SUBMITTALS

- A. Layout drawings for all piping, including sizes, types, and locations. The drawings shall also indicate location of all fittings, wall and floor penetrations, valves, and pipe supports.
- B. Catalog data for all pipe, fittings, couplings and appurtenances.
- C. Manufacturer's instructions for installation and assembly of push-on and mechanical joints and accessories, including the manufacturer's recommended maximum deflection per joint.
- D. Submit certificates of compliance for all pipe, fittings and appurtenances in this section.
- E. Shop drawings for precast manholes, including plans, elevations, sections, details, and frames and covers.

1.03 PERFORMANCE REQUIREMENTS

- A. Influent sewer, gravity-flow non-pressure piping shall have a pressure rating of 10-foot head of water minimum.

1.04 PROJECT CONDITIONS

- A. Contractor shall not interrupt service to existing facilities without the Owner's written permission and then only after arranging to provide temporary service.

PART 2 - MATERIALS

2.01 DUCTILE IRON GRAVITY SEWER PIPE AND FITTINGS

- A. Pipe: ANSI A21.51, Push-On Joints.

- B. Fittings: ductile iron; ANSI A21.10 or A21.53, as applicable, Joints.
- C. Push-On Joint Gaskets: ANSI A21.11, rubber.

2.02 PROTECTIVE COATINGS AND LININGS

- A. Coat buried pipe and fittings with one mil thickness of asphaltic coating per AWWA C151, C110 and C153, as applicable.
- B. Line ductile iron pipe and fittings with Ceramic Epoxy, Induron Protecto 401, or approved equal.

2.03 PVC DRAIN PIPE AND FITTINGS

- A. Pipe: Cellular Core, ASTM F891.
- B. Fittings: PVC DWV fittings, ASTM D2665.
- C. Joints: Solvent-cemented, ASTM F656 and ASTM D2564.

2.04 MANHOLES

- A. Standard Precast Concrete Manholes: ASTM C478, precast reinforced concrete, of depth indicated, with provision for sealant joints.
 - 1. Diameter: 48-inches minimum, unless indicated otherwise.
 - 2. Ballast: Increase thickness of precast concrete sections or add concrete to base section, as required to prevent flotation.
 - 3. Base Section: 6-inch minimum thickness for bottom slab and 4-inch minimum thickness for walls and base riser section and having separate base slab or base section with integral bottom slab.
 - 4. Riser Sections: 4-inch minimum thickness and of length to provide depth indicated.
 - 5. Top Section: Eccentric-cone type, unless indicated otherwise. Top of cone of size that matches grade rings.
 - 6. Joint Sealant: ASTM C990, bitumen or butyl rubber.
 - 7. Resilient Pipe Connectors: ASTM C923, cast or fitted into manhole walls for each pipe connection/penetration.
 - 8. Steps: Individual fiberglass-reinforced plastic (FRP) steps, or ASTM A615 deformed, ½-inch steel reinforcing rods encased in ASTM D4101 polypropylene plastic (PP), wide enough to allow both feet on one step and

designed to prevent lateral slippage off of step. Cast or anchor steps into sidewall at 12-inch intervals.

9. Grade Rings: Reinforced concrete rings, 6- to 9-inch total thickness, to match diameter of manhole frame and cover.
10. Protective Coating: Coat exterior surface of precast concrete units with Carbolite Bitumastic 300-M, or approved equal, 32 mil minimum thickness.
11. Manhole Frames and Covers: Heavy duty, cast iron with solid lid and self-sealing gasket to make watertight, Neenah Model R-1557 frame and lid with self-sealing application, or approved equal.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Drawing plans and details indicate general location and arrangement of underground sanitary sewer piping. Location and arrangement of piping layout take design considerations into account. Install piping as indicated, to the extent practical. Where specific installation is not indicated, follow piping manufacturer's written instructions.
- B. Install piping beginning at low point, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves and couplings according to manufacturer's written instructions.
- C. Install proper size increasers, reducers, and couplings where different sizes or materials of pipes and fittings are connected. Reducing size of piping in direction of flow is prohibited.
- D. Install influent sewer, gravity-flow non-pressure piping according to the following:
 1. Install piping pitched down in direction of flow, at a minimum slope of 1-percent unless indicated otherwise.
 2. Install piping NPS 6 and larger with restrained joints at tee fittings and at changes in direction. Use corrosion-resistant rods, pipe or fitting manufacturer's proprietary restraint system, or cast-in-place concrete supports or anchors.
 3. Install ductile iron, gravity sewer piping according to ASTM A746.
 4. Install ductile iron and special fittings according to AWWA C600 or M41.
- E. Install buried PVC drain piping according to ASTM D2321 and ASTM F1668.

- F. Clear interior of piping and manholes of dirt and superfluous material as work progresses. Maintain swab or drag in piping and pull past each joint as it is completed. Place plug in end of incomplete piping at end of day and when work stops.

3.02 PIPE JOINT CONSTRUCTION

- A. Where specific joint construction is not indicated, follow piping manufacturer's written instructions.
- B. Join influent sewer, gravity-flow non-pressure piping according to the following:
 - 1. Join ductile iron gravity sewer piping according to AWWA C600.
 - 2. Join ductile iron and special fittings according to AWWA C600 or M41.
- C. Join PVC drain piping according to ASTM D2855 for solvent-cemented joints.

3.03 MANHOLE INSTALLATION

- A. Install manholes complete with appurtenances and accessories indicated.
- B. Install precast concrete manhole sections with sealants according to ASTM C891.
- C. Set tops of frames and covers flush with asphalt or concrete surfaces and 3 inches above ground finished grade.

3.04 CONNECTIONS

- A. Make connections to existing manholes by cutting opening into existing unit large enough to allow 3 inches of concrete to be packed around entering connection. Cut end of connection pipe passing through structure wall to conform to shape of, and be flush with, inside wall, unless indicated otherwise. On outside of manhole wall, encase entering connection in 6 inches of concrete for minimum length of 12 inches to provide additional support of collar from connection to undisturbed ground.
 - 1. Use concrete that will attain minimum 28-day compressive strength of 3,000 psi.
 - 2. Use epoxy bonding compound as interface between new and existing concrete and piping materials.
- B. Protect existing piping and manholes to prevent concrete or debris from entering while making connections. Remove debris or other extraneous material that may accumulate.

3.05 CLOSING ABANDONED SANITARY SEWER SYSTEMS

- A. Close open ends of abandoned underground piping with at least one (1) linear foot of Portland cement concrete. Ensure that closures are strong enough to withstand hydrostatic and earth pressures that may result after ends of abandoned piping have been closed.

3.06 IDENTIFICATION

- A. Install green warning tape directly over piping.

3.07 FIELD QUALITY CONTROL

- A. Inspect interior of piping to determine whether line displacement or other damage has occurred. Inspect after approximately 24 inches of backfill is in place and again at completion.
 - 1. Submit a report for each inspection.
 - 2. Defects requiring correction include the following:
 - a. Alignment: Less than full diameter of inside of pipe is visible between structures.
 - b. Crushed, broken, cracked, or otherwise damaged piping.
 - c. Infiltration: Water leakage into pipe.
 - d. Exfiltration: Water leakage from or around pipe.
 - 3. Replace defective piping using new materials and repeat inspections until defects are within allowances specified.
 - 4. Re-inspect and repeat procedure until results are satisfactory.
- B. Test new piping systems, and parts of existing systems that have been altered, extended, or repaired for leaks and defects.
 - 1. Do not enclose, cover, or put into service before inspection and approval.
 - 2. Schedule tests and inspections with the Owner at least 24 hours advance notice.
 - 3. Hydrostatic Tests: Test sanitary sewer according to the Frederick County General Conditions and Standard Specifications for Water Mains, Sanitary Sewer and Related Structures and the following:

- a. Allowable leakage is a maximum of 10.48 gpd/mile/inch of nominal pipe diameter.
 - b. Close openings in system and fill with water.
 - c. Purge air and refill with water.
 - d. Disconnect water supply.
 - e. Test and inspect joints for leaks.
 - f. Option: Test ductile iron piping according to AWWA C600, "Hydrostatic Testing" Section. Use test pressure of at least 10 psig.
4. Manholes: Perform hydraulic test according to ASTM C969.
- C. Leaks and loss in test pressure constitute defects that must be repaired.
- D. Replace leaking piping using new materials and repeat testing until leakage is within allowances specified.

3.08 CLEANING

- A. Clean interior of piping of dirt and superfluous material.

END OF SECTION

SECTION 02740
ASPHALT PAVEMENT

PART 1 - GENERAL

1.01 SUMMARY

- A. The work to be performed under this section includes, but is not limited to, the removal of existing macadam and/or asphalt concrete and furnishing of all materials, labor, tools and equipment necessary for the asphalt paving as shown on the Contract Drawings.

1.02 DESCRIPTION

- A. Provide asphalt paving according to materials, workmanship, and other applicable requirements of Maryland Department of Transportation State Highway Administration (MDSHA) *Standard Specifications for Construction and Materials* Category 500.

1.03 SUBMITTALS

- A. Product Data: For each type of product required. Include technical data and tested physical and performance properties.
- B. Job-Mix Designs: For each job mix proposed for the work.
- C. Qualifications: For pavement manufacturer.
- D. Material Test Reports: For each paving material.
- E. Material Certificates: For each paving material, signed by its manufacturer.

1.04 QUALITY ASSURANCE

- A. Manufacturer shall be a paving-mix manufacturer registered with, and approved by, the MDSHA.
- B. Testing Agency shall be qualified according to ASTM D3666 for testing indicated, as documented according to ASTM E548.
- C. Comply with MDSHA requirements for asphalt paving work.
- D. Comply with AI MS-22, "Construction of Hot Mix Asphalt Pavements", unless more stringent requirements are indicated.

1.05 PROJECT CONDITIONS

- A. Do not apply asphalt materials if subgrade is wet or excessively damp or if the following conditions are not met:
 - 1. Prime and Tack Coats: Minimum surface temperature of 40 deg F.
 - 2. Slurry Coat: Comply with weather limitations of ASTM D3910.
 - 3. Asphalt Base Course: Minimum surface temperature of 40 deg F and rising at time of placement.
 - 4. Asphalt Surface Course: Minimum surface temperature of 40 deg F at time of placement.
 - 5. Polymer-modified Surface Course: Minimum ambient air and surface temperatures are at least 50 deg F at time of placement.
- B. Do not apply new asphalt pavement until all existing macadam and/or asphalt concrete pavement is removed and the subgrade is prepared.

PART 2 - MATERIALS

2.01 AGGREGATES

- A. Use materials and gradations that have performed satisfactorily in previous installations.
- B. Aggregates shall be in accordance with MDSHA *Standard Specifications for Construction and Materials* Section 901.

2.02 ASPHALT MATERIALS

- A. Asphalt binder shall be in accordance with AASHTO MP1.
- B. Asphalt cement, prime coat and tack coat shall be in accordance with MDSHA *Standard Specifications for Construction and Materials* Section 904.
- C. Water shall be potable.

2.03 DESIGN MIXES

- A. Design mixes shall be developed by the Contractor in conformance with MDSHA *Standard Specifications for Construction and Materials* Section 904.
- B. Design mixes shall be submitted to the Engineer for approval.

2.04 AUXILIARY MATERIALS

- A. Herbicide shall be commercial chemical for weed control, registered with the EPA. Provide in granular, liquid, or wettable powder form.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Verify that all existing macadam and/or asphalt concrete has been removed and subgrade is dry and in suitable condition to support paving and imposed loads.
- B. Proof-roll subgrade and/or subbase using heavy, pneumatic-tired roller to locate areas that are unstable or that require further compaction.
- C. Proceed with paving only after unsatisfactory conditions have been corrected.

3.02 SURFACE PREPARATION

- A. General: Immediately before placing asphalt materials, remove loose and deleterious material from substrate surfaces. Ensure that prepared subgrade is ready to receive paving. Sweep loose granular particles from surface of unbound-aggregate base course. Do not dislodge or disturb aggregate embedded in compacted surface of base course.
- B. Herbicide Treatment: Apply herbicide according to manufacturers recommended rates and written application instructions. Apply to dry, prepared subgrade or surface of compacted-aggregate base before applying paving material.
- C. Prime Coat: Apply uniformly over surface of compacted unbound-aggregate base course at a rate of 0.15 to 0.50 gal/sq. yd. Apply enough material to penetrate and seal but not flood surface. Allow prime coat to cure for 72 hours minimum.
 - 1. If prime coat is not entirely absorbed within 24 hours after application, spread sand over surface to blot excess asphalt. Use enough sand to prevent pickup under traffic. Remove loose sand by sweeping before pavement is placed and after volatiles have evaporated.
 - 2. Protect primed substrate from damage until ready to receive paving.
- D. Tack Coat: Apply uniformly at a rate of 0.05 to 0.15 gal/sq. yd.
 - 1. Allow tack coat to cure undisturbed before applying asphalt paving.
 - 2. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.

3.03 ASPHALT PLACING

- A. Place asphalt on prepared surface, spread uniformly, and strike off in a manner that prevents segregation of mix. Place each course to required grade, cross section, and thickness when compacted.
- B. Spread mix at a minimum temperature of 225 deg F, beginning on the high side.
- C. Promptly correct surface irregularities in paving course. Use suitable hand tools to remove excess material forming high spots. Fill depressions with asphalt to prevent segregation of mix and use suitable hand tools to smooth surface.

3.04 COMPACTION

- A. General: Begin compaction as soon as placed paving will bear roller weight without excessive displacement. Compact paving with hand tampers or vibratory-plate compactors in areas inaccessible to rollers. No traffic is permitted on the pavement after rolling until it has cooled to less than 140 deg F.
- B. Breakdown Rolling: Complete breakdown or initial rolling immediately after rolling joints and outside edges. Examine surface immediately after breakdown rolling for required grade and smoothness.
- C. Intermediate Rolling: Begin intermediate rolling immediately after breakdown rolling while asphalt is still hot enough to achieve specified density. Continue rolling until asphalt course has been uniformly compacted to an average density of 92 percent of reference maximum theoretical density according to ASTM D2041, but not less than 90 percent nor greater than 96 percent.
- D. Finish Rolling: Finish roll paved surfaces to remove roller marks while asphalt is still warm.
- E. Edge Shaping: While surface is being compacted and finished, trim edges of pavement to proper alignment. Bevel edges while asphalt is still warm and compact thoroughly.
- F. Repairs: Remove paved areas that are defective or contaminated with foreign materials and replace with fresh asphalt. Compact by rolling to specified density and surface smoothness.
- G. Protection: After final rolling, do not permit vehicular traffic on pavement until it has cooled and hardened. Erect barricades to protect paving from traffic until mixture has cooled enough not to become marked.

3.05 INSTALLATION TOLERANCES

- A. Thickness: Compact each course to produce the thickness indicated within the following tolerances:
 - 1. Base Course: Plus or minus, ½-inch.
 - 2. Surface Course: Plus ¼-inch, no minus.
- B. Surface Smoothness: Compact each course to produce a surface smoothness within the following tolerances as determined by using a 10-foot straightedge applied transversely or longitudinally to paved areas:
 - 1. Base Course: ¼-inch.
 - 2. Surface Course: ⅛-inch.

3.06 FIELD QUALITY CONTROL

- A. Testing Agency: The Contractor shall engage a qualified independent testing and inspecting agency to perform field tests and inspections and to prepare test reports. Testing agency shall conduct and interpret tests and state in reports whether tested work complies with or deviates from the specified requirements.
- B. Thickness: In-place compacted thickness of asphalt courses shall be determined according to ASTM D3549.
- C. Surface Smoothness: Finished surfaces of each asphalt course shall be tested for compliance with smoothness tolerances.
- D. Testing agency shall take samples of uncompacted paving mixtures and compacted pavement according to ASTM D979 or AASHTO T168.
 - 1. Reference maximum theoretical density shall be determined by averaging results from four samples of asphalt paving mixture delivered to site, prepared according to ASTM D2041, and compacted according to job-mix specifications.
 - 2. In-place density of compacted pavement shall be determined by testing core samples according to ASTM D1188 or ASTM D2726.
 - a. One core sample shall be taken for every 1,000 sq. yds. or less of installed pavement, with no fewer than 3 cores taken.
 - b. Field density of in-place compacted pavement may also be determined by nuclear method according to ASTM D2950 and correlated with ASTM D1188 or ASTM D2726.

- E. Remove and replace or install additional asphalt where test results or measurements indicate that it does not comply with specified requirements.

END OF SECTION

SECTION 02750

TEMPORARY BYPASS PUMPING SYSTEMS

PART 1 - GENERAL

1.01 DESCRIPTION

- A. This section includes requirements to furnish all materials, labor, equipment, power, maintenance, etc. to implement a temporary pumping system for the purpose of diverting sewage flows.

1.02 QUALITY ASSURANCE

- A. The design, installation and operation of the temporary pumping system shall be the Contractor's responsibility. The Contractor shall employ the services of a vendor who can demonstrate to the Engineer that he specializes in the design and operation of temporary bypass pumping systems. The vendor shall provide at least five (5) references to the Engineer of projects similar in size and complexity to this project that have been performed by his firm within the past three (3) years. The bypass pumping system shall meet the requirements of all codes and regulatory agencies having jurisdiction.

1.03 SUBMITTALS

- A. The Contractor shall submit detailed plans and descriptions outlining all provisions and precautions to be taken by the Contractor regarding the handling of wastewater flows. This plan must be specific and complete, including such items as schedules, locations, elevations, capacities of equipment, materials and all other incidental items necessary and/or required to insure proper protection of the facilities, including protection of the access and bypass pumping locations from damage due to the discharge flows, and compliance with the requirements and permit conditions specified in these Contract Documents. No construction shall begin until all provisions and requirements have been reviewed by the Engineer.
- B. The Contractor shall submit working plans for the bypass pumping location, which shall include but not be limited to details of the following:
 - 1. Staging area for pump(s).
 - 2. Sewer plugging methods and type of plugs.
 - 3. Number, size, material, location and method of installation of suction piping.
 - 4. Number, size, material, method of installation and location of installation of discharge piping.

5. Bypass pump sizes, and power requirements.
 6. Calculations of static lift, friction losses, and flow velocity (pump curves showing pump operating range shall be submitted).
 7. Standby power generator size and location.
 8. Force main tapping and connection plan.
 9. Thrust and restraint block sizes and locations, if necessary.
 10. Sections showing suction and discharge pipe depth, embedment, select fill and special backfill.
 11. Method of noise attenuation for pump(s) and/or generator.
 12. Any temporary pipe supports, and anchoring required.
 13. Design plans and computations for access to bypass pumping locations indicated on the drawings.
 14. Calculations for selection of bypass pumping pipe sizes.
 15. Schedule for installation and maintenance of bypass pumping system.
 16. Plan indicating bypass pumping line locations.
- C. The Contractor shall be responsible for the design of a complete support and protection of excavation plan, including any dewatering that may be required, in order to excavate the force main to perform line tapping and stopping services, as necessary to provide a connection for the temporary bypass pumping and to complete the pumping station improvements work. This support and protection of excavation plan shall include design calculations and complete working drawings prepared and sealed by an experienced Professional Engineer registered in the State of Maryland.

PART 2 - MATERIALS

2.01 EQUIPMENT AND PIPING

- A. All pumps used shall be fully automatic self-priming units that do not require the use of foot-valves or vacuum pumps in the priming system. The pumps shall be diesel powered. All pumps used must be constructed to allow dry running for long periods of time to accommodate the cyclical nature of sewage flows. The use of electric pumps in any capacity will not be approved.

- B. The Contractor shall provide the necessary start, stop, and variable speed pump controls. Each diesel pump shall have a soft start with automatic ramping of speed to minimize flow and pressure spikes in the piping systems. Diesel pumps shall have a control panel, supplied by the bypass pump vendor at each pump location to provide means to control pump system flows, provide start/stop operation, and protect pump and piping system from high system pressure or deadhead operating conditions. The control panel shall allow for manual/auto speed control with infinite speed adjustment capability. The system shall also incorporate pressure-sensing devices to allow for automatic speed control as well as automatic low pressure start, and high pressure stop capability. The pressure sensing system shall also provide for automatic shutdown of pumping system in the event of high operating pressure or deadhead conditions. The Contractor is responsible for providing all instrumentation and control equipment necessary for monitoring the bypass pumping system. In the event of an overflow due to influent flow to the station being in excess of the required bypass pumping capacity, the Contractor will have to produce data showing the bypass system was pumping the required capacity at the time of the spillage or overflow.
- C. The Contractor shall include one stand-by pump of equal capacity to the largest primary pump, to be maintained on site. The stand-by-pump shall be piped and on-line, isolated from the primary system by a valve.
- D. Discharge Piping: In order to prevent the accidental spillage of flows, all discharge systems shall be constructed of rigid pipe with leak proof joints, suitable for the intended use. Under no circumstances will aluminum "irrigation" type piping or glued PVC pipe be allowed. Contractor shall also be responsible for any damage to the force main as a result of this work and shall be responsible for all sewage overflows and/or spills and clean up thereof, including all costs associated with such clean up. The Contractor shall also be liable for any civil and/or criminal penalties associated with any overflows and/or spills.
- E. Each bypass pump's control system shall include 8 programmable relays and 66 selectable features, including pump running, pump failure and others as directed by the Owner, as well as RS-232 and RS-485 communication ports which shall enable communication with SCADA and remote alarm equipment. The control system shall maintain an "event history" of up to 32 warning alarms.
- F. Bypass pumping system shall be provided with a wireless, remote alarm monitoring and notification system (WRTU) capable of remotely notifying the Contractor and the Owner of any problem with the bypass pumping system in time to prevent a sewage overflow. The WRTU shall be capable of monitoring and remotely notifying the Contractor and Owner of at least 8 different alarms and shall be installed in a NEMA 4X enclosure. The WRTU shall be a RACO AlarmAgent or approved equal. All temporary power, wireless network service plans, and programming for the remote alarm monitoring and notification system shall be the Contractor's responsibility.

2.02 DESIGN REQUIREMENTS

- A. Bypass pumping systems shall be capable of pumping all flows up to, and including, the capacity indicated on Dwg. T1. The Contractor shall provide all pipeline plugs, pumps of adequate size to handle all flows conveyed to the pumping station during the work, and temporary suction and discharge piping to ensure that all flow can be safely diverted around the pumping station for the duration of the work. The Contractor shall develop a system curve for the bypass pumping system.
- B. The Contractor shall have adequate back-up equipment available and ready for immediate operation and use in the event of an emergency or breakdown. One back-up pump shall be installed at the bypassing location, ready for use in the event of primary pump failure. This back-up pump is in addition to the stand-by pump specified in Paragraph 2.01.C and does not have to be piped and on-line. The standby pump controls and alarms shall be independent of the primary pumping system controls and alarms.
- C. The bypass pumping system shall be capable of bypassing the flow around the work area and of releasing any amount of flow up to full available flow into the work area as necessary for satisfactory performances of work.
- D. The Contractor shall make all arrangements for bypass pumping during the time when the pumping station is shut down for any reason. The bypass pumping system must overcome any force main pressure on discharge.
- E. The bypass pumping system shall be sound attenuated and shall not produce noise levels greater than 70 dBA at 30 feet at any time. Contractor shall provide noise level testing at the start of bypass pumping operations and at least once a month thereafter for the duration of the project to demonstrate that these noise levels are being met. If noise levels are not being met at any time during the bypass pumping operation, the Contractor shall take necessary remedial actions and provide additional noise level tests to demonstrate compliance at no additional cost to the Owner.

2.03 PERFORMANCE REQUIREMENTS

- A. It is essential to the operation of the existing sewerage system that there be no interruption in the flow of sewage throughout the duration of the project. To this end, the Contractor shall provide, maintain and operate all temporary facilities such as dams, plugs, pumping equipment (both primary and back-up units as required), conduits, all necessary power and fuel, and all other labor and equipment necessary to intercept the sewage flow before it reaches the point where it would interfere with his work, and return it to the force main.
- B. The design, including TDH requirements, installation and operation of the temporary bypass pumping system shall be the Contractor's responsibility. The bypass system shall meet the requirements of all codes and regulatory agencies having jurisdiction.

- C. The Contractor shall provide all necessary means to safely intercept the sewage before it reaches the work area. The Contractor will not be permitted to stop or impede the flows under any circumstances.
- D. The Contractor shall maintain sewer flow in a manner that will not cause surcharging of sewers or damage to sewers, and that will protect public and private property from damage and flooding.
- E. The Contractor shall protect water resources, wetlands and other natural resources.

PART 3 - EXECUTION

3.01 PRECAUTIONS

- A. Contractor is responsible for locating any existing utilities in the area where the Contractor selects to locate the bypass suction and discharge pipes. The Contractor shall locate his bypass pipes to minimize any disturbance to existing utilities and shall obtain approval of the pipe locations from the Owner and the Engineer. All costs and approvals associated with relocating utilities shall be the Contractor's responsibility.
- B. During all bypass pumping operations, the Contractor shall protect the pumping station, force main and all sewer lines from damage inflicted by any equipment. The Contractor shall be responsible for all physical damage to the pumping station and force main and all sewer lines caused by human or mechanical failure.

3.02 INSTALLATION AND REMOVAL

- A. The Contractor shall make connections to the existing sewer and force main and install temporary bypass pumping equipment only within the limits of disturbance indicated on the Drawings and as may be required to provide adequate suction conduit. Contractor shall be responsible for obtaining any additional temporary easements as may be required to provide the necessary bypass pumping operations. All coupons removed from existing piping shall be salvaged and stored at the pumping station for inspection by the Owner.
- B. Provide thrust blocking and permanent support of tapping valve.
- C. When plugging or blocking is no longer needed for performance and acceptance of work, it is to be removed in a manner that permits the sewage flow to slowly return to normal without surge, to prevent surcharging or causing other major disturbances downstream.
- D. The Contractor shall exercise caution and comply with OSHA requirements when working in the presence of sewer gases, combustible or oxygen-deficient atmospheres, and confined spaces.

- E. All bypass alarm and control wiring shall be installed in conduit or cable assemblies. All cables and fuel lines shall be neatly routed and adequately supported between equipment. Supports shall be spaced a maximum distance of two feet.
- F. Upon completion of the project and just prior to placing the pumping station in service, the Contractor shall hydraulically flush the impacted gravity sewer system upstream of the bypass pumping system using a high-pressure water jet or equivalent technique to remove all grease and debris. All solids, trash, debris, grease, etc. shall be collected and disposed of by a vacuum pump truck service before allowing flow back into the pumping station wetwell. Disposal of collected material shall be at an acceptable offsite facility. The Contractor shall thoroughly clean pipes, manholes, junction chambers, influent chambers, wetwells and any other structures from which the bypass pumping system draws suction or that is allowed to surcharge at any time during the temporary bypass pumping operations.

3.03 FIELD QUALITY CONTROL, OPERATION AND MAINTENANCE

A. TESTS

1. The Contractor shall perform leakage and pressure tests of the bypass pumping discharging piping using clean water prior to actual operation. The Engineer will be given 48 hours' notice prior to testing.
2. The minimum hydrostatic test pressure of the bypass pumping discharge piping shall be 1.5 times the operating pressure or the rated working pressure of the pipe, whichever is greater. The discharge piping system shall be hydrostatically tested for two hours without loss of pressure. Leakage shall be determined by loss of pressure. The Contractor shall provide dished heads, blind flange or bulkheads as necessary to isolate and test the bypass piping.
3. Once the bypass pumping system is set-up and operational, it shall be operated for a minimum of 72 continuous, trouble-free hours prior to the Contractor shutting off power to, or otherwise disrupting operation of, the existing pumping station. Should there be any problem with the operation of the bypass pumping system during this 72-hour test period, the problem shall be remedied, and the 72-hour test period started over. The Contractor shall demonstrate that the temporary bypass pumping system is installed as intended by operating the primary pump(s), stand-by pump, control system, remote alarming equipment, and all ancillary equipment. The temporary bypass pumping system shall be exercised on a weekly basis to ensure all components are fully operational.
4. Upon completion of the testing, all modifications to the bypass pumping system shall be brought to the Owner's attention.

B. OPERATION AND MAINTENANCE

1. The Contractor shall ensure that the temporary pumping system is properly maintained and that the remote alarm system is operational at all times. The Contractor shall respond to all alarms and rectify all situations in sufficient time to prevent sewage overflows. All alarms shall be sent to the Owner by the remote alarm system for informational purposes only. The Contractor shall have a competent and responsible bypass pumping system operator onsite within 30 minutes of alarm notification.
1. Batteries for all bypass pumps, including stand-by and back-up pumps, shall be equipped with a battery maintainer to provide a trickle charge to keep all batteries charged at all times without overcharging the batteries.
2. The Contractor shall be responsible for maintaining daily records of flow and maintenance activities, which shall be readily accessible for review by the Owner upon request.

3.04 EXTRA MATERIALS

- A. Any spare parts for pumps and piping necessary to ensure continuous operation to handle the specified sewage flows for the necessary duration of bypass pumping shall be kept on site as required. The Contractor shall be responsible, and liable, for any sewage backups or overflows that occur due to failure or shutdown of the bypass pumping system.
- B. Adequate hoisting equipment for pump(s) and accessories shall be maintained on the site.

END OF SECTION

SECTION 02821

CHAIN-LINK FENCE AND GATES

PART 1 - GENERAL

1.01 DESCRIPTION

- A. This Section includes requirements for providing chain-link fence, gates, and accessories, as indicated herein and as shown on the drawings, to include the tie in to the existing fencing and posts that are to remain in order to provide a completely functional system. Fence fabric shall be galvanized.

1.02 SUBMITTALS

- A. Submit the following shop drawings:
 - 1. Plan layout including spacing of posts and other components, locations of gates, post foundation dimensions, abrupt changes in grade, locations of corner, end and pull posts, hardware anchorage, and schedule of components.
 - 2. Cross sectional dimensions of posts, braces, rails, fittings, gates and accessories.
 - 3. Design of gates and details of gate hardware and accessories.
- B. Product data on fabric, post, fittings, accessories and hardware. Contractor shall take accurate field measurements to confirm existing fence fabric mech opening size and fabric height prior to submission to the Engineer for approval.
- C. Two (2) samples of fence fabric, 12 x 12 inches in size, illustrating construction.

1.03 PROJECT RECORD DOCUMENTS

- A. Submit as-built drawings of the fence and gates.
- B. Accurately record actual locations of perimeter posts relative to property lines.

1.04 PRODUCT DELIVERY, STORAGE AND PROTECTION

- A. Materials shall be delivered to the site in an undamaged condition. Materials shall be carefully stored off the ground to provide proper protection against oxidation caused by ground contact. Defective or damaged materials shall be replaced by the Contractor at no expense to the Owner.

PART 2 - PRODUCTS

2.01 FENCE FABRIC

- A. Fence fabric shall be made from galvanized fabric in accordance with ASTM A392. Fence fabric shall be woven in 2-inch mesh. Contractor shall take accurate field measurements to confirm existing fence fabric mesh opening size prior to submission to the Engineer for approval. Fabric shall be fabricated of 9-gauge wire. Fabric height shall be 7-feet. Contractor shall take accurate field measurements to confirm and match existing fabric height prior to product submission to the Engineer for approval. Fabric shall be knuckled on the top and bottom selvages.

2.02 GATES

- A. Gates shall be the types and sizes as shown on the drawings. Gate frames shall be ASTM 1043 Group 1C pipe with zinc external coating Type B, minimum nominal pipe size (NPS) 1 5/8-inch. Swing gates shall be galvanized steel welded fabrication in accordance with ASTM F900 and horizontal slide gate shall be in accordance with ASTM F1184. Gates shall be same height as fencing.
- B. Swing gate leaves more than 8-feet wide shall have either intermediate members and diagonal truss rods or shall have tubular members as necessary to provide rigid construction, free from sag or twist. Gate leaves less than 8-feet wide shall have truss rods or intermediate braces.
- C. Gate fabric shall be same as specified for fence fabric. Gate fabric shall be attached to the gate frame by method standard with the manufacturer, except that welding will not be permitted.
- D. Latches, hinges, stops, keepers, rollers, and other hardware items shall be furnished as required for the operation of the gates. Latches shall be arranged for padlocking so that the padlocks will be accessible from both sides of the gates. Stops shall be provided for holding the gates in the open position.

2.03 SLIDE GATES

- A. Slide gates shall be the cantilever type with sizes as shown on the drawings. Slide gates shall be in accordance with ASTM F1184, Type II, Class 2 - Internal Roller Design. Gate frames shall be ASTM F1043 Group 1C steel pipe with zinc external coating Type B minimum nominal pipe size (NPS) 2 3/8-inch. Gates shall be same height as adjacent chain link fencing.
- B. Design Criteria:
 - 1. Gate track system shall be keyed to interlock into gate frame member. When interlocked with and welded to the "keyed" frame top member, gate track shall form a composite structure.

2. Gate shall have a minimum counterbalance length of 50% of the opening.
 3. Gate shall have intermediate vertical members with spacing less than 50% of the gate frame height.
 4. Entire gate frame, including the counterbalance section, shall include two adjustable stainless steel cables (minimum 3/16-inch diameter) per bay to allow complete gate frame adjustment.
 5. Gate truck assemblies shall be tested for continuous duty and shall have zinc plated steel bearings meeting ASTM B117 salt spray test with no red rust after 790 hours. Bearings shall be specifically designed for roller applications with full complement ball bearings, shock resistant outer races, and captured seals.
 6. Gate truck assemblies shall be supported by a minimum 5/8-inch diameter zinc plated steel bolt with self-aligning capability, rated to support a 2,000-pound reaction load.
 7. Hanger brackets shall be hot-dipped galvanized steel with a minimum 3/8-inch thickness and gusseted.
 8. Gate top track and supporting hanger bracket assemblies shall be designed to withstand a 2,000-pound vertical reaction load without exceeding allowable stresses.
- C. Gate frame shall be fabricated from 6063-T6 aluminum alloy extrusions. The top member shall be a 3" x 5" aluminum structural tube extrusion weighing not less than 3.0 lb/ft. This frame member shall be keyed to interlock with a keyed track member. If fabricated as a single horizontal piece, the bottom members shall be a 2" x 5" aluminum structural tube weighing not less than 2.0 lb/ft. If fabricated in two horizontal pieces, the bottom member shall be a 5" aluminum structural channel weighing not less than 2.65 lb/ft.
- D. Major vertical members at the ends of the opening portion of the frame shall be "P" shaped in cross section with a nominal base dimension of no less than 2" x 2" and weighing not less than 1.6 lb/ft. Major members shall separate each bay and be spaced at intervals less than the gate height. Intermediate vertical members weighing not less than 0.82 lb/ft shall alternate between the 2" x 2" major members.
- E. The gate frame shall have separate semi-enclosed keyed tracks extruded from 6005A-T61 or 6105-T5 aluminum alloy, and weighing not less than 2.9 lb/ft. Track members are to be located on each side of the top member. When interlocked and welded to the keyed top member, it shall form a composite structure with the top of the gate frame. Welds shall be placed alternately along the top and side of the track at 9-inch centers with welds being a minimum of 2-inch long. All welds shall conform to AWS D1.2 Structural Welding Code and all welders shall be certified to AWS D1.2 Structural Welding Code.

F. Gate Mounting:

1. Gate frame shall be supported from the track by four (4) swivel type, self-aligning, 4-wheeled, sealed lubricant, ball-bearing truck assemblies.
2. The bottom of each support post shall have a bracket equipped with a pair of 3-inch UHMW guide wheels. Wheel cover protectors shall be included with bottom guides to comply with UL325.
3. Gap protectors compliant with ASTM F2200 shall also be provided.
4. The slide gate shall slide on the inside of the fence.
5. Provide lockable catch assembly. Latches, catches, keepers, rollers, and other hardware items shall be furnished as required for the fully functional operation of the gate. Latches shall be arranged for padlocking so that the padlocks will be accessible from both sides of the gates.

G. Gate fabric shall be same as specified for fence fabric. Gate fabric shall be attached at each end of the gate frame by standard fence industry tension bars and tied at each 2" x 2" vertical member with standard fence industry ties. There shall be no leading or bottom edge protrusions in accordance with ASTM F2200.

2.04 POSTS

A. Posts shall be zinc-coated Group IC steel pipe conforming to the requirements of ASTM F1043 and F1083. Minimum sizes shall be as shown on the drawings. Line posts and terminal (corner, gate, and pull) posts selected shall be of the same designation throughout the fence. Gate posts shall be for the gate type indicated to the limitations specified in ASTM F900 and ASTM F1184, with minimum NPS of 2 1/2-inch for line posts, 3-inch for terminal posts, and 4-inch for gate posts.

2.05 BRACES AND RAILS

A. Braces and top rails shall be zinc coated Group IC steel pipe minimum NPS 1 5/8-inch conforming to the requirements of ASTM F1043.

2.06 WIRE

A. Tension wire shall be 0.177-inch diameter, Type II, Class 2 coating, in accordance with ASTM A824.

2.07 ACCESSORIES

- A. All accessories shall be in accordance with ASTM F626. Ferrous accessories shall be zinc-coated with minimum thickness of 0.006-inch and maximum thickness of 0.015-inch.
- B. Tension and brace bands shall be galvanized pressed steel complying with ASTM F626, minimum steel thickness of 12 gauge, minimum width of 3/4 inch and minimum zinc coating of 1.20 oz/ft².
- C. Truss rods shall be furnished for each terminal post. Truss rods shall be provided with turnbuckles or other equivalent provisions for adjustment. Truss rods shall be minimum 3/8-inch diameter steel with a minimum zinc coating of 1.2 oz/ft², assembly capable of withstanding a minimum tension of 2,000 lbs.
- D. Tension bars shall be galvanized steel with minimum zinc coating of 1.2 oz/ft². Bars for 2 inch mesh shall be a minimum cross section of 3/16 inch by 3/4 inch.
- E. Tie wire for attaching fabric to rails, braces, and posts shall be 9-gauge steel wire and match the coating of the fence fabric.
- F. Miscellaneous hardware coatings shall conform to ASTM A153 unless modified.
- G. Barbed wire arms shall be corrosion-resistant, with clips, slots, or other means for attaching strands of barbed wire, and means for attaching to posts or integral with post cap; for each post. Line posts shall have arms that accommodate top rail or tension wire. Fence corner posts shall have corner arms. Barbed wire arms shall be Type I, single slanted arm.

2.08 BARBED WIRE

- A. Zinc-coated steel barbed wire shall be in accordance with ASTM A121, chain-link fence grade for standard three-strand barbed wire. Barbed wire shall consist of 0.099-inch diameter line wire with 0.080-inch diameter, 4-point round barbs spaced not more than 5-inches on center.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Fence shall be installed to the lines and grades indicated. Line posts shall be spaced equidistant at intervals not exceeding 10 feet. Terminal (corner, gate, and pull) posts shall be set at abrupt changes in vertical and horizontal alignment. Fabric shall be continuous between terminal posts; however, runs between terminal posts shall not exceed 500 feet. Any damage to galvanized surfaces, including welding, shall be repaired with paint containing zinc dust in accordance with ASTM A780.

3.02 EXCAVATION

- A. Post holes shall be cleared of loose material. Waste material shall be disposed of by the Contractor. Ground surface irregularities along the fence line shall be eliminated to the extent necessary to maintain no clearance between the bottom of the fence fabric and finish grade.

3.03 POSTS

- A. Posts shall be set plumb and in alignment. Posts shall be set in concrete to the depth indicated on the Contract Drawings. Hole diameters shall be not less than 16-inches for terminal posts and not less than 12-inches for line posts. Concrete and grout shall be thoroughly consolidated around each post, shall be free of voids and finished to form a dome. Concrete and grout shall be allowed to cure a minimum of seventy-two (72) hours prior to attachment of any item to the posts.

3.04 RAILS, TENSION WIRE, BRACES AND TRUSS RODS

- A. Top rails shall be supported at each post to form a continuous brace between terminal posts. Where required, sections of top rail shall be joined using sleeves or couplings that will allow expansion or contraction of the rail.
- B. Tension wire shall be installed in accordance with ASTM F567, maintaining plumb position and alignment of fencing. Pull wire taut, without sags. Fasten fabric to tension wire with 0.120-inch diameter hog rings of same material and finish as fabric wire, spaced a maximum of 24 inches o.c. Install bottom tension wire within 6 inches of bottom of fabric and tie to each post with not less than same diameter and type of wire.
- C. Braces and truss rods shall be installed as indicated and in conformance with the standard practice for the fence furnished. Horizontal compression braces and diagonal tension truss rods shall be installed. Braces and truss rods shall extend from terminal posts to line posts. Diagonal braces shall form an angle of approximately 40 to 50 degrees with the horizontal.

3.05 FABRIC

- A. Chain-link fabric shall be installed on the side of the post indicated. Fabric shall be attached to terminal posts with stretcher bars and tension bands. Bands shall be spaced at approximately 15-inch intervals. The fabric shall be installed and pulled taut to provide a smooth and uniform appearance free from sag, without permanently distorting the fabric diamond or reducing the fabric height. Fabric shall be fastened to line posts at approximately 15-inch intervals and fastened to all rails and tension wires at approximately 12-inch intervals. Fabric shall be cut by untwisting and removing pickets. Splicing shall be accomplished by weaving a single picket into the ends of the rolls to be joined. The bottom of the installed fabric shall be to the finished grade, but not more than 2-inch above the ground.

3.06 GATES

- A. Gates shall be installed at the locations shown on the drawings. Hinged gates shall be mounted to swing as indicated. Latches, stops, and keepers shall be installed as required. Hinge pins, and hardware shall be welded or otherwise secured to prevent removal. Slide gate shall be installed in accordance with ASTM F1184, and as recommended by the manufacturer.

3.07 EXISTING FENCE AND MESH

- A. Take extreme caution to not damage the existing fence, to include all posts and mesh to remain in order to tie in the new fence mesh and all other necessary fence components to the nearest fence post to the 100-year floodplain line on the property (and outside of the 100-year floodplain) as shown on the drawings. This would include the nearest fence post near Property Corner Coordinate 8 and the nearest fence post nearest Control Coordinate 1029 and not within the 100-year floodplain.
- B. Provide all components as necessary to complete the fence tie in so that there is no gap in the fencing between the existing and new fence and mesh. Ensure existing fence is securely fastened to the existing post to remain.

3.08 ERECTION TOLERANCES

- A. Maximum Variation from Plumb: 1/4-inch.
- B. Maximum Offset from True Position: 1-inch.

3.09 GROUNDING

- A. Install fence grounding at maximum intervals of 750-feet by driving a grounding rod vertically until the top is 6-inches below finished grade. Connect rod to fence with No. 6 AWG conductor. Connect conductor to each fence component at the grounding location. Ground fence on each side of gate openings. Bond metal gates to gate posts using No. 2 AWG wire and bury it at least 18-inches below finished grade. Connect bonding jumper between gate post and gate frame. Make connections so possibility of galvanic action or electrolysis is minimized.

3.10 BARBED WIRE

- A. Install barbed wire uniformly spaced and angle outward. Pull wire taut and install securely to extension arms and secure to end post or terminal arms.

3.11 ADJUSTING AND DEMONSTRATION

- A. Adjust gate to operate smoothly, easily, and quietly, free of binding, warping, excessive deflection, distortion, non-alignment, misplacement, disruption, or malfunction, throughout the entire operating range. Confirm that latches and locks engage accurately and securely without forcing or binding.

B. Lubricate hardware and other moving parts.

END OF SECTION

SECTION 03300

CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.01 DESCRIPTION

- A. The work of this section includes, but is not limited to:
 - 1. Concrete Reinforcement
 - 2. Concrete Formwork
 - 3. Cast-In-Place Concrete
 - 4. Concrete Accessories
 - 5. Concrete Curbing and Gutters
 - 6. Watertightness Testing of Structures
- B. Work on this Project shall conform to all requirements of ACI 350.5, "Specifications for Environmental Concrete Structures," published by the American Concrete Institute, Farmington Hills, Michigan, except as modified by these Contract Documents.
- C. Work on this Project shall conform to all requirements of ACI 350.1-10, "Tightness Testing of Environmental Engineering Concrete Containment Structures," published by the American Concrete Institute, Farmington Hills, Michigan, except as modified by these Contract Documents.
- D. Work on this Project shall conform to all requirements of ACI 117-10, "Specification for Tolerances for Concrete Construction and Materials", published by the American Concrete Institute, Farmington Hills, Michigan, except as modified by these Contract Documents.
- E. Work on this Project shall conform to all requirements of ACI 301-16, "Specifications for Structural Concrete", published by the American Concrete Institute, Farmington Hills, Michigan, except as modified by these Contract Documents.

F. Alternate to Cast-In-Place Concrete Structures:

If the Contractor proposes any construction type other than Cast-In-Place Concrete, the structures under consideration shall be designed by the Contractor or the Contractor's fabricator/manufacturer and the design shall be in accordance with the Engineers requirements. Alternate design shall be signed and sealed by a registered Professional Engineer in the State of Maryland and submitted to the Engineer.

1.02 REFERENCED STANDARDS AND SPECIFICATIONS

A. American Concrete Institute (ACI)

1. 117 Standard Specifications for Tolerances for Concrete Construction and Materials
2. 301 Specifications for Structural Concrete for Buildings
3. 304R Guide for Measuring, Mixing, Transporting, and Placing Concrete
4. 305R Guide to Hot Weather Concreting
5. 305.1 Specification for Hot Weather Concreting
6. 306R Guide to Cold Weather Concreting
7. 306.1 Specification for Cold Weather Concreting
8. 308.1 Specification for Curing Concrete
9. 309R Guide for Consolidation of Concrete
10. 315 Details and Detailing of Concrete Reinforcement
11. 318 Building Code Requirements for Structural Concrete
12. 347.R Guide to Formwork for Concrete
13. 350 Code Requirements for Environmental Engineering Concrete Structures
14. 350.1 Specification for Tightness Testing of Environmental Engineering Concrete Containment Structures and Commentary
15. 350.5 Specifications for Environmental Concrete Structures

- B. American Society for Testing and Materials (ASTM)
1. A276 Standard Specification for Stainless Steel Bars and Shapes
 2. A615 Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement
 3. A775 Standard Specification for Epoxy-Coated Steel Reinforcing Bars
 4. A1064 Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete
 5. C31 Standard Practice for Making and Coring Concrete Test Specimens in the Field
 6. C33 Standard Specification for Concrete Aggregate
 7. C39 Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens
 8. C42 Standard Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete
 9. C94 Specification for Ready-Mixed Concrete
 10. C138 Standard Test Method for Density (Unit Weight), Yield, and Air Content (Gravimetric) of Concrete
 11. C143 Standard Test Method for Slump of Hydraulic Cement Concrete
 12. C150 Specification for Portland Cement
 13. C171 Specification for Sheet Materials for Curing Concrete
 14. C172 Standard Practice for Sampling Freshly Mixed Concrete
 15. C173 Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method
 16. C227 Standard Test Method for Potential Alkali Reactivity of Cement-Aggregate Combinations (Mortar-Bar Method)
 17. C231 Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method
 18. C260 Specification for Air-Entraining Admixtures for Concrete

19. C309 Specification for Liquid Membrane-forming Compounds for Curing Concrete
20. C457 Standard Test Method for Microscopical Determination of Parameters of the Air-Void System in Hardened Concrete
21. C494 Specification for Chemical Admixtures for Concrete
22. C595 Standard Specification for Blended Hydraulic Cements
23. C618 Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete
24. C666 Standard Test Method for Resistance of Concrete to Rapid Freezing and Thawing
25. C881 Specification for Epoxy-Resin-Base Bonding Systems for Concrete
26. C920 Standard Specification for Elastomeric Joint Sealants
27. C989 Standard Specification for Slag Cement for use in Concrete and Mortars
28. C1012 Standard Test Method for Length Change of Hydraulic-Cement Mortars Exposed to a Sulfate Solution
29. C1064 Standard Test Method for Temperature of Freshly Mixed Hydraulic-Cement Concrete
30. C1077 Standard Practice for Agencies Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Testing Agency Evaluation
31. C1116 Standard Specification for Fiber-Reinforced Concrete
32. C1202 Standard Test Method for Electrical Indication of Concrete's Ability to Resist Chloride Ion Penetration
33. C1240 Standard Specification for Silica Fume Used in Cementitious Mixtures
34. C1567 Standard Test Method for Determining the Potential Alkali-Silica Reactivity of Combinations of Cementitious Materials and Aggregates (Accelerated Mortar-Bar Method)
35. D226 Standard Specification for Asphalt-Saturated Organic Felt used in Roofing and Waterproofing

36. D227 Standard Specification for Coal-Tar-Saturated Organic Felt used in Roofing and Waterproofing
37. D448 Standard Classification for Sizes of Aggregates for Road and Bridge Construction
38. D638 Standard Test Method for Tensile Properties of Plastics
39. D994 Standard Specification for Preformed Expansion Joint Filler for Concrete (Bituminous Type)
40. D1751 Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)
41. D1752 Standard Specification for Preformed Sponge Rubber Cork and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction
42. D3963 Standard Specification for Fabrication and Jobsite Handling of Epoxy-Coated Steel Reinforcing Bars
43. E154 Standard Test Methods for Water Vapor Retarders used in Contact with Earth Under Concrete Slabs, on Walls, or as Ground Cover
44. E329 Standard Specification for Agencies Engaged in Construction Inspection, Testing, or Special Inspection
45. E1643 Standard Practice for Selection, Design, Installation, and Inspection of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs
46. E1745 Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs

C. American Welding Society (AWS)

1. D1.4 Structural Welding Code - Reinforcing Steel

D. Corps of Engineers

1. CRD C572 Specification for Polyvinyl Chloride Waterstop

E. Government Services Administration (GSA)

1. TT-S-00227E - Sealing Compound: Elastomeric Type, Multi-Component (For Caulking, Sealing, and Glazing in Buildings and Other Structures)

- F. American Association of State Highway and Transportation Officials (AASHTO)
 - 1. T303 Accelerated Detection of Potentially Deleterious Expansion of Mortar Bars Due to Alkali-Silica Reaction
 - 2. M85 Standard Specification for Portland Cement (Chemical and Physical)
 - 3. M182 Standard Specification for Burlap Cloth Made from Jute or Kenaf and Cotton Mats
- G. Concrete Reinforcing Steel Institute (CRSI)
 - 1. Manual of Standard Practice

1.03 QUALITY ASSURANCE

- A. Design Criteria:
 - 1. Design each required concrete group to meet the physical properties specified in this Section.
 - 2. In addition to structural strength and stability requirements, design and construct concrete in structures to ensure:
 - a. Maximum density and impermeability - these quantities are achieved with low water cement ratios and a slow, moist cure.
 - b. Maximum resistance to reaction of chemicals, alternate wetting and drying, and exposure to the elements.
 - c. Well-formed and smooth surfaces to minimize resistance to flow.
- B. Testing Agency Qualifications: An independent agency, acceptable to the Engineer, qualified according to ASTM C1077 and ASTM E329 for testing indicated.
 - 1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-1 or an equivalent certification program.
 - 2. Personnel performing laboratory tests shall be ACI-certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician - Level I. Testing Agency laboratory supervisor shall be an ACI-certified Concrete Laboratory Testing Technician - Level II.

Testing Agency: Concrete testing for slump, compressive strength, and air content shall be performed by a testing laboratory engaged and paid by the Contractor and

approved by the Engineer. No concrete shall be poured unless the testing agency is on-site.

- C. Mix Designer: Person responsible for developing concrete mixture proportions certified as NRMCA Concrete Technologist Level 2 or DOT certified mix designer in the jurisdiction of the work.
- D. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C94 requirements for production facilities and equipment. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."
- E. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from single source, and obtain admixtures from single source from single manufacturer.
- F. Construct and erect concrete formwork and accessories in accordance with ACI 301, ACI 347.R, ACI 350, and ACI 350.5.
- G. Perform concrete reinforcing work and cast-in-place concrete work in accordance with ACI 117, 301, ACI 350, and ACI 350.5.
- H. All field joints in waterstops shall be free of misalignment, bubbles, inadequate bond, porosity, cracks, offsets, and other defects which would reduce the potential resistance of the material to water pressure at any point. All defective joints shall be replaced with material which shall pass said inspection, and all faulty material shall be removed from the site and disposed of by the Contractor as its own expense.

1.04 SUBMITTALS

- A. Shop Drawings: Submit detailed reinforcing drawings prepared in accordance with ACI 315, including bar schedule with bar marks and bends indicated. Indicate all openings, including additional reinforcing at openings and corner bar arrangements at intersecting beams, walls and footings indicated in the typical details and structural drawings, indicate proposed construction joint layout.
- B. Design Mix:
 - 1. Prior to start of placing concrete, submit for review design mix for each type of concrete, indicating that the concrete ingredients and proportions will result in a concrete mix meeting the physical requirements for each concrete specified in this Section.
 - 2. Do not vary proportions of the ingredients or source of material of the approved mix without submitting corresponding test result documentation to the Engineer for approval.

3. When a water reducing admixture is to be used, the Contractor shall furnish mix designs for concrete both with and without the admixture.

Each concrete mix submittal shall contain the following information, as applicable:

- a. Documentation of average strength for each proposed mix design in accordance with ACI 301.
 - b. Location and purpose of the mix.
 - c. Slump on which the design is based.
 - d. Total gallons of water per cubic yard, and the water/cement ratio.
 - e. Brand, type, composition and quantity of cement.
 - f. Brand, type, composition and quantity of fly ash.
 - g. Specific Gravity, source and gradation of each aggregate.
 - h. Ratio of fine to total aggregate per cubic yard.
 - i. Weight (surface dry) of each aggregate per cubic yard.
 - j. Brand, type, and ASTM designation, active chemical ingredients and quantity of each admixture.
 - k. Air content.
 - l. Time of initial and final set.
 - m. Certificate of Compliance for Cement.
 - n. Concrete pour sequence.
 - o. Letter of Certification that concrete producer has verified compatibility of constituent materials in design mix.
4. Submit field or laboratory test records used to document that proposed mixture will achieve the required average compressive strength and other specified requirements, for each class and mix of concrete.

C. Certificates

1. Submit a certification attesting that reinforcing steel meets the requirements of ASTM A615, and that welded steel wire fabric meets the requirements of ASTM A1064.

2. Submit, with the concrete mix design, laboratory test reports and manufacturer's certificates attesting the conformance of ingredients with these specifications.
 3. Submit a certification or delivery ticket from the concrete supplier for each batch delivered to the site (ASTM C94). The delivery ticket shall list: name of ready-mix batch plant, serial number of ticket, date and truck number, name of Contractor, specific designation of job, batch number, amount of concrete, time loaded or of first mixing of cement and aggregates, number of revolutions, water added by receiver of concrete and receiver's initials, type and name of admixtures and amount of same, type and brand of cement, amount of cement, total water content by producer, maximum size of aggregate, weights of fine and coarse aggregate, and indication that ingredients are as previously certified or approved.
 4. The Contractor shall furnish a Certificate of Compliance signed by the supplier identifying the type of fly ash and stating that the fly ash complies with ASTM C618 and these specifications, together with all supporting test data prior to the use of the fly ash the sample represents. The supporting data shall also contain test results confirming that the fly ash in combination with the cement and water to be used meets all strength requirements and is compatible with air-entraining agents and other admixtures.
- D. Test Reports: Submit four (4) copies of required slump tests, air content tests, and strength tests.
1. Water-Soluble Chloride-Ion Content in Hardened Concrete:
 - a. Supplier's Certificate of Compliance that each admixture does not include any intentionally added chlorides and/or that their chloride content does not exceed trace amounts.
 - b. Verification that potable water is used in the concrete mix or test data documenting the chloride content of the water.
 - c. Letter from the concrete supplier stating that fine and coarse aggregates are from sources that are not known to be susceptible to chlorides in the aggregates.
 2. Alkali silica reactivity in accordance with ASTM C1567.
 3. Indication of permeability in accordance with ASTM C1202.
 4. Freeze-thaw durability in accordance with ASTM C457 or ASTM C666.

- E. Aggregates:
 - 1. Percent of fine aggregate weight to total aggregate weight.
 - 2. Deleterious substances in fine aggregate:
 - a. Clays and friable
 - b. Percent passing No. 200 sieve
 - c. Percent of coal and lignite in fine aggregate
 - 3. Deleterious substances in coarse aggregate.
- F. Pour Schedules: Submit concurrently with the steel reinforcing drawings six (6) copies of concrete pour schedules showing sequence of pours and all contraction, expansion and construction joints.
- G. Watertightness test procedures and test results data.
- H. Product Data: For each type of product indicated.
- I. Formwork Shop Drawings: Prepared by or under the supervision of a qualified Professional Engineer registered in the State of Maryland.
 - 1. Indicate detailing, fabrication, assembly, and support of formwork.
 - 2. Shoring and Reshoring: Indicate proposed schedule and sequence of stripping formwork, shoring removal, and reshoring installation and removal.
 - 3. Joints in forms shall not leak water, cement and fines, or concrete mortar during placing and vibrating of concrete.
 - 4. Limit panel deflections to $l/240$ of each panel span to meet required tolerances.
 - 5. Forms shall be designed for predetermined placing rates per hour, considering expected air temperatures and setting rates.
 - 6. Adequate clean-out holes shall be provided at the bottom of each lift of forms. Temporary openings shall be provided at the base of column forms and wall forms and at other points to facilitate cleaning and observation immediately before the concrete is deposited. The size, number and location of such clean-outs shall be as acceptable to the Engineer.

- J. Material Certificates: For each of the following, signed by manufacturers:
1. Cementitious materials
 2. Aggregates
 3. Admixtures
 4. Form materials and form-release agents
 5. Mix water
 6. Steel reinforcement and accessories
 7. Fiber reinforcement
 8. Waterstops
 9. Curing compounds
 10. Floor and slab treatments
 11. Bonding agents
 12. Adhesives
 13. Vapor retarders
 14. Semirigid joint filler
 15. Joint-filler strips
 16. Repair materials
- K. Material Test Reports: For the following, from a qualified testing agency, indicating compliance with requirements:
1. Aggregates. Include service record data indicating absence of deleterious expansion of concrete due to alkali aggregate reactivity.
- L. Field quality control reports.
- M. Proposed curing methods.
- N. Detailed plan for cold weather curing and protection of concrete placed and cured in weather below 40 degrees F or near 40 degrees F and falling. The details shall include, but not be limited to, the following:

1. Procedures for protecting the subgrade from frost and the accumulation of ice or snow on reinforcement and other metallic embedments or forms prior to concrete placement.
 2. Methods for temperature protection during placement.
 3. Types of covering, insulation, housing, or heating to be provided.
 4. Curing methods to be used during and following the protection period.
 5. Use of strength accelerating admixtures.
 6. Methods for verification of in-place strength.
 7. Documentation of embedments that must be at a temperature above freezing prior to placement of concrete.
 8. Procedures for measuring and recording concrete temperatures.
 9. Procedures for preventing drying during dry, windy conditions.
- O. Detailed plan for hot weather placements, including curing and protection for concrete placed in ambient temperatures over 80 degrees F.

1.05 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Reinforcing Steel:
1. For reinforcing steel fabricated on-site, ship from the mill in bundles, limited to one size and length, tagged with a waterproof tag showing the name of the mill, heat number, grade and size of the bars, and identifying number.
 2. For reinforcing steel fabricated off-site, deliver in bundles identified as to structure and shop drawing number. Identify each individual bar with a waterproof tag showing the grade, size and bar mark from the approved bar schedule.
 3. Deliver, store, and handle steel reinforcement to prevent bending and damage, and in accordance with CRSI publication "Placing Reinforcing Bars." Avoid damaging coatings on reinforcing steel.
- B. Concrete Ingredients: Handle, control and store concrete materials in accordance with ACI 304, Chapter 2.
- C. Waterstops: Store waterstops under cover to protect from moisture, sunlight, dirt, oil, and other contaminants.

PART 2 - PRODUCTS

2.01 GENERAL

- A. Products shall be in accordance with requirements of ACI 301 unless otherwise noted.

2.02 FORM MATERIALS

- A. Forms for Exposed Finish Concrete: Plywood, metal, metal-framed plywood faced, or other acceptable panel-type materials, to provide continuous, straight, smooth, exposed surfaces. Furnish in largest practicable sizes to minimize number of joints and to conform to joint system shown on drawings. Materials shall be new or in an undamaged condition.
 - 1. Use plywood complying with US Product Standard PS-1 "B-B (Concrete Form) Plywood", Class I, Exterior Grade or better, mill-oiled and edge-sealed, with each piece bearing legible inspection trademark.
 - 2. Forms for Unexposed Finish Concrete: Plywood, lumber, metal, or other acceptable material. Provide lumber dressed on at least two edges and one side for tight fit.
 - 3. Form Coatings: Provide commercial formulation form-coating compounds that will not bond with, stain, nor adversely affect concrete surfaces, and will not impair subsequent treatments of concrete surfaces.
 - 4. Form Ties: Factory-fabricated, adjustable-length, removable or snap off metal form ties, designed to prevent form deflection and to prevent spalling concrete upon removal. Provide units that will leave no metal closer than 1½-inch to surface.
 - 5. Provide ties which, when removed, will leave holes not larger than 1-inch diameter in concrete surface.
- B. Earth cuts shall not be used as forms for vertical surfaces unless written approval is received by the Engineer.
- C. Chamfer Strips: Wood, metal, PVC, or rubber strips, (¾-inch by ¾-inch), minimum, unless noted otherwise.
- D. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.
 - 1. Formulate form-release agent with rust inhibitor for steel form-facing materials.

- E. Form Ties: Factory-fabricated, removable or snap-off metal or glass-fiber-reinforced plastic form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.
 - 1. Furnish units that will leave no corrodible metal closer than 1½-inch to the plane of exposed concrete surface.
 - 2. Furnish ties that, when removed, will leave holes no larger than ⅞-inch in diameter in concrete surface.
 - 3. Furnish ties with integral water-barrier plates to walls indicated to receive dampproofing or waterproofing, and walls that will be in contact with liquids in the completed structure. Orient waterstop perpendicular to tie and symmetrical about center of tie.
 - 4. Wire ties are not permitted.
- F. Beveled Edge Corner Strips: Nonabsorbent material, compatible with form surface, fully sealed on all sides prohibiting loss of paste or water between the two surfaces.

2.03 REINFORCING MATERIALS

- A. Reinforcing Bars: ASTM A615, Grade 60, deformed, epoxy coated in accordance with ASTM A775.
- B. Welded Wire Reinforcement: ASTM A1064, fabricated and furnished in flat sheets.
- C. Supports for Reinforcement: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire fabric in place. Use wire bar type supports complying with CRSI specifications.
 - 1. For slabs-on-grade, use supports with sand plates or horizontal runners where base material will not support chair legs.
 - 2. For exposed-to-view concrete surfaces, where legs of supports are in contact with forms, provide supports with legs which are plastic protected (CRSI, Class 1) or stainless steel protected (CRSI, Class 2).
- D. Joint Dowel Bars: ASTM A615, Grade 60, plain-steel bars, cut true to length with ends square and free of burrs.
- E. Epoxy Repair Coating: Liquid, two-part, epoxy repair coatings; compatible with epoxy coating on reinforcement and complying with ASTM A775.
- F. Stainless Joint Dowel Bar: ASTM A276, Type 316L.

2.04 CONCRETE MATERIALS

- A. Materials: Unless otherwise specified, materials shall be in accordance with ACI 301 and ACI 350.5.
- B. Portland Cement: ASTM C150, Type I or Type II:
 - 1. Conforming to the chemical requirements in AASHTO M 85 for a maximum alkali content of 0.60%.
 - 2. Portland Cement shall not contain more than 8% tricalcium aluminate and more than 12% tetracalcium aluminoferrite.
 - 3. Use one brand of cement from one manufacturing source and mill throughout project, unless written approval is received by the Engineer.
 - 4. Blended Hydraulic Cement:
 - a. Unless otherwise specified, blended hydraulic cements shall conform to the requirements of ASTM C595.
 - b. Portland cement used in blended hydraulic cement shall conform to the requirements of ASTM C150.
 - c. Blended cements shall be Type IP (Portland Fly Ash Cement) or Type IS (Portland Slag Cement) conforming to ASTM C595.
 - (1) Type IP cement shall be an interground blend of Portland Cement and fly ash in which the fly ash constituent is between 15% and 25% of the weight of the total blend.
 - (2) Type IS cement shall be an interground blend of Portland Cement and slag cement in which the slag constituent is between 35% and 50% of the weight of the total blend.
- C. Normal Weight Aggregates: ASTM C33, and as herein specified. Provide aggregates from a single source.
 - 1. Fine Aggregate shall be clean, sharp, natural or manufactured sand, free from loam, clay lumps, or other deleterious substance within allowable standards.
 - 2. Coarse Aggregate shall be clean, uncoated, graded aggregate, containing no clay, mud, loam or foreign matter and free of excessively flat or elongated pieces.
 - a. Maximum size of coarse aggregate shall not exceed:

- (1) 0.2 narrowest dimension between forms.
- (2) $\frac{3}{4}$ minimum clear spacing between reinforcing.
- (3) $\frac{1}{3}$ thickness of slab.

D. Supplementary Cementitious Materials (SCM):

1. Fly Ash (Pozzolan): Class F fly ash in accordance with ASTM C618, except as modified herein:
 - a. ASTM C618, Table 1, Loss on Ignition: Maximum 3 percent.
 - b. ASTM C618, Table 2, Water Requirement: Maximum 100 percent of control.
 - c. ASTM C618, Table 3, Expansion of Test Mixture. Results shall be evaluated using either Procedure A or Procedure B and as follows:
 - (1) Procedure A after 6-month sulfate exposure, maximum 0.10 percent.
 - (2) Procedure B, expansion of test mixture as a percentage of sulfate resistance cement control, after at least 6-month exposure, maximum 100 percent.
 - d. Where fly ash is specified to be used with Portland cement, fly ash shall meet one of the following requirements:
 - (1) CaO: Maximum 15 percent.
 - (2) Test cementitious materials as follows:
 - (a) In accordance with ASTM C1012.
 - (b) Furnish test data confirming fly ash in combination with cement used meets strength requirements, is compatible with air-entraining agents and other additives, provides increased sulfate resistance equivalent to or better than Type II cement.
 - (c) Conduct tests using proposed fly ash and cement samples together with control samples using Type II cement without fly ash.

- e. Additional fly ash shall not be included in concrete mixed with Type IS or IP cement.
 - 2. Slag Cement: In accordance with ATSM C 989, Grade 100 or Grade 120, including tests for effectiveness of slag in preventing excessive expansion due to alkali-aggregate reactivity as described in Appendix X-3 of ASTM C989.
 - a. Additional slag cement shall not be included in concrete mixed with Type IS or IP cement.
- E. Silica Fume: ASTM C1240, amorphous silica.
- F. Water: ASTM C94 and Potable
- G. Admixtures:
 - 1. General: Total Chloride ions from admixtures and other measures shall be no greater than 0.1 percent by weight of cement in the concrete mix immediately prior to service exposure.
 - 2. Provide admixtures certified by manufacturer 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.
- H. Air-Entraining Admixture: ASTM C260, certified by manufacturer to be compatible with other required admixtures.
 - 1. Available Products: Subject to compliance with requirements, products that may be incorporated in the work include, but are not limited to, the following:
 - a. "Sika AER-C"; Sika Corp.
 - b. "MasterAir VR-10 or MasterAir AE-90"; BASF.
 - c. "Darex AEA" or "Daravair"; GCP Applied Technologies.
- I. Water-Reducing Admixture: ASTM C494, Type A, and containing not more than 0.1 percent chloride ions.
 - 1. Available Products: Subject to compliance with requirements, products which may be incorporated in the work include, but are not limited to, the following:
 - a. "WRDA with Hycol"; GCP Applied Technologies.

- b. "MasterPozzolith 210"; BASF.
 - c. "Plastocrete 161"; Sika Chemical Corp.
- J. High Range Water Reducing Admixture (Super Plasticizer): ASTM C494, Type F or Type G and containing not more than 0.1 percent chloride ions.
 - 1. Available Products: Subject to compliance with requirements, products which may be incorporated in the work include, but are not limited to, the following:
 - a. "Daracem"; GCP Applied Technologies.
 - b. "Sikament"; Sika Chemical Corp.
 - c. "MasterRheobuild"; BASF.
- K. Water Reducing, Non-Chloride Accelerator Admixture: ASTM C494, Type E, and containing not more than 0.1 percent chloride ions.
 - 1. Available Products: Subject to compliance with requirements, products which may be incorporated in the work include, but are not limited to, the following:
 - a. "Accelguard 80"; Euclid Chemical Co.
 - b. "MasterSet FP 20"; BASF.
 - c. "A-40"; Specco Industries.
- L. Water Reducing, Retarding Admixture: ASTM C494, Type D, and containing not more than 0.1 percent chloride ions.
 - 1. Available Products: Subject to compliance with requirements, products which may be incorporated in the work include, but are not limited to, the following:
 - a. "MasterPozzolith"; BASF.
 - b. "Eucon Retarder 75"; Euclid Chemical Co.
 - c. "Daratard", GCP Applied Technologies.

- M. Integral Crystalline Waterproofing Admixture: Provide an Integral Crystalline Waterproofing Admixture for concrete in liquid containment structures.
1. Available products: Subject to compliance with requirements, products which may be incorporated in the work include, but are not limited to, the following:
 - a. "Krystol KIM"; Kryton
 - b. "Xypex Admix C"; Xypex
 - c. "AQUAFIN-IC ADMIX"; Aquafin
 - d. "MasterLife 300D"; BASF
 - e. "ADI-CON CW PLUS"; W.R. Meadows
 - f. "CWS ADMIX"; Concrete Waterproofing Systems LTD
- N. Shrinkage Reducing Admixture:
1. Shrinkage reducing admixture is permitted to be used in the mix to meet shrinkage limitations provided that specified strength is met and there is no reduction in sulfate resistance and no increase in permeability. Quantity of shrinkage reducing admixture used in the mix shall be added to the quantity of water for purposes of determining the water/cementitious materials ratio.
 2. Available products: Subject to compliance with requirements, products which may be incorporated in the work include, but are not limited to, the following:
 - a. "Masterlife SRA20"; BASF
 - b. "PREVent-C"; Premier CPG
 - c. "Eclipse 4500"; GCP Applied Technologies
 - d. "Eucon SRA"; Euclid Chemical Company
- O. Prohibited Admixtures: Calcium chloride thyocyanates or admixtures containing more than 0.1 percent chloride ions are not permitted.
- P. Synthetic Fiber: Uniformly disperse in concrete mixture at manufacturer's recommended rate, but not less than 1.5 lb/cu. yd. Use Fibermesh 150 only 100 percent virgin polypropylene multifilament fibers containing no reprocessed olefin materials and specifically engineered and manufactured in an ISO 9001:2000 certified facility for use as concrete secondary reinforcement. Application per cubic yard shall equal a minimum of 1.5 lb per cubic yard. Fibers are for the control of cracking due to plastic shrinkage, plastic settlement and thermal

expansion/contraction, lowered permeability, increased impact, abrasion and shatter resistance. Fiber manufacturer shall document evidence of ten-year satisfactory performance history, ISO 9001:2000 certification of manufacturing facility, compliance with applicable building codes and ASTM C1116, Type III fiber reinforced concrete. Fibrous concrete reinforcement shall be manufactured by Propex Concrete Systems, Euclid Chemical Company, or approved equal. Synthetic fiber shall only be used at locations indicated on the contract drawings.

2.05 RELATED MATERIALS

A. Waterstops:

1. Cast-In-Place PVC/TPV Waterstops.

a. Material:

(1) Polyvinyl Chloride: Corps of Engineers CRD-C 572; Extruded from elastomeric plastic compound of which resin shall be prime virgin polyvinyl chloride (PVC). Compound shall not contain scrapped material, reclaimed material, or pigment. Chemical extenders in the PVC are not permitted.

(a) Tensile Strength - 1,750 psi min. (ASTM D638)

(b) Ultimate Elongation - 280% min. (ASTM D638)

(2) Manufacturers: BoMetals, Inc.; DuraJoint Concrete Accessories; or Sika Greenstreak.

(3) Thermoplastic Vulcanizate: Fully cross-liked Thermoplastic Vulcanizate (TPV), containing no plasticizer, mineral fillers, scrap or reclaimed material.

(a) Manufacturers: Wirestop® Paul Murphy Plastics Company; Earth Shield TPV/TPE-R by JP Specialties, Inc.; TPE-R by BoMetals, Inc.; Westec TPE-R by Westec Barrier Technologies; or TPE-R by DuraJoint Concrete Accessories.

b. Provide 9-inch wide by $\frac{3}{8}$ -inch thick waterstop unless noted otherwise on the Contract Drawings. Provide 9-inch x $\frac{3}{8}$ -inch flat ribbed or flat dumbbell type waterstops at construction joints; and 9-inch x $\frac{3}{8}$ -inch centerbulb ribbed or centerbulb dumbbell type waterstops at expansion and contraction joints. Waterstop shall maintain a consistent thickness.

- c. Waterstops shall be manufactured with factory-installed galvanized or stainless steel wireloops, or metal eyelets, along the edge of both side, integral to the waterstop; for proper positioning of waterstop in forms at time of concrete placement, to facilitate securing the waterstop to reinforcing steel to prevent displacement during concrete placing operations and to ensure accurate location of waterstop in center of joint. The waterstops shall be wired to the reinforcement in accordance to the manufacturer's recommendations. If no manufacturer recommendations are available, then the waterstop shall be wired a maximum of two (2) feet on center.
 - d. Factory fabricated corners, intersection, and directional changes shall be used. Waterstops shall be heat spliced using an appropriate splicing device provided by the manufacturer. Splicing shall occur outside the reinforcing steel assembly. Provide at all construction, contraction and expansion joints and at other joints as indicated on the Contract Drawings.
 - e. When waterstop is to be installed in concrete that is to be in contact with drinking water, waterstop shall be certified for use in potable water per NSF/ANSI Standard 61. Third-party certified documentation to be provided by the Manufacturer.
 - f. Corrugated or tapered type waterstops are not acceptable.
2. Self-Expanding Butyl Strip Waterstops: Manufactured rectangular or trapezoidal strip, butyl rubber with sodium bentonite or other hydrophilic polymers, for adhesive bonding to concrete, $\frac{3}{4}$ -inch by 1-inch.
- a. Available Products:
 - (1) Colloid Environmental Technologies Company; Volclay Waterstop-RX.
 - (2) Concrete Sealants Inc.; Conseal CS-231.
 - (3) Greenstreak; Swellstop.
 - (4) Henry Company, Sealants Division; Hydro-Flex.
 - (5) JP Specialties, Inc.; EarthShield Type 20.
 - (6) Or approved equal.
3. Self-Expanding Rubber Strip Waterstops: Manufactured rectangular or trapezoidal strip, bentonite-free hydrophilic polymer modified chloroprene rubber, for adhesive bonding to concrete, $\frac{3}{8}$ -inch by $\frac{3}{4}$ -inch.

- a. Available Products:
 - (1) Deneef Construction Chemicals; SwellSeal.
 - (2) Greenstreak; Hydrotite.
 - (3) Mitsubishi International Corporation; Adeka Ultra Seal.
 - (4) Or approved equal.

4. "Tee" Shaped Waterstop:

- a. Provide split "Tee" shaped waterstops as manufactured by Paul Murphy Plastic Co. or approved equal. Where "Tee" waterstops are to be used, the following procedures shall be used:
 - (1) Apply FX-752 All Purpose Bonding Agent as manufactured by Simpson Strong-Tie, or approved equal, to the existing structure where the waterstop is to be installed.
 - (2) Apply FX-263 Rapid Hardening Vertical/Overhead Repair Mortar as manufactured by Simpson Strong-Tie, or approved equal, to a depth of not less than 1/4" to the existing structure where the waterstop is to be installed.
 - (3) Allow the trowelable mortar to set a minimum of 48 hours. Apply FX-523 Flexibilized Epoxy Adhesive as manufactured by Simpson Strong-Tie, or approved equal, to adhere the waterstop to the troweled mortar surface. New concrete shall not be placed until the FX-523 Flexibilized Epoxy Adhesive, or approved equal, and waterstop have been in place for a minimum of one hour.
- b. If a manufacturer other than Simpson Strong-Tie is used, all components to install the split "Tee" waterstop shall be from the same approved manufacturer.

B. Vapor Retarder:

- 1. Plastic Vapor Retarder: ASTM E1745, Class A, provide sheet vapor retarder cover over prepared base material where indicated below slabs on grade. Use only materials, which are resistant to decay when tested in accordance with ASTM E154, as follows:
 - a. Vapor retarder sheet membrane not less than 10 mils thick, as specified in Section 07190 Under-Slab Vapor Retarder.

2. Granular Fill: Clean mixture of crushed stone or crushed or uncrushed gravel; ASTM D448, Size 57, with 100 percent passing a 1½-inch sieve and 0 to 5 percent passing a No. 8 sieve.
 3. Fine-Graded Granular Material: Clean mixture of crushed stone, crushed gravel, and manufactured or natural sand; ASTM D448, Size No. 10, with 100 percent passing a ¾-inch sieve, and 10 to 30 percent passing a No. 100 sieve. Material shall have a uniform distribution of particle sizes ranging from No. 4 to the No. 200 sieve. Refer to ASTM C33, Table 1, for limitation of deleterious substance limits for fine aggregates.
- C. Absorptive Cover: Burlap cloth made from jute or kenaf, weighing approximately 9 oz. per square yard, complying with AASHTO M182, Class 2.
- D. Moisture Retaining Cover: One of the following, complying with ASTM C171.
1. Polyethylene film, or
 2. White burlap-polyethylene sheet.
- E. Liquid Membrane Forming Curing Compound: Liquid type membrane forming curing compound complying with ASTM C309, Type I, Class A or Class B. Moisture loss not more than 0.055 gr./sq. cm. when applied at 200 sq. ft./gal.
1. Available Products: Subject to compliance with requirements, products which may be incorporated in the work include, but are not limited to, the following:
 - a. "MasterKure"; BASF,
 - b. "Kurez"; Euclid Chemical Co., or
 - c. "Clear Resin Cure J11W"; Dayton Superior.
- F. Bonding Compound: Polyvinyl acetate or acrylic base.
1. Available Products: Subject to compliance with requirements, products which may be incorporated in the work include, but are not limited to, the following:
 2. Acrylic or Styrene Butadiene:
 - a. "Burke Bonding Agent J40"; Dayton Superior,
 - b. "SBR Latex"; Euclid Chemical Co., or
 - c. "Daraweld C"; GCP Applied Technologies.

G. Epoxy Adhesive: ASTM C881, two-component material suitable for use on dry or damp surfaces. Provide material "Type", "Grade", and "Class" to suit project requirements. Types III, IV and V, load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.

1. Available Products: Subject to compliance with requirements, products which may be incorporated in the work include, but are not limited to, the following:
 - a. "Epobond"; L & M Construction Chemicals,
 - b. "Sikadur Hi-Mod"; Sika Chemical Corp, or
 - c. "Duralcrete"; Euclid Chemical Co.

H. Fasteners:

1. Fasteners and Anchors shall be of the type and size shown on the Drawings, and are specified as follows:

Anchors with capability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E488, conducted by a qualified independent testing agency.

a. Anchor Bolts:

- (1) 304 Stainless Steel, unless noted otherwise on the Drawings.
- (2) Size and configuration as shown on the Drawings.

b. Mechanically Fastened Anchors:

- (1) Expansion anchors shall have embedment lengths as shown in the Contract Drawings.
 - (a) 304 Stainless Steel, Condition CW1 or CW2, unless noted otherwise on the Drawings.
 - (b) Acceptable manufacturers: "Kwik Bolt TZ" by Hilti, Inc., or approved equal.
- (2) Request for an alternate expansion anchor shall include the following:
 - (a) Building Code Compliance Certifications
 - (b) International Code Council Approvals

- (c) Product Description
- (d) Material Specifications
- (e) Allowable Tension and Shear Static Loads
- (f) Technical Data
- (g) Anchor Spacing and Edge Distance Reduction Factors

c. Chemically Fastened Anchors/Reinforcing Bars:

(1) Sizes and embedments of chemically fastened anchors/reinforcing bars shall be as shown in the Contract Drawings.

(a) Acceptable manufacturers: "HIT RE 500 Epoxy Anchoring System" as manufactured by Hilti, Inc., or approved equal.

(2) Request for an alternate fastening system shall include the following:

- (a) Product Description
- (b) Material Specifications
- (c) Technical Data
- (d) Allowable Loads
- (e) Ultimate Strengths
- (f) Spacing and Edge Distance Reduction Factors
- (g) Influence of Temperature on Strength
- (h) Resistance to Chemicals
- (i) Installation Guidelines

2. Substitution of the anchor types shown on the Drawings shall not be permitted without approval of the Engineer.

- I. Pre-molded Joint Fillers:
 - 1. Pre-molded Joint Fillers and Bond Breakers: Unless otherwise noted on the Drawings, the materials shall conform to the following:
 - a. Pre-formed Non-extruding Filler: ASTM D994, ASTM D1751, asphalt-saturated cellulosic fiber, or ASTM D1752 self-expanding cork.
 - b. Manufactured clear adhesive tape to break bond between sealant and joint filler.
- J. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.
 - 1. Available Products: Subject to compliance with requirements, products which may be incorporated in the work include, but are not limited to, the following:
 - a. "AquaFilm"; Dayton Superior,
 - b. "VaporAid"; Kaufman Products, Inc., or
 - c. "SikaFilm"; Sika Corporation.
- K. Bond Breaker: Non-staining liquid product which imparts a waterproof film to prevent adhesion of concrete and will not leave a paint-impeding coating on the face of the concrete.
- L. Joint Sealant - In accordance with the following for joints intended to be submerged and/or in contact with process liquids. Joint types include: Control, construction, expansion, contraction, and isolation. For joint sealant accessories and installation, see Section 07900 "Sealants and Caulking."
 - 1. Comply with ASTM C920, Type M, Class 25, Grade NS/Grade P/Grade SL, Use NT, I, G, A, O, T, M; GSA TT-S-00227E Type 1/Type 2, Class A.
 - 2. Sealant shall be a two-component base system, polysulfide. Sealant shall be conforming to NBS and GSA TT-S-0227E (1970); FX-572/573 Polysulfide Joint Sealant as manufactured by Simpson Strong-Tie, or Thiokol 2235M/2235SL Polysulfide Joint sealant as manufactured by ITW PolySpec or approved equal.
 - 3. Joint Sealant Color: To match adjacent concrete work, unless otherwise directed by the Owner.

M. Backing Rod:

1. Backing rod shall be an extruded closed-cell, polyethylene foam rod. The material shall be compatible with the joint sealant material used and shall have a tensile strength of not less than 40 psi and a compression deflection of approximately 25 percent at 8 psi. The rod shall be 1/8-inch larger in diameter than the joint width except that a 1-inch diameter rod shall be used for a 3/4-inch wide joint.

N. Roofing Felt: ASTM D226, Type II, #30 asphalt-saturated or approved equal weight of ASTM D227 coal-tar saturated felt.

O. Granular Base Subgrade: Provide layer of AASHTO No. 57 stone with thicknesses as shown on the Contract Drawings.

2.06 FLOOR AND SLAB TREATMENTS

A. Unpigmented Mineral Dry-Shake Floor Hardener: Factory packaged dry combination of Portland cement, graded quartz aggregate, and plasticizing admixture.

1. Available Products: Subject to compliance with requirements, products which may be incorporated in the work include, but are not limited to, the following:
 - a. "Quartz Tuff"; Dayton Superior,
 - b. "Surflex"; Euclid Chemical Company, or
 - c. "Quartzplate FF"; L&M Construction Chemicals, Inc.

2.07 PROPORTIONING AND DESIGN OF MIXES

A. General: Concrete shall be composed of cement, admixtures, aggregates and water. These materials shall be of the qualities specified. The exact proportions in which these materials are to be used for different parts of the work will be determined during the trial batch/mix design. In general, the mix shall be designed to produce a concrete capable of being deposited so as to obtain maximum density and minimum shrinkage and, where deposited in forms, to have good consolidation properties and maximum smoothness of surface. Mix designs with more than 41 percent of sand of the total weight of fine and course aggregate shall not be used. The aggregate gradations shall be formulated to provide fresh concrete that will not promote rock pockets around reinforcing steel or embedded items. The proportions shall be changed whenever necessary or desirable to meet the required results at no additional cost to the Owner. All changes shall be subject to review by the Engineer.

- B. Prepare design mixes for each type and strength of concrete by either laboratory trial batch or field experience methods as specified in ACI 301. If trial batch method is used, use an independent testing facility acceptable to Engineer for preparing and reporting proposed mix designs. The testing facility shall not be the same as used for field quality control testing. Prepare design mixes for the following minimum 28-day compressive strengths and applications:
1. 3,500 psi air entrained use for all pipe encasements, reaction backings, Fill Concrete and Structural Foundation Backfill.
 2. 4,500 psi use for all structural concrete unless otherwise noted. Submit separate mixes for each condition i.e., air entrained, non-air entrained, pumped.
- C. Submit design mixes and proof of performances for each type and strength of concrete in accordance with ACI 301 and ACI 318.
1. When field tests are available, follow the Field Test Data design method per ACI 301.
 - a. Provide thirty (30) consecutive tests (or two groups of the same design mix totaling 30 or more), and compute the standard deviation per ACI 301, Section 4.2.3.2.
 - b. When only 15 to 29 tests are available, compute the increased standard deviation per ACI 301, Section 4.2.3.2.
 2. When field tests are not available, supplier shall supply the trial mix design following the restrictions of ACI 301, Section 4.2.3.3. and 4.2.3.4.

Trial mixtures shall be tested by an independent testing facility and shall not be the same at the facility used or field quality control testing.
 3. Upon written approval by the Engineer, where field test records for trial data are not available, the concrete mix design may follow the Empirical Method of ACI 301.
 4. When permitted by Engineer, materials certificates in lieu of materials laboratory test reports can be submitted. Materials certificates shall be signed by manufacturer and Contractor, certifying that each material item complies with or exceeds specified requirements.
 5. Provide certification from admixture manufacturers that chloride content complies with specification requirements.
- D. Submit written reports to Engineer of each proposed mix for each class of concrete at least 15 days prior to start of work. Do not begin concrete production until mixes have been reviewed and approved by Engineer.

- E. Adjustment to Concrete Mixes: Mix design adjustments may be requested by Contractor when characteristics of materials, job conditions, weather, test results, or other circumstances warrant; at no additional cost to Owner and as accepted by Engineer. Laboratory test data for revised mix design and strength results must be submitted to and accepted by Engineer before using in work.
- F. Limit water-soluble, chloride-ion content in hardened concrete to 0.10 percent by weight of cement.
- G. Admixtures:
 - 1. Use water-reducing admixture or high range water-reducing admixture (superplasticizer) in concrete as required for placement and workability.
 - 2. Use non-chloride accelerating admixture in concrete slabs placed at ambient temperatures below 50 degrees F.
 - 3. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
 - 4. Use water-reducing admixture in pumped concrete, concrete for heavy-use industrial slabs and parking structure slabs, concrete required to be watertight, and concrete with a water-cementitious materials ratio below 0.50.
 - 5. Use air-entraining admixture in exterior exposed concrete, unless otherwise indicated. Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having total air content with a tolerance of plus or minus 1½ percent within following limits:
 - a. Concrete structures and slabs exposed to freezing and thawing, deicer chemicals, or hydraulic pressure.
 - (1) 4.5 percent (moderate exposure); 5.5 percent (severe exposure) 1½-inch max. aggregate.
 - (2) 4.5 percent (moderate exposure); 6.0 percent (severe exposure) 1-inch max. aggregate.
 - (3) 5.0 percent (moderate exposure); 6.0 percent (severe exposure) ¾-inch max. aggregate.
 - b. Other concrete (not exposed to freezing, thawing, or hydraulic pressure) or to receive a surface hardener: 2 percent to 4 percent air.
 - c. Use admixtures for water reduction and set control in strict compliance with manufacturer's directions.

- H. Cement Content: Provide concrete for following conditions with maximum water-cement (W/C) ratios, by weight, as follows:
1. All 4,500 psi concrete mixes shall have a max: W/C 0.45.
 2. All other concrete mixes shall have a max W/C 0.42.
 3. The cement factor shall not be less than:
 - a. 515 lb/yd³ of concrete with 1½-inch max. aggregate.
 - b. 535 lb/yd³ of concrete with 1-inch max. aggregate.
 - c. 560 lb/yd³ of concrete with ¾-inch max. aggregate.
- I. Slump Limits: Proportion and design mixes to result in concrete slump at point of placement as follows:
1. Maximum slump.
 - a. Reinforced concrete foundation slabs and substructure walls - 3-inch.
 - b. Reinforced concrete, slabs, beams, walls, columns - 4-inch.
 - c. Pipe encasements - 4-inch.
 - d. Structural foundation backfills - 6-inch.
 - e. Concrete containing HRWR admixture (super-plasticizer): Not more than 8-inch after addition of HRWR to site-verified 2-inch - 3-inch slump concrete.
 2. Minimum slump for all concrete shall be 1-inch.
 3. Use admixtures for water-reducing and set control in strict compliance with manufacturer's directions.
 4. Slump may be increased for workability by adding High Range water reducing admixture.

2.08 MIX DESIGNS USING POTENTIALLY REACTIVE AGGREGATE

A. Aggregate Evaluation:

1. Test aggregates according to AASHTO T 303. Aggregates that develop expansion greater than 0.10% after 14 days in solution (16 days – age of bar) are considered potentially reactive with cement alkalis. The Contractor may test aggregates according to ASTM C227 to confirm potential reactivity of fine or coarse aggregate, but not to classify an aggregate as “nonreactive.” If ASTM C227 mortar bars are made with cement having an alkali content greater than 0.80%, aggregates are considered to be “reactive” if expansion is greater than 0.05% at 3 months or greater than 0.10% at 6 months.
2. Use aggregates that are deemed potentially reactive only with cements or cement-pozzolan combinations as specified. If one or both of the aggregates (coarse or fine) used in a mix is reactive, mitigation is required as specified. This requirement applies to all concrete.

B. Cement/Cement-Pozzolan Requirements: For use with aggregate deemed potentially reactive as specified. Provide Portland cement or Portland cement-pozzolan combinations conforming to the requirements of this Section.

1. Portland Cement. Conforming to the optional chemical requirement in AASHTO M 85 for a maximum alkali content of 0.60%.
2. Portland Cement-Pozzolan Combination. Furnish a combination of Portland cement with an alkali content no greater than 1.40% and silica fume.

Silica Fume - Use a quantity of silica fume between 5% and 10%, by mass, of the total cementitious material. Use of silica fume will be allowed on an experimental basis only, until sufficient experience is gained.

2.09 CONCRETE MIXING

- A. Job Site Mixing: Mix materials for concrete in appropriate drum type batch machine mixer. For mixers of one cubic yard, or smaller capacity, continue mixing at least 1½ minutes, but not more than five minutes after ingredients are in mixer, before any part of batch is released. For mixers of capacity larger than one cubic yard, increase minimum 1½ minutes of mixing time by 15 seconds for each additional cubic yard, or fraction thereof. Job site mixing is limited to small quantities with approval of the Engineer.
- B. Provide batch ticket for each batch discharged and used in work, indicating project identification name and number, date, mix type, mix time, quantity, and amount of water introduced.

- C. Ready Mix Concrete: Comply with requirements and recommended practices of ASTM C94, ACI 304R, and as specified.
 - 1. When air temperature is between 85 degrees F. and 90 degrees F., reduce mixing and delivery time from 1½ hours to 75 minutes, and when air temperature is above 90 degrees F, reduce mixing and delivery time to 60 minutes.
 - 2. Plant Equipment and facilities shall conform to the "Checklist for Certification of Ready Mixed Concrete Production Facilities" of the National Ready-Mixed Concrete Association.
 - 3. During hot weather, or under conditions contributing to rapid setting of concrete, a shorter mixing time than specified in ASTM C94 may be required.

PART 3 - EXECUTION

3.01 GENERAL

- A. Execution shall be in accordance with requirements of ACI 301 and ACI 350.5 unless otherwise noted.
- B. Unless otherwise specified, conform to ACI 304R, 305R, and 306R for concrete installation requirements, such as preparation, mixing, conveying, depositing, curing, and cold and hot weather requirements. Consolidate concrete in accordance with ACI 309R.
- C. Concrete not placed within 90 minutes or 300 revolutions, whichever occurs first, after the first mixing of the cement and aggregates will be rejected.
- D. Conduits, pipes, or items other than those specified in this Section are not to be embedded in concrete of water bearing structures unless specifically shown in the contract documents or by written approval by the Engineer.

3.02 COORDINATION

Examine the drawings and specifications for work of other sections or other contractors and coordinate such work with the requirements of this Section. Make provisions for installation of such items as sleeves, pipes, conduits, inserts and hangers in a manner that will not impair or weaken concrete construction.

3.03 REINFORCEMENT

- A. Unless otherwise specified, place reinforcing steel in accordance with CRSI Recommended Practice for Placing Reinforcing Bars.

B. The Contractor shall not cut embedded reinforcing steel that is cast into structural concrete without prior written approval by the Engineer.

C. Cleaning and Bending:

1. Reinforcing bars shall be fabricated in accordance with the standard fabricating tolerances in Fig. 2.1(a) and Fig 2.1(b) in ACI 117.
2. When it is necessary to move bars to avoid interference with the reinforcement, conduits, or embedded items exceeding the specified placing tolerances, the resulting arrangement of bars shall be subject to acceptance by the Engineer.
3. All reinforcement shall be bent cold. Perform all reinforcement bending and cutting operations in the shop. Do not bend or straighten bars in a manner that will damage the reinforcement.
4. All reinforcement, at the time it is placed, shall be free of mud, oil, or other materials that may adversely affect or reduce the bond. Reinforcement with rust, mill scale, or a combination of both shall be considered satisfactory provided the minimum dimensions, weight, and height of deformations of a hand-wire-brushed test specimen conforms to the requirements of ASTM A615.

D. Placement:

Place reinforcing steel in accordance with CRSI Recommended Practice for Placing Reinforcing Bars, unless otherwise specified.

1. Arrange and place reinforcement in accordance with the approved shop drawings.
2. Reinforcement shall be placed to the tolerances indicated in ACI 301, Section 3.3.
3. All reinforcement shall be supported and fastened before concrete is placed and shall be secured against displacement.
4. Reinforcement supported from the ground shall rest on precast concrete blocks having a compressive strength equal to or greater than the specified compressive strength of the concrete being placed.
5. Reinforcement supported from formwork shall rest on bar supports made of concrete, metal, plastic, or other acceptable materials. Where the concrete surface will be exposed to the weather in the finished structure, the portions of all bar supports within ½-inch of the concrete surface shall be non-corrosive or protected against corrosion.

6. Templates shall be furnished for placement of all column dowels and anchor bolts.
7. All splices shall be as indicated on the Contract Drawings.
8. Bending or straightening of bars partially embedded in concrete shall not be permitted.
9. Welding of crossing bars (tack welding) for assembly of reinforcement is prohibited.
10. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.
11. Epoxy-Coated Reinforcement: Repair cut and damaged epoxy coatings with epoxy repair coating according to ASTM D3963. Use epoxy-coated steel wire ties to fasten epoxy-coated steel reinforcement.
12. Place reinforcement a minimum of 2" clear of any metal pipe or fitting.

E. Splicing

1. Furnish reinforcing bars in full lengths as indicated on the Contract Drawings and approved shop drawings.
2. Do not splice bars unless indicated on the Contract Drawings or approved by the Engineer in writing.
3. When authorized, make splices in accordance with ACI 318 or ACI 350. Perform welding in accordance with AWS D1.4.
4. Lap welded wire reinforcement not less than one mesh space plus 2", and tie.

F. Concrete Cover

1. Provide clearance and spacing indicated on the Contract Drawings.
2. Where no clearances are indicated, the thickness of concrete cover over reinforcement shall be:
 - a. 3" for concrete placed against ground without the use of forms.
 - b. 2" for concrete placed in forms that will be exposed to ground or weather.
 - c. 1½" for formed concrete not exposed to ground or weather.
 - d. ¾" for slabs not exposed to ground or weather

G. Cleaning and Replacing Existing Reinforcing Steel:

Existing reinforcing steel that is to be incorporated into the proposed work as shown in the Contract Drawings shall be cleaned until free of all concrete, scale, rust and dust. If reinforcing bar has lost more than 20% of its original cross-sectional area, provide a new bar with size that matches the bar under repair, lapping the existing reinforcing steel per chart shown in Contract Drawings. Where the required bar lap is not available or limits of concrete removal to achieve bar lap are too great, use an approved mechanical splice.

H. Cutting New Openings in Existing Concrete:

Where existing reinforcing has been cut when cutting new openings in existing concrete walls or slabs, reinforcing shall be chipped a minimum of 2 inches below proposed finished surface and covered with minimum 10,000 psi non-shrink grout.

3.04 FORMWORK

A. Responsibility:

1. The design and construction of formwork are the sole responsibility of the Contractor.
2. The Contractor shall remove and replace forms which no longer have smooth surfaces and/or are weak resulting in intrusions or extrusions in the concrete face.

B. Design Criteria:

1. Design formwork system which is adequately braced and has strength and stability to ensure finished concrete within the tolerances specified in ACI 347.R, and construct in accordance with ACI 301.
 - a. Class A, $\frac{1}{8}$ -inch for smooth-formed finished surfaces.
 - b. Class B, $\frac{1}{4}$ -inch for rough-formed finished surfaces.
2. Provide formwork sufficiently tight to prevent leakage of mortar.
3. Chamfer external corners $\frac{3}{4}$ -inch, unless noted otherwise in the Contract Documents.
4. Curved portions of walls shall not be formed in a segmented fashion. Curves shall be formed using flexible systems as manufactured by Symons 'Flex-Form', PERI Form Works or approved equal.

5. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.
 - a. Install joints, reglets, recesses, and the like, for easy removal.
 - b. Do not use rust-stained steel form-facing materials.
6. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations.
7. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.
8. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.
9. Forms at Joints and Corners: Ties or bolts shall be provided three to six inches (3" to 6") from each side of concrete construction joints for tightening the forms against the hardened adjacent concrete prior to placing fresh concrete. At joints where forms have been removed and reconstructed, the form surface shall extend over the concrete already in place; and the forms shall be drawn tightly against the previously placed concrete prior to the placing the fresh concrete. Forms shall be filleted at all sharp corners, except when otherwise specified in the Contract Documents and shall be given a bevel or draft in the case of all projections. All exposed corners of concrete shall be chamfered with three-quarters inch by three-quarters inch ($\frac{3}{4}$ " x $\frac{3}{4}$ ") milled chamfer strips, except on unexposed footings or where specified in the Contract Documents.
10. The surface of the steel forms in contact with the concrete shall be smooth and free of bolts, bolt heads, nuts, rivet heads, welding seams and surface irregularities. Forms that produce unacceptable concrete surfaces will be rejected and shall not be reused.
11. Form Ties: Only form ties approved by the Engineer shall be used. Ties shall leave no metal closer than one and a half inches ($1\frac{1}{2}$ ") from the surface. They shall not be fitted with lugs, cones, washers or other devices which act as spreaders within the form or for any purpose that leaves a hole larger than seven-eighths inch ($\frac{7}{8}$ ") diameter. When prefabricated steel girder forms are used, tapered ties up to one and one half-inch ($1\frac{1}{2}$ ") maximum diameter shall be used. Ties shall be clean and free of rust. When ties are removed, the holes shall be pressure grouted with a non-shrink mortar mixed to match the color and texture of the concrete.

12. Portions of ties to be removed from the concrete shall be coated with a clear lubricant or other approved material to facilitate removal. Care shall be exercised during removal of form ties to avoid spalling the concrete on the exposed surface. Cutting back from the face is prohibited.
13. All formwork shall be temporary and removed by the Contractor as part of this Work, unless written approval is given by the Engineer; or unless noted otherwise in the Contract Drawings.
14. Brace formwork as required to prevent distortion during concrete placement.
15. Prior to form removal, provide thermal protection for concrete being placed under the requirements of cold weather concreting.

C. Coating Forms:

1. Coat forms with bond breaker prior to the placement of reinforcing steel.
2. Do not allow excess form coating material to stand in puddles in the forms or to come in contact with concrete against which fresh concrete is to be placed.
3. Clean reinforcing steel that has become contaminated with bond breaker to the satisfaction of the Engineer prior to placing concrete.

D. Embedded Items:

1. Clean items to be embedded in concrete free from oil or foreign matter that would weaken the bond of the concrete to these items.
2. Install in the formwork requisite inserts, anchors, sleeves, and other items specified under other sections of these specifications. Close ends of conduits, piping, and sleeves embedded in concrete with caps or plugs.
3. Embedded items shall be positioned accurately and supported against displacement.
4. Conduit and pipes embedded in concrete shall be located in accordance with ACI 350, 6.3.
5. Anchor bolts/rods shall be accurately set and shall be maintained in position by templates while being embedded in concrete.

E. Joints:

1. Make contraction, expansion, and construction joints where indicated on the Contract Drawings. Additional construction joints are subject to prior approval of the Engineer. Locate additional construction joints to least impair the strength of the structure.
2. Continue reinforcing steel and welded wire reinforcement across construction joints.
3. Install premolded joint filler at locations indicated. Extend filler from bottom of concrete.
4. Make splices in premolded filler in manner to preclude penetration of concrete between joint faces.
5. The surface of the concrete at all joints shall be thoroughly cleaned and all latency removed prior to placing adjoining concrete.
6. Before bonding concrete is placed, clean the surface of loose or soft particles or other objectionable materials and keep wet for a minimum period of 12 hours.
7. The hardened concrete of construction joints and of joints between footings and walls or columns, between walls or columns and beams or floors they support, joints in unexposed walls and all others not mentioned below shall be dampened (but not saturated) immediately prior to placing of fresh concrete.
8. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or asphalt coat one-half of dowel length to prevent concrete bonding to one side of joint.
9. The surface of the hardened concrete at construction joints shall be cleaned and kept moistened until the additional concrete is placed. The top surface of concrete shall be leveled using a grade strip, unless otherwise specified. At chamfers the top surface of the concrete shall be steel troweled adjacent to the chamfer using the top surface for the chamfer strip as a guide.
10. The Contractor shall place an epoxy bonding compound on the surface areas of existing concrete (concrete that existed prior to the beginning of the Contract) which will be in contact with new concrete. The surfaces to be coated shall be clean, sound, and dry and bonding compound shall be mixed and applied in conformance with the manufacturer's recommendations.

F. Waterstops:

1. Install waterstops of the sizes and shapes indicated. Support and protect that portion of the waterstop, which extends beyond the bulkhead during placing of concrete and subsequent removal of forms.
2. Waterstops shall be continuous at construction, contraction and expansion joints to form a watertight compartment.
3. Minimum Width: 9 inches.
4. Make field splices by heat-sealing, maintaining the continuity of the ribs and bulbs, and allow the splice to cool before stressing. Field splice must be watertight. Repair damaged waterstops per manufacturer's instructions.
5. Waterstop shall be installed in accordance with the manufacturer's guidelines and written instructions.
6. Splice in accordance with waterstop manufacturer's written instructions using Teflon-coated thermostatically controlled heating iron, heated to the manufacturer's recommended splicing temperature. Field splices permitted only for straight butt welds.
7. Install waterstop in longest lengths possible. Splices shall be made by certified, trained personnel using approved equipment and procedures. Inspect waterstop and field splices for defects. Replace any damaged or unacceptable waterstop and dispose of defective material.
8. Exposed waterstops shall be protected during application of form release agents to avoid being coated.
9. Position waterstop to ensure clearance between waterstop and reinforcing steel of a minimum two times the largest aggregate size, to prevent rock pockets, air voids and honeycombing.
10. Carefully place concrete without displacing waterstop from proper position. Thoroughly and systematically vibrate concrete in the vicinity of the joint, and to maximized intimate contact between concrete and waterstop.
11. Prior to second placement of concrete, clean exposed waterstop leg to ensure full contact of second concrete placement. Remove laitance, spillage, form oil and dirt.
12. When any waterstop is installed in the concrete on one side of a joint, while the other half or portion of the waterstop remains exposed to the atmosphere for more than 2 days, suitable precautions shall be taken to shade and protect the exposed waterstop from direct rays of the sun during the entire exposure and until the exposed portion of the waterstop is embedded in concrete.

13. Use only factory made waterstop fabrications for all intersections, changes of directions and transitions.
14. Center waterstop on joint.
15. Waterstop at vertical joints shall terminate 3 inches below the top of exposed wall. Where waterstop with a center bulb is used, the end of the center bulb shall be plugged with a flexible material, such as foam rubber, to prevent concrete intrusion at ends where the bulb will be exposed to concrete extrusions.
16. Waterstops shall be manufactured with factory-installed galvanized or stainless steel wireloops, or metal eyelets, along the edge of both side, integral to the waterstop; for proper positioning of waterstop in forms at time of concrete placement, to facilitate securing the waterstop to reinforcing steel to prevent displacement during concrete placing operations and to ensure accurate location of waterstop in center of joint. The waterstops shall be wired to the reinforcement in accordance with the manufacturer's recommendations. If no manufacturer recommendations are available, then the waterstop shall be wired a maximum of two (2) feet on center.
17. Horizontal Waterstops: Ensure space beneath waterstop is completely filled with concrete. During concrete placement, make visual inspection of waterstop area. Limit concrete placement to elevation of waterstop, vibrate concrete under waterstop, lift waterstop to confirm full consolidation without voids, then place remaining concrete.
18. Swellable Waterstop: Install in accordance with manufacturer's written instructions. Provide minimum cover over waterstop as recommended by manufacturer. Splice waterstop and fabricate joints and intersections per the manufacturers written recommendations.

3.05 VAPOR RETARDERS

- A. Plastic Vapor Retarders: Place, protect, and repair vapor retarders according to ASTM E1643 and manufacturer's written instruction.
 1. Lap joints 12 inches, unless otherwise specified by the manufacturer, and seal with manufacturer's recommended tape.
- B. Granular Course: Cover vapor retarder with granular fill, moisten, and compact with mechanical equipment to elevation tolerances of plus 0-inch or minus $\frac{3}{4}$ - inch. Place and compact a $\frac{1}{2}$ -inch thick layer of fine-graded granular material over granular fill.

3.06 PREPARATION OF EQUIPMENT AND PLACE OF DEPOSIT

- A. Before placement, clean equipment for mixing and transporting the concrete. Remove debris and ice from the places to be occupied by the concrete. Clean reinforcement of dirt, loose rust, and mill scale, or other coatings.
- B. Remove water from place of deposit before concrete is placed. Remove laitance and unsound material from hardened concrete before additional concrete is added.
- C. Thoroughly wet the stone based on which slabs are to be placed where no vapor retarder is indicated.

3.07 MIXING

- A. Mix and deliver ready-mixed concrete in accordance with ASTM C94. Plant equipment and facilities shall conform to "Certification of Ready-Mixed Concrete Production Facilities (Checklist with Instructions)" of the National Ready-Mixed Concrete Association.
- B. Do not over-mix. Do not use concrete which is retained in mixers so long as to require additional water in excess of design mix water to permit satisfactory placing.
- C. Use preparation methods capable of producing concrete with a temperature not more than 85 degrees F, and not less than 55 degrees F, at the time of placement.
- D. Do not heat concrete ingredients to a temperature higher than that necessary to keep the temperature of the mixed concrete, as placed, within the specified temperatures.
- E. Do not heat water in excess of 140 degrees F.
- F. Control of Admixtures:
 - 1. Air-entraining admixtures and other required and/or approved admixtures shall be charged into the mixer as solutions and shall be measured by means of an acceptable mechanical dispensing device. The liquid shall be considered a part of the mixing water. Admixtures that cannot be added in solution may be weighed or may be measured by volume if so recommended by the manufacturer.
 - 2. If two or more admixtures are used in the concrete, they shall be added separately to avoid possible interaction that might interfere with the efficiency of either admixture or adversely affect the concrete.

3. Addition of retarding admixtures shall be completed within 1 minute after addition of water to the cement has been completed, or prior to the beginning of the last three-quarters of the required mixing, whichever occurs first.

G. Tempering and Control of mixing water:

1. Concrete shall be mixed only in quantities for immediate use. Concrete, which has set, shall be discarded and shall not be retempered.
2. When concrete arrives at the project with slump below that suitable for placing, as indicated by the Specifications, water may be added only if either the maximum permissible water-cement ratio or the maximum slump is exceeded. The water shall be incorporated by additional mixing equal to at least half of the total mixing required. Discharge of the concrete shall be completed within 1½ hours, or before the truck drum has revolved 300 revolutions, whichever comes first, after the introduction of the mixing water to the cement and aggregates or the introduction of the cement to the aggregates. Truck batch slips must include time of batching, total drum revolutions upon arrival at site, and quantity of water (in gallons) per cubic yard available to be added to attain the maximum design water-cement ratio.

H. Project-Site Mixing: Measure, batch, and mix concrete materials and concrete according to ASTM C94. Mix concrete materials in appropriate drum-type batch machine mixer.

1. For mixer capacity of 1 cu. yd. or smaller, continue mixing at least 1½ minutes, but not more than 5 minutes after ingredients are in mixer, before any part of batch is released.
2. For mixer capacity larger than 1 cu. yd., increase mixing time by 15 seconds for each additional 1 cu. yd.
3. Provide batch ticket for each batch discharged and used in the Work, indicating Project identification name and number, date, mixture type, mixture time, quantity, and amount of water added. Record approximate location of final deposit in structure.

3.08 CONVEYING

Convey concrete from the mixer to the final deposit by methods that will prevent segregation or loss of materials.

A. Preparation Before Placing:

1. Hardened concrete and foreign materials shall be removed from the inner surfaces of the conveying equipment.

2. Formwork shall be completed; snow, ice and water shall be removed; reinforcement shall be secured in place; expansion joint material, anchors, waterstops and other embedded items shall be positioned; and the entire preparation shall be accepted.
3. Concrete shall not be placed on frozen ground.

B. Conveying:

1. Concrete shall be handled from the mixer to the place of final deposit as rapidly as practicable by methods which will prevent segregation or loss of ingredients and in a manner, which will assure that the required quality of the concrete is maintained.
2. Conveying equipment shall be of a size and design such that detectable setting of concrete shall not occur before adjacent concrete is placed. Conveying equipment shall be cleaned at the end of each operation or workday. Conveying equipment and operations shall conform to the following additional requirements:
 - a. Truck mixers, agitators and non-agitating units and their manner of operation shall conform to the applicable requirements of ASTM C94.
 - b. Belt conveyors shall be horizontal or at a slope which will not cause excessive segregation or loss of ingredients. Concrete shall be protected against undue drying or rise in temperature. An acceptable arrangement shall be used at the discharge end to prevent segregation. Mortar shall not be allowed to adhere to the return length of the belt. Long runs shall be discharged into a hopper or through a baffle.
 - c. Chutes shall be metal or metal-lined and shall have a slope not exceeding 1 vertical to 2 horizontal and not less than 1 vertical to 3 horizontal. Chutes more than 20 feet long and chutes not meeting the slope requirements may be used provided they discharge into a hopper before distribution.
 - d. Pumping or pneumatic conveying equipment shall be capable of pumping the specified mix with adequate pumping capacity. Pneumatic placement shall be controlled so that segregation is not apparent in the discharged concrete. The loss of slump in pumping or pneumatic conveying equipment shall not exceed 2 inches. Concrete shall not be conveyed through pipe made of aluminum or aluminum alloy.

3.09 CONCRETE PLACEMENT

- A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections have been performed.
- B. Remove water, debris, and foreign material from within forms.
- C. Provide sufficient illumination in the interior of forms so concrete deposition is visible, permitting confirmation of consolidation quality.
- D. Do not use aluminum conveying devices.
- E. Do not add water to concrete during delivery, at Project site, or during placement unless approved by the Engineer.
- F. Concrete Temperature: The concrete temperature at the time of placement shall be 65 deg F +/- 15 deg F.
- G. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301.
 - 1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.
- H. Deposit concrete as nearly as practical in its final position to avoid segregation due to rehandling or flowing. Do not use vibrators to move concrete horizontally with the forms.
- I. Do not use tempered concrete or concrete contaminated by foreign material.
- J. Plan and conduct concrete placement to ensure that the concrete is kept plastic and that the concrete is free of cold joints.
- K. Where there is a time delay greater than 45 minutes between adjacent concrete placement, a bulkhead construction joint, complete with waterstops where required, must be installed.
- L. Remove temporary spreaders in forms when concrete has reached an elevation rendering their service unnecessary.
- M. Do not commence placing when the sun, heat, wind or limitations of facilities provided prevent proper finishing or curing.
- N. Concrete shall be deposited continuously, or in layers of such thickness that no concrete will be deposited on concrete which has hardened sufficiently to cause the formation of seams or planes of weakness within the section. If a section cannot be placed continuously, construction joints shall be located as indicated on the Contract Drawings. Placing shall be carried on at such a rate that the concrete

which is being integrated with fresh concrete is still plastic. Concrete which has partially hardened or has been contaminated by foreign materials shall not be deposited. Temporary spreaders in forms shall be removed when the concrete placing has reached an elevation rendering their service unnecessary. They may remain embedded in the concrete only if made of metal or concrete and if prior acceptance has been obtained.

1. Deposit concrete in horizontal layers of depth to not exceed formwork design pressures and in a manner to avoid inclined construction joints.
 2. Consolidate placed concrete with mechanical vibrating equipment according to ACI 309R.
 3. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.
- O. Placing - Placing of concrete in supported elements shall not be started until the concrete previously placed in columns and walls is no longer plastic and has been in place at least two hours.
- P. Segregation - Concrete shall be deposited as nearly as practicable in its final position to avoid segregation due to re-handling or flowing. Concrete shall not be subjected to any procedure, which will cause segregation.
- Q. Where placing operations would involve dropping the concrete more than 5 feet, it shall be deposited through a tube made of sheet metal, canvas or other approved materials. Aluminum hoppers or tubes shall not be used. Lower ends shall be kept as close as possible to the newly placed concrete and not more than 3 feet above the concrete. All tubes shall have a minimum diameter of 6 inches unless otherwise directed by the Engineer. Concrete shall be placed to avoid segregation of the material and the displacement of the reinforcement. The use of troughs, chutes and pipes for conveying concrete more than fifteen feet (15') from the mixer to the forms will be permitted only when acceptable by the Engineer. Open troughs and chutes shall be metal, or metal lined. Where segregation occurs due to steep slopes, chutes shall be equipped with baffles.
- R. Where vertical placements have horizontal construction joints, succeeding lifts shall not be placed until the lower placement has set for twelve (12) hours. Prior to subsequent placement, all accumulations of mortar splashed upon the reinforcement shall be cleaned. Care shall be exercised not to injure or break the concrete seal bond near and at the surface of the concrete while cleaning the reinforcement.

- S. When the ambient air temperature is below forty degrees (40°) F, the temperature of the air in contact with the reinforcement shall be raised to forty degrees (40°) F prior to placing the concrete. When the ambient air temperature is above seventy degrees (70°) F and the reinforcement is exposed to the direct rays of the sun, the reinforcement shall be cooled to seventy degrees (70°) F or less by means of a water spray prior to placing concrete. When the ambient air temperature is above seventy degrees (70°) F and the steel forms that remain in place are exposed to the direct rays of the sun, the forms shall be cooled by means of water spray prior to placing concrete.
- T. When abnormal wind or storms are forecast locally by the National Weather Service, concrete other than foundation concrete shall not be placed during the period covered by the forecast.
- U. Cast-In-Place concrete shall be homogeneous throughout the structural element. The methods used to place shall prevent segregation.

3.10 CONSOLIDATION

- A. All concrete shall be consolidated by vibration, spading, rodding or forking so that the concrete is thoroughly worked around the reinforcement, around embedded items, and into corners of forms, eliminating all air or stone pockets which may cause honeycombing, pitting, or planes of weakness. Internal vibrators used shall be the largest size and most powerful that can be properly used in the work. Competent workmen shall operate the vibrators. Use of vibrators to transport concrete within forms shall not be allowed. Vibrators shall be inserted and withdrawn at points approximately 18 inches apart. At each insertion, the duration shall be sufficient to consolidate the concrete but not sufficient to cause segregation, generally from 5 to 15 seconds. A spare vibrator shall be kept on the job site during all concrete placing operations. Where the concrete is to have an as-cast finish, a full surface of mortar shall be brought against the form by the vibration process, supplemented if necessary by spading to work the coarse aggregate back from the formed surface.
- B. Consolidate concrete thoroughly as it is placed in order to secure a dense mass. Work concrete well around the reinforcement and embedded items and into the corners of the forms.
- C. Use internal vibrators inserted vertically over the entire area of the placement.
- D. Vibrate until voids are eliminated, coarse aggregate is suspended in mortar, and entrapped air bubbles begin to rise to the surface. Concrete should move back into the space vacated by the vibrator.
- E. Space vibrator insertions such that the area visibly affected by the vibrator overlaps the adjacent just-vibrated area by a few inches.
- F. Penetrate at least 6" into previously placed layers in order to bond between layers and avoid cold joints.

- G. Form vibrators may not be used.
- H. Take care not to over-vibrate air entrained concrete. Place vibrator to eliminate honeycombing but avoid excess vibrating that bleeds all entrapped air from the mix.
- I. Do not use vibrators to transport concrete.
- J. Care shall be used in placing concrete around waterstops. The concrete shall be carefully worked by rodding and vibrating to make sure that all air and rock pockets have been eliminated. Where flat-strip type waterstops are placed horizontally, the concrete shall be worked under the waterstops by hand, making sure that all air and rock pockets have been eliminated. Concrete surrounding the waterstops shall be given additional vibration, over and above that used for adjacent concrete placement to assure complete embedment of the waterstops in the concrete.

3.11 JOINTS

- A. Construct expansion, contraction, construction, control, and isolation joints where indicated on the drawings and at additional locations approved by the Engineer as shown in the Contract Documents.
- B. Where the placing of concrete is discontinued, clean off laitance and other objectionable material to a sufficient depth to expose sound concrete as soon as concrete is firm enough to retain its form. Smooth the top surface of concrete adjacent to the forms with a trowel to minimize visible joints on exposed faces.
- C. Immediately after the work of placing concrete is halted, remove accumulations splashed upon the reinforcement and the surfaces of the forms. Perform this removal before concrete takes its initial set. Clean reinforcing steel carefully to prevent damage to the concrete steel bond.
- D. Do not halt work within 18" of the top of any face.
- E. For bonded horizontal joint construction, roughen the surface and expose the aggregate. Clean the surface thoroughly by wet sandblasting, by cutting with high-pressure water jet or by other approved methods. Perform cleaning after the concrete has hardened to prevent raveling of the surface below the desired depth.
- F. Roughened construction joints in new concrete:
 - 1. Roughen and clean surface to minimum of ¼-inch amplitude using one of the following:
 - a. Sandblast/mechanically roughen after concrete has fully cured.
 - b. Water blast after concrete has partially cured.

- c. Green cut fresh concrete with high-pressure water and hand tools.
 - d. Perform roughening so as not to damage waterstop, if one is present.
- G. Roughened construction joints in existing concrete:
 - 1. Thoroughly clean and mechanically roughen existing concrete surfaces to roughen profile of ¼-inch.
- H. Before bonding concrete is placed, clean the surface of loose or soft particles or other objectionable materials and keep wet for a minimum period of 12 hours.
- I. Cover the cleaned and saturated surface with a coating of neat cement grout and deposit new concrete before the grout has attained its initial set.
- J. The hardened concrete of construction joints and of joints between footings and walls or columns, between walls or columns and beams or floors they support, joints in unexposed walls and all others not mentioned below shall be dampened (but not saturated) immediately prior to placing of fresh concrete.
- K. The hardened concrete of horizontal construction joints in exposed work; horizontal construction joints in the middle of beams, girders, joists, and slabs; and horizontal construction joints in work designed to contain liquids shall be dampened (but not saturated) and then thoroughly covered with a coat of cement grout of similar proportions to the mortar in the concrete. The fresh concrete shall be placed before the grout has attained its initial set.
- L. Joint Finishing:
 - 1. Edge or lightly stone the edges of expansion and contraction joints after the forms are stripped and before the adjacent slab is placed.
 - 2. Leave joints in the completed work carefully tooled and free of mortar and concrete.
 - 3. Leave joint filler exposed for its full length with clean and true edges.
 - 4. Apply sealant at joints where indicated.

3.12 CONCRETE PROTECTION

- A. Immediately after placement, protect concrete from premature drying, excessively hot or cold temperature and mechanical injury. Maintain with minimum moisture loss and relatively constant temperature for the period necessary for hydration of the cement and hardening of the concrete.

- B. After the concrete has hardened, loosen forms as soon as possible without damage to the concrete, and run curing water continuously down inside the form.
- C. Unless adequate protection is provided, concrete shall not be placed during rain, sleet or snow.
- D. Rainwater shall not be allowed to increase the mixing water or damage the surface finish.
- E. The temperature of the concrete as placed shall not be so high as to cause difficulty from loss of slump, flash set, or cold joints and should not exceed 90 degrees F. When the temperature of the steel is greater than 120 degrees F, steel forms and reinforcement shall be sprayed with water just prior to placing the concrete.
- F. Protection from Mechanical Injury - During the curing period, the concrete shall be protected from damaging mechanical disturbances, such as load stresses, heavy shock, and excessive vibration. All finished concrete surfaces shall be protected from damage by construction equipment, materials or methods, by application of curing procedures, and by rain or running water. Self-supporting structures shall not be loaded in such a way as to overstress the concrete.
- G. Loads shall not be applied to the concrete structure until the Contractor has completed curing, removing forms and placed concrete has reached the 28-day compressive strength, f'_c .

3.13 REMOVAL OF FORMS

- A. Form removal shall be in accordance with the requirements of ACI 301 and ACI 350.5.
- B. Forms for sides of beams, walls, columns, and other vertical faces which do not sustain loads may be removed after cumulatively curing at not less than 50 degrees F for 24 hours after the last portion of concrete in the section has been placed, if the concrete is hard enough to not be damaged by form-removal operations and curing and protection operations are maintained.
 - 1. Leave formwork for beam soffits, joists, slabs and other structural elements that supports weight of concrete in place until concrete has achieved its 28-day design compressive strength.
 - 2. Remove forms only if shores have been arranged to permit removal of forms without loosening or disturbing shores.
 - 3. Schedule form removal to maintain surface appearances that matches approved work.
 - 4. Cut off and grind glass-fiber-reinforced plastic form ties flush with surface of concrete.

- C. In cold weather, all forms must remain in place for 5 days.
- D. Notify the Engineer before forms are removed in order that an examination of the newly-stripped surfaces may be made prior to patching.
- E. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material will not be acceptable for exposed surfaces. Apply new form-release agent.
- F. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets. Do not use patched forms for exposed concrete surfaces unless approved by Engineer.
- G. An accurate record shall be maintained by the Contractor of the dates of concrete placements and the exact location thereof and the dates and times of removal of forms, including any form loosening. These records shall be available for inspection at all times at the site, and two copies shall be furnished to the Engineer upon completion of the concrete work.

3.14 REPAIR OF SURFACE DEFECTS

- A. Repair immediately after form removal.
- B. Defective Concrete: Repair and patch defective areas when approved by Engineer. Remove and replace concrete that cannot be repaired and patched to Engineer's approval.
- C. Patching Mortar: Mix dry-pack patching mortar, consisting of one part Portland cement to two and one-half parts fine aggregates passing a No. 16 Sieve, using only enough water for handling and placing.
- D. Repair of Defective Areas: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.
 - 1. All honeycombed and other defective concrete shall be removed down to sound concrete. If chipping is necessary, the edges shall be perpendicular to the surface or slightly undercut. No feathered edges will be permitted. The area to be patched and an area at least 6 inches wide surrounding it shall be dampened to prevent absorption of water from the patching mortar. A bonding grout shall be prepared using a mix of approximately 1 part cement to 1 part fine sand passing a No. 30 mesh sieve, mixed to the consistency of thick cream, and then well brushed into the surface.

2. The patching mixture shall be made of the same materials and of approximately the same proportions as used for the concrete, except that the coarse aggregate shall be omitted, and the mortar shall consist of not more than 1 part cement to 2½ parts sand by damp loose volume. White Portland cement shall be substituted for a part of the gray Portland cement on exposed concrete in order to produce a color matching the color of the surrounding concrete, as determined by a trial patch. The quantity of mixing water shall be no more than necessary for handling and placing. The patching mortar shall be mixed in advance and allowed to stand with frequent manipulation with a trowel, without addition of water, until it has reached the stiffest consistency that will permit placing.
 3. After surface water has evaporated from the area to be patched, the bond coat shall be well brushed into the surface. When the bond coat begins to lose the water sheen, the pre-mixed patching mortar shall be applied. The mortar shall be thoroughly consolidated into place and struck off so as to leave the patch slightly higher than the surrounding surface. To permit initial shrinkage, it shall be left undisturbed for at least 1 hour before being finally finished. The patched area shall be kept damp for 7 days. Metal tools shall not be used in finishing a patch in a formed wall, which will be exposed.
- E. Tie Holes - After being cleaned and thoroughly dampened, the tie holes shall be filled solid with patching mortar.
 - F. Proprietary Materials - if approved by the Engineer, proprietary compounds for adhesion or as patching ingredients may be used in lieu of or in addition to the foregoing patching procedures. Such compounds shall be used in accordance with the manufacturer's recommendations.
 - G. Perform patching before curing compound is applied.
 - H. Cure patched areas in the same way as adjacent concrete.
 - I. Make repairs uniform in color and finish with surrounding concrete.
 - J. Crack Repair: Where cracks in existing or new concrete are deemed by Engineer as requiring repair, repair the cracks using epoxy injection or polyurethane grout injection.
 - K. Perform structural repairs of concrete, subject to Engineer's approval, using epoxy adhesive and patching mortar.
 - L. Repair materials and installation not specified above may be used, subject to Engineer's approval.

3.15 CURING

- A. Keep concrete moist for at least 7 curing days after placement.
- B. A curing day is defined as 24-hour day when the concrete surfaces are kept moist and the uniform temperature of the concrete mass is between 55 degrees F and 75 degrees F.
- C. Curing may be achieved by water curing or application of a liquid membrane-forming curing compound. Curing compounds may not be used on surfaces that are to receive additional concrete, paint, sealers, hardeners, tile, or other special coatings.
- D. Water curing is the preferred method of protection. Cover exposed surfaces with a saturated material (burlap or cotton mats) and keep wet continuously with a soil soaker hose for 7 days. Leave covering in place, without wetting, for an additional 3 days.
- E. The use of curing compound (ASTM C309) is permissible. Keep surfaces moist after the forms are removed and the form tie holes repaired. After the surfaces are finished, apply the curing compound according to the manufacturer's recommendations. Do not remove too much forming at one time.
- F. Slabs: Immediately following slab finishing, apply liquid membrane-forming curing compound or begin water curing before the surface becomes dry.
- G. Vertical Surfaces: When the forms are removed entirely, spray the surface with water and allow to reach a uniform damp appearance with no free water on the surface. Apply curing compound or begin water curing.
- H. Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and ACI 301 for hot-weather protection during curing.
- I. Evaporation Retarder: Apply evaporation retarder to unformed 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.
- J. Unless adequate protection is provided, concrete shall not be placed during rain, sleet or snow.
- K. Rainwater shall not be allowed to increase the mixing water or damage the surface finish.

- L. Formed surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces. If forms remain during curing period, moist cure after loosening forms. If removing forms before end of curing period, continue curing for the remainder of the curing period.
- M. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces.
- N. Curing shall start as soon as the concrete has set sufficiently. Cure concrete according to ACI 308.1, or one or a combination of the following methods:
 - 1. All footings shall be cured for five days using the method specified in the following paragraph 3.17.O.1 thru 3.17.O.5.
 - 2. Vertical surfaces shall be cured in the forms for seven (7) days. However, the forms may be removed after twenty-four (24) hours for structural elements six feet (6') or less in height, or after forty-eight (48) hours for structural elements greater than six feet (6') high, with the following provisions. The surface shall be cured as specified in the following paragraph 3.17.O.4 for the remainder of the seven (7) day curing period. The forms shall not be removed when cold weather protection is required. Forms, falsework, centering, etc., carrying loads shall remain in place for a minimum of seven (7) days and until the concrete has attained a compressive strength of three thousand five hundred (3500) psi. Internal bulkheads used for forming construction joints, etc. may be removed after the concrete has been in place for twenty-four (24) hours if it is necessary to do so to continue the Work without interruption. When a higher strength concrete than specified is used, forms, falsework, centering, etc., carrying loads shall remain in place for three and a half (3½) days and until the concrete has attained a compressive strength of three thousand five hundred (3500) psi.
 - 3. Fiber column forms may be removed at times specified above, but no later than ten (10) days after placing concrete.
 - 4. Tops of end walls, end support walls, etc., shall be cured for three (3) days with burlap or cotton mats as specified in the following paragraphs 3.17.O.2 or 3.17.O.4, respectively.
 - 5. Horizontal surfaces shall be cured for seven (7) days as specified in 3.17.O.2 or 3.17.O.5.
- O. Curing Methods
 - 1. Flooding. Units of structures that will be below water in the completed structure, i.e., bottom slabs of culverts, footings, struts, etc., may be gradually flooded when approved by the Engineer after the concrete is

twelve (12) hours old, provided the curing water conforms to the aforementioned. The temperature of this water shall be maintained at thirty-five degrees (35°) F or above for the specified curing time.

2. Burlap. Two (2) layers of burlap shall be used. Successive strips of burlap shall be overlapped a minimum of six inches (6"). The second burlap layer shall be placed not less than forty-five degrees (45°) to the first layer, or in lieu of this, the six inches (6") overlap of the second layer may be placed midway between the first layer. This material shall be thoroughly saturated by immersion in curing water for at least twenty-four (24) hours prior to placement and shall be kept saturated throughout the time specified for curing.
3. White Opaque Polyethylene Backed Nonwoven Fabric. One (1) layer of white opaque polyethylene backed fabric shall be used. Successive strips shall be overlapped a minimum of six inches (6"). This material shall be thoroughly saturated by immersion in curing water for at least twenty-four (24) hours prior to placement and shall be kept saturated throughout the time specified for curing.
4. Cotton Mats. One (1) layer of cotton mat material shall be used and shall be kept thoroughly saturated with curing water prior to placement and throughout the time specified for curing. The material shall be kept in tight contact with the concrete.
5. White Opaque Burlap Polyethylene or White Opaque Polyethylene Film. The white opaque burlap polyethylene sheeting shall be placed on no less than one (1) layer of wet burlap with the burlap side of the sheeting facing down. White opaque polyethylene film, if used, shall be placed on no less than two (2) layers of wet burlap. Only one (1) layer of cotton mats is required in any usage. These materials may only be used atop the wet burlap or cotton mats on unobstructed flat and reasonably level surfaces.
 - a. Adjacent mats or sheets shall be lapped no less than one foot (1'). The ends shall be brought down around the sides of the concrete being cured and securely fastened to make an airtight seal.
 - b. The white opaque burlap polyethylene sheeting or the white opaque polyethylene film shall remain in place for the same length of time as required for burlap or cotton mats. These protective coverings need not be wetted down; however, the covered burlap or cotton mats shall be kept wet for the time interval specified.
6. Liquid Membrane. Liquid membrane forming compounds shall be applied in conformance with manufacturer's recommendations or as directed by the Engineer. The material shall be applied by sprayers and shall be thoroughly agitated before and during use.

3.16 FINISHING FORMED SURFACES

- A. Concrete faces shall be finished with one of the following types. All concrete Work shall have a Smooth-Formed Finish as described below unless otherwise specified.
 - 1. Rough-Formed Finish (RFF): As-cast concrete texture imparted by form - facing material with tie holes and defects repaired and patched. Remove fins and other projections that exceed specified limits on formed-surface irregularities.
 - 2. Apply to concrete surfaces not exposed to public view.
- B. Smooth-Formed Finish (SFF): 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 defects. Remove fins and other projections that exceed specified limits on formed-surface irregularities.
 - 1. Apply to concrete surfaces exposed to public view, to receive a rubbed finish, or to be covered with a coating or covering material applied directly to concrete.
- C. Rubbed Finish: Apply the following to smooth-formed finished as-cast concrete where indicated:
 - 1. Smooth-Rubbed Finish (SRF): Not later than one day after form removal, moisten concrete surfaces and rub with carborundum brick or another abrasive until producing a uniform color and texture. Do not apply cement grout other than that created by the rubbing process.
 - 2. Grout-Cleaned Finish (GCF): Wet concrete surfaces and apply grout of a consistency of thick paint to coat surfaces and fill small holes. Mix one part Portland cement to one and one-half parts fine sand with a 1:1 mixture of bonding admixture and water. Add white Portland cement in amounts determined by trial patches so color of dry grout will match adjacent surfaces. Scrub grout into voids and remove excess grout. When grout whitens, rub surface with clean burlap and keep surface damp by fog spray for at least 36 hours.
 - 3. Cork-Floated Finish (CFF): Wet concrete surfaces and apply a stiff grout. Mix one part Portland cement and one part fine sand with a 1:1 mixture of bonding agent and water. Add white Portland cement in amounts determined by trial patches so color of dry grout will match adjacent surfaces. Compress grout into voids by grinding surface. In a swirling motion, finish surface with a cork float.

- D. 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.

3.17 CONCRETE SLAB FINISHING

- A. Complete screeding and darbying slabs before excess moisture or bleeding water is present on the surface.
- B. Do not begin subsequent finishing operations until surface water has disappeared and the concrete will sustain foot pressure with only approximately ¼" indentation.
- C. Scratch Finish (SF): While still plastic, texture concrete surface that has been screeded and bull-floated or darbies. Use stiff brushes, brooms, or rakes to produce a profile amplitude of ¼-inch in one direction.
- D. Float Finish (FF):
 - 1. Use for base slabs of wetwells, tanks and other structures that contain liquid.
 - 2. Consolidate concrete with a power-drive disc-type float or a combination floating-troweling machine with metal float shoes attached.
 - 3. Machines which have a water attachment for wetting the concrete during the finishing operation are prohibited.
 - 4. Check and level surface plane to a tolerance not exceeding ¼" in 10 feet when tested with a 10-foot straightedge. Cut down high spots and fill low spots. Immediately after re-leveling, refloat surface to a uniform, smooth, granular texture.
 - 5. Where slab drainage is indicated, take care to maintain accurate slopes for drainage.
- E. Steel Troweling: After float finishing, steel trowel surface as specified to increase compaction of fines and to provide maximum density and wear resistance. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance.
 - 1. Apply a trowel finish to surfaces indicated, exposed to view or to be covered with resilient flooring, carpet, ceramic or quarry tile set over a cleavage membrane, paint, or another thin-film-finish coating system.

2. Finish and measure surface so gap at any point between concrete surface and an unveled, freestanding, 10-ft long straightedge resting on two high spots and placed anywhere on the surface does not exceed $\frac{1}{4}$ -inch.
- F. Trowel and Fine-Broom Finish: Apply a first trowel finish to surfaces indicated or where ceramic or quarry tile is to be installed by either thickset or thin-set method. While concrete is still plastic, slightly scarify surface with a fine broom.
1. Comply with flatness and levelness tolerances for trowel finished floor surfaces.
- G. Non-slip Broom Finish: In addition to floating and troweling, provide walks, ramps, steps, and exposed floor areas subject to foot traffic and likely to be wet with a final non-slip broom finish. Draw broom over previously finished finish.
- H. Dry-Shake Floor Hardener Finish: After initial floating, apply dry-shake floor hardener to surfaces according to manufacturer's written instruction and as follows:
1. Uniformly apply dry-shake floor hardener at a rate of 100 lb/100 sq. ft. unless greater amount is recommended by manufacture.
 2. Uniformly distribute approximately two-thirds of dry-shake floor hardener over surface by hand or with mechanical spreader and embed by power floating. Follow power floating with a second dry-shake floor hardener application, uniformly distributing remainder of material, and embed by power floating.
 3. After final floating, apply a trowel finish. Cure concrete with curing compound recommended by dry-shake floor hardener manufacturer and apply immediately after final finishing.
- I. Abrasive Aggregate Non-Slip Finish:
1. Screed and float concrete to the required finish level with no coarse aggregate visible.
 2. Uniformly sprinkle abrasive aggregate over the floated surface at a rate of not less than $\frac{1}{4}$ pound per square foot.
 3. Steel trowel surface to a smooth even finish.

4. Immediately after curing, remove cement coating covering the abrasive aggregate by steel brushing, rubbing with an abrasive stone or sandblasting to expose abrasive particles.

Concrete Finish Schedule	
Interior slabs	Dry-Shake Floor Hardener
Interior elevated walkway slabs	Broom Finish
Interior and exterior walls not receiving formliner finish and exposed to public view (1)	Smooth-Rubbed Finish
Exterior walkways/slabs, ramps, stairs, slabs on grade and slabs exposed to weather.	Broom Finish
Beams and columns	Smooth-Formed Finish
Concrete surfaces not exposed to public view	Rough-Formed Finish
Concrete not listed above and exposed to public view (1)	Smooth-Formed Finish
Base slabs of wet tanks/structures	Float Finish

(1) All concrete surfaces that are visible to any person walking through the treatment plant, pumping station, vault, facility buildings, galleries, rooms, platforms, etc. is "exposed to public view".

3.18 HOT WEATHER REQUIREMENTS

- A. Conform to ACI 305R and ACI 305.1 when concreting during hot weather.
- B. Hot weather conditions are deemed to exist when the temperature in the forms is 75 degrees F or above, or a combination of high air temperature, low relative humidity and wind velocity impairs the quality of fresh or hardened concrete. Take protective measures for mixing, transporting and placing concrete in accordance with ACI 305.1.
- C. The temperature of the concrete at the place of discharge may not exceed 85 degrees F.
 1. If ice is used to lower temperature, place crushed, shaved or chipped ice directly into the mixer as part or all of the mixing water. Mix until ice is completely melted.
 2. Record the concrete temperature at the time of discharge.
- D. Do not add water that will cause the proportions to exceed the maximum water-cement ratio.
 1. Notify the resident project representative before adding any water to the concrete mix.
 2. Record the amount of water added to the concrete at the jobsite.

- E. Discharge concrete within 45 minutes or 100 revolutions, whichever occurs first, after the first mixing of cement and aggregates.
- F. Placing and Curing:
 - 1. Place concrete promptly upon arrival.
 - 2. Provide at least one standby vibrator for each 3 vibrators in use.
 - a. Protect concrete from direct sunlight. Keep forms covered and moist by means of water sprinkling or the application of continuously wetted burlap or cotton mats for a minimum of 24 hours.
 - 3. When forms are removed, provide wet cover to the newly exposed surfaces to avoid exposure to hot sun and wind.
 - 4. Continue specified water curing methods for 10 days. Leave covering in place 4 additional days. Do not permit alternate wetting and drying cycles.
 - 5. For slabs on grade, beam and deck concrete, and other horizontal placements, protect the surface between finishing operations using one or more of the following methods:
 - a. Careful use of a fog nozzle.
 - b. Spreading and removing polyethylene sheeting between finishing operations.
 - c. Application of monomolecular film after the strike off.

3.19 COLD WEATHER REQUIREMENTS

- A. Conform to ACI 306R and ACI 306.1 when concreting during cold weather.
- B. Cold weather is defined any time when the daily temperature is 40 degrees F or lower during placement and the protection period.
- C. Protect concrete surfaces from freezing for at least 24 hours after placement.
- D. All surfaces in contact with newly-placed concrete including formwork, reinforcement and subgrade must be above 35 degrees F.
- E. Place concrete at a temperature of not less than 55 degrees F. Mix concrete at a temperature between:
 - 1. 60 degrees F and 70 degrees F when outside air temperature is above 30 degrees F.

2. 65 degrees F and 75 degrees F when outside air temperature is between 0 degrees F and 30 degrees F.
 3. 70 degrees F and 80 degrees F when outside air temperature is below 0 degrees F.
- F. Follow concrete placement with tarpaulins or other readily movable coverings, so only a few feet of concrete are exposed to the outside air at any time.
 - G. Maintain the temperature and moisture conditions specified in all parts of the newly-placed concrete by covering, insulating, housing or heating. Arrange for protection methods in advance of placement.
 - H. Maintain concrete at a temperature of not less than 50 degrees F or more than 70 degrees F for a period of 3 days after placement. Maintain concrete at a temperature of not less than 50 deg F nor more than 70 deg F for a period of 7 days after placement. At the end of the heating period, the concrete surfaces shall be cooled to the temperature of the outside air by slowly reducing the artificial heat at a uniform rate until the temperature of the outside air is reached within a twenty-four (24) hour period.
 - I. Do not remove forms during the initial protection period.
 - J. Protect insulation against wetting that will impair its insulating value using moisture-proof cover material. Keep insulation in close contact with concrete.
 - K. Construct enclosure to withstand wind and snow loads and be reasonably air-tight. Provide sufficient space between the concrete and enclosure to permit free circulation of heated air.
 - L. Use vented heaters. Do not permit heaters to heat or dry concrete locally.
 - M. Maintain relative humidity above 40% within heated enclosures before construction supports are removed.
 - N. Monitor temperature to ensure concrete is kept within specified limits recording time and concrete temperature every 8 hours.
 - O. Assure concrete has developed necessary strength before removing forms. Provide additional test cylinders with the same protection as the structure they represent to verify concrete strength before construction supports are removed.
 - P. If water curing is used, terminate at least 12 hours before end of temperature protection period. Permit concrete to dry.

- Q. After the required protection period, gradually reduce the concrete temperature within an enclosure or insulation at a rate not to exceed 20o per day until the outside temperature has been reached.
- R. Apply membrane-forming curing compound to concrete surfaces during the first period of above-freezing temperatures after forms are stripped and before air temperature rises to 50 degrees. Apply membrane-forming curing compound to slabs as soon as finishing operations are completed, except where live steam curing is used.
- S. The Contractor shall have tarpaulins, insulating devices, and other suitable materials at the site to enclose or protect all portions of the concrete requiring protection. Materials shall be installed as close as possible to keep exposure to cold weather to a minimum. Where heating is required, the spaces to be heated shall be completely enclosed and the temperature kept at required levels by the use of heaters approved by the Engineer.
- T. The Contractor shall provide a sufficient number of maximum/minimum recording thermometers to record temperature in each concrete placement undergoing cold weather protection.
- U. The curing period for all structure concrete requiring cold weather protection shall conform to the cold weather protection period except when the normal curing period is longer.

3.20 CURBING AND SIDEWALKS

- A. Shall be installed using materials and practices set forth in these specifications.
- B. Shall be as detailed on the contract documents.

3.21 TESTING AND FIELD QUALITY CONTROL

- A. General - Concrete materials and operations will be tested and inspected as the work progresses. Failure to detect any defective work or material shall not in any way prevent later rejection when either such defect is discovered, nor shall it obligate the Owner for final acceptance.
- B. Testing Services - The following testing services shall be performed by the designated testing agency:
 - 1. Perform compressive strength, slump and air content tests of the concrete during construction in accordance with the following procedures:

- a. Secure composite samples in accordance with ASTM C172. Each sample shall be obtained from a different batch of concrete on a random basis, avoiding any selection of the test batch other than by a number selected at random before commencement of concrete placement.
 - b. Mold and cure one set of ten-cylinder specimens from each sample in accordance with ASTM C31. Any deviations from the requirements of this standard shall be recorded in the test report. Specimens shall be 6-inch diameter by 12-inch high cylinders.
 - c. Of each set of ten cylinders, laboratory cure five cylinders and field cure five cylinders. Test field and laboratory cylinder specimens in accordance with ASTM C39. Test 2 of each cylinder at 7 days; test 2 of each cylinder at 28 days. Hold the remaining cylinder for testing in the event that any of the other cylinders are damaged prior to testing. The acceptance test results shall be the average of the strengths of the two cylinders tested at 28 days. If one cylinder in a test manifests evidence of improper sampling, molding or testing, it shall be discarded, and the strength of the remaining cylinder shall be considered the test result. Should both cylinders in a test show any of the above defects, the entire test shall be discarded.
 - d. Make at least one strength test for each 50-cu. yd., or fraction thereof, of each mixture design of concrete placed in any 1 day. When the total quantity of concrete with a given mix design is less than 20 cu. yd., the strength tests may be waived by the Engineer if, in the Engineer's judgment, adequate evidence of satisfactory strength is provided, such as strength test results for the same kind of concrete supplied on the same day and under comparable conditions to other work or other projects.
2. Determine slump of the concrete at point of placement for each composite sample for each strength test and whenever consistency of concrete appears to vary, using ASTM C143.
 3. Determine air content of the concrete sample for each strength test in accordance with ASTM C231, ASTM C173, or ASTM C138. One test for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform a minimum of one test per 50 CY of concrete placed.
 4. Determine temperature of the concrete sample for each strength test. ASTM C1064: one test hourly when air temp is 40 deg F and below and when 80 deg F and above.
 5. High Range Water Reducer (Superplasticizer) Admixture Segregation Test: Test each truck prior to use on job.

- a. Segregation Test Objective: Concrete with 4-inch to 8-inch slump must stay together when slumped. Segregation is assumed to cause mortar to flow out of mix even though aggregate may stay piled enough to meet slump test.
 - b. Test Procedure: Make slump test and check for excessive slump and observe to see if mortar or moisture flows from slumped concrete.
 - c. Reject concrete if mortar or moisture separates and flows out of mix.
- C. Additional Services When Required - The following services shall be performed by the testing agency when required by the Owner at the Contractor's expense:
 - 1. Inspect concrete batching, mixing and delivery operations to the extent deemed necessary by the Owner.
 - 2. Sample concrete at point of placement and perform required tests.
 - 3. Review the manufacturer's report for each shipment of cement and reinforcing steel and conduct laboratory tests or spot checks of the materials as received for compliance with specifications.
- D. Other Services as Needed - The following services shall be performed by the testing agency at the Contractor's expense:
 - 1. Additional testing and inspection required because of changes in materials or proportions requested by the Contractor.
 - 2. Additional testing of materials or concrete occasioned by their failure by test or inspection to meet specification requirements.
- E. Duties and Authorities of Designated Testing Agency:
 - 1. Representatives of the agency shall inspect, sample and test the materials and the production of concrete as required by the Owner. When it appears that any material furnished, or work performed by the Contractor fails to fulfill specification requirements, the testing agency shall report such deficiency to the Owner and the Contractor.
 - 2. The agency shall report all test and inspection results to the Owner, Engineer and Contractor immediately after they are performed. All test reports shall include the exact location in the work at which the batch represented by a test was deposited. Reports of strength tests shall include detailed information on storage and curing of specimens prior to testing.

3. The testing agency and its representatives are not authorized to revoke, alter, relax, enlarge or release any requirement of the Contract Documents, nor to approve or accept any portion of the work.

F. Responsibilities and Duties of Contractor:

1. The Contractor shall provide the necessary testing services for the following:
 - a. Qualification of proposed materials and the establishment of mixture designs.
 - b. Other testing services needed or required by the Contractor.
2. The use of testing services shall in no way relieve the Contractor of the responsibility to furnish materials and construction in full compliance with the Contract Documents.
3. The Contractor shall submit to the Engineer the concrete materials and the concrete mix designs proposed for use with a written request for acceptance. This submittal shall include the results of all testing performed to qualify the materials and to establish the mix designs. No concrete shall be placed in the work until the Contractor has received such acceptance in writing.
4. To facilitate testing and inspection, the Contractor shall:
 - a. Furnish any necessary labor to assist the testing agency in obtaining and handling samples at the project or other sources of materials.
 - b. Advise the testing agency sufficiently in advance of operations to allow for completion of quality tests and for the assignment of personnel.
 - c. Provide and maintain for the sole use of the testing agency adequate facilities for safe storage and proper curing of concrete test specimens on the project site for the first 24 hours as required by ASTM C31.

3.22 WATERTIGHTNESS OF STRUCTURES

- A. The provisions of this section are applicable to cast-in-place reinforced concrete water bearing and dry structures. Refer to Section 03410 for precast structural concrete specifications.

- B. The Contractor shall provide all labor, materials, tools, equipment and devices for testing the water-tightness of new structures, constructed under this Contract. Testing shall be performed prior to the acceptance or placing the structure in operation, but in the case of concrete structures, after the concrete is at least seven days old and has achieved the 28-day minimum design strength. All structures, both water holding and dry, are meant to be watertight and free from discernible infiltration and exfiltration.
- C. Structures Designed to Contain Liquid:
 - 1. Structures designed to contain liquid shall be thoroughly cleaned prior to the introduction of water for test purposes. Before testing a structure, all pipelines connecting to the structure shall have been tested and approved for leakage. All structures shall be tested for leakage and shall be tested in accordance with ACI 350.1. Testing shall be conducted prior to back filling soil around structures, unless otherwise noted.
 - 2. If any structure fails to meet the above requirements for water tightness, then the Contractor shall drain the structure, locate and repair all leaks and retest the structure as many times as is necessary to obtain a watertight structure as defined herein, all to the satisfaction of the Engineer and at no extra cost to the Owner.
- D. Structures designed to be dry shall have the interior thoroughly cleaned below finished grade and pumped dry if necessary. Openings below grade shall be bulkheaded and made tight. After a period of 5 days, interior surfaces will be inspected for accumulation of moisture and any excess accumulation indicative of defects in the structure in the judgment of the Engineer shall be repaired by the Contractor at no cost to the Owner and to the satisfaction of the Engineer.
- E. All leaks and defects in structures shall be repaired or remedied without additional compensation at whatever time during the course of the Contract they become apparent.
- F. Potable water shall be used for filling structures for leakage tests.
- G. No separate payment will be made for testing structures neither for water tightness nor for the cost of the water used. The cost thereof shall be considered as included in the lump sum and unit prices bid for this Contract.

3.23 EVALUATION AND ACCEPTANCE OF CONCRETE

- A. Evaluation of Test Results:
 - 1. Test results for standard molded and standard cured test cylinders shall be evaluated separately for each specified concrete mixture design. Such evaluation shall be valid only if tests have been conducted in accordance with procedures specified.

2. For evaluation, each specified mixture design shall be represented by at least five tests.

B. Acceptance of Concrete:

1. Strength - Concrete shall meet the minimum requirements of ACI 301 and ACI 350.5. The strength level of the concrete will be considered satisfactory so long as the averages of all sets of three consecutive strength test results equal or exceed the specified strength f'_c , and no individual strength test result falls below the specified strength f'_c by more than 500 psi.
2. Durability - The durability level of the concrete will be considered satisfactory so long as the requirements of ACI 301 and ACI 350.5 are met.
3. Dimensional Tolerances - The concrete will be considered satisfactory so long as the requirements of ACI 301 and ACI 350.5 are met.
4. Finishes and Appearance - The concrete will be considered satisfactory so long as the requirements of ACI 301 and ACI 350.5 are met.

C. Testing of Concrete in Place:

1. Testing by impact hammer, sonoscope, or other nondestructive device may be permitted by the Owner to determine relative strengths at various locations in the structure as an aid in evaluating concrete strength in place or for selecting areas to be cored. Such tests, unless properly calibrated and correlated with other test data, shall not be used as a basis for acceptance or rejection.
2. Core tests:
 - a. Where required, cores at least 2-inch in diameter shall be obtained and tested in accordance with ASTM C42. If the concrete in the structure will be dry under service conditions, the cores shall be air dried (temperature 60 degrees F to 80 degrees F, relative humidity less than 60 percent) for 7 days before testing and shall be tested dry. If the concrete in the structure will be more than superficially wet under service conditions, the cores shall be tested after moisture conditioning in accordance with ASTM C42.
 - b. At least three representative cores shall be taken from each member or area of concrete in place that is considered potentially deficient. The location of cores shall be determined by the Engineer to least impair the strength of the structure. If, before testing, one or more of the cores shows evidence of having been damaged

subsequent to or during removal from the structure, it shall be replaced with a new core.

- c. The strength level of concrete in the area represented by a core test will be considered adequate if the average strength of the cores is equal to at least 85 percent of specified strength f'_c and if no single core is less than 75 percent of the specified strength f'_c .
- d. Core holes shall be filled with low slump concrete or mortar. See Section 3.14, Repair of Surface Defects.

3.24 ACCEPTANCE OF STRUCTURE

A. General:

- 1. Completed concrete work shall meet all requirements of ACI 301, unless otherwise specified.
- 2. Completed concrete work which meets all applicable requirements will be accepted without qualification.
- 3. Completed concrete work, which fails to meet one or more requirements, but which has been repaired to bring it into compliance will be accepted without qualification.
- 4. Completed concrete work which fails to meet one or more requirements, and which cannot be brought into compliance may be accepted or rejected as provided in these Specifications or in the Contract Documents. In this event, modifications may be required to assure that the work complies with the design intent.

B. Dimensional Tolerances:

- 1. Formed surfaces resulting in concrete outlines smaller than permitted by the tolerances of ACI 117 shall be considered potentially deficient in strength and subject to the provisions of Section 3.23.
- 2. Formed surfaces resulting in concrete outlines larger than permitted by the tolerances of ACI 117 may be rejected and the excess material shall be subject to removal. If removal of the excess material is permitted, it shall be accomplished in such a manner as to maintain the strength of the section and to meet all other applicable requirements of function and appearance.
- 3. Concrete members cast in the wrong location may be rejected if the strength, appearance or function of the structure is adversely affected or misplaced items interfere with other construction.

4. Inaccurately formed concrete surfaces exceeding the limits of ACI 117, and which are exposed to view, may be rejected and shall be repaired or removed and replaced if required.
 5. Finished slabs exceeding the tolerances of ACI 117 may be repaired provided that strength or appearance is not adversely affected. High spots may be removed with terrazzo grinder, low spots filled with a patching compound, or other remedial measures performed as permitted.
- C. Appearance:
1. Other concrete exposed to view with defects which adversely affect the appearance of the specified finish may be repaired only by acceptable methods.
 2. Concrete not exposed to view is not subject to rejection for defective appearance.
- D. Strength of Structure:
1. The strength of the structure in place will be considered potentially deficient if it fails to comply with any requirements, which control the strength of the structure, including but not necessarily limited to the following conditions:
 - a. Low concrete strength as designated in Section 3.23.
 - b. Reinforcing steel size, quantity, strength, position, or arrangement at variance with the requirements of Section 3.03, Reinforcement, or the Contact Drawings.
 - c. Concrete, which differs from the required dimensions or location in such a manner as to reduce the strength.
 - d. Curing less than that specified.
 - e. Inadequate protection of concrete from extremes of temperature during early stages of hardening and strength development.
 - f. Mechanical injury (as defined in Section 3.12.F), construction fires, accidents or premature removal of formwork likely to result in deficient strength.
 - g. Poor workmanship likely to result in deficient strength.
 2. Structural analysis and/or additional testing may be required when the strength of the structure is considered potentially deficient.

3. Core tests in accordance with Section 3.23.C.2 may be required when the strength of the concrete in place is considered potentially deficient.
4. If core tests are inconclusive or impractical to obtain or if structural analysis does not confirm the safety of the structure, load tests may be required, and the results evaluated in accordance with ACI 318.
5. Concrete work judged inadequate by structural analysis or by results of a load test shall be reinforced with additional construction if so directed by the Owner, or shall be replaced, at the Contractor's expense.
6. The Contractor shall pay all costs incurred in providing the additional testing, analysis and/or engineering services required by this section.

E. Durability of Structure:

The durability level of the structure will be considered satisfactory so long as the requirements of ACI 301 are met.

END OF SECTION

SECTION 03410

PRECAST STRUCTURAL CONCRETE

PART 1 - GENERAL

1.01 SUMMARY

- A. Contractor shall provide all materials, labor, equipment and services necessary to design, construct and install precast concrete structures, as shown on the Contract Drawings.
- B. The structures shall be constructed of precast reinforced concrete. They shall be watertight, non-corrosive, durable and structurally sound. All inlet and outlet connections shall be sealed.

1.02 SUBMITTALS

- A. Shop Drawings: Submit detailed fabrication and installation drawings certified by a Professional Engineer registered in the State of Maryland prior to fabrication. Show plans, elevations, dimensions, cross sections, openings, joint design, and indicate location, size and type of reinforcing steel.
- B. Calculations: Submit manufacturer's complete design calculations certified by a Professional Engineer registered in the State of Maryland, including load calculations, buoyancy calculations, and concrete mix design.
- C. Certifications: Submit manufacturer's certifications and laboratory test reports including mill certification for the reinforcing steel, certificates of compliance for all flexible connectors and/or inlet and outlet seals, and certified test reports specified in referenced ASTM Standards.
- D. Watertightness test procedures and test results data.

1.03 DESIGN CRITERIA

- A. All precast structures shall be designed in accordance with ACI 350 "Building Code Requirements for Environmental Engineering Concrete Structures."
- B. Top slab must be separate and removable from structure. Structures shall be designed to accommodate pumps, piping, valves and other equipment, as shown or specified.
- C. Loads:
 - 1. Live Load: MDSHA HS-27 (135% of AASHTO HS20-44 Loading).

- 2. Dead Load: Earth at 125-pcf with an at rest coefficient equal to 0.53. Hydrostatic pressure should be included as applicable.
- D. Flotation design shall have a factor of safety of 1.5 minimum.
- E. Wall thicknesses shown on Contract Drawings are the minimum.
- F. All mechanical connections between precast units and any cast-in-place concrete or precast units shall be 316 stainless steel.
- G. Precast structures shall be designed to account for all reaction loads resulting from hoisting equipment, handrails, hatches, and other equipment, either embedded or attached to the structure, with a minimum thickness to fully embed all sleeves, bases, frames, anchors and other items that will impact the design.
- H. The base with riser walls and shelf shall be cast monolithically as a single unit. Rectangular vaults with an interior width dimension greater than 6'-0" or interior length dimension greater than 12'-0" may have a cast-in-place concrete bottom in lieu of a monolithic cast bottom, provided the design is in accordance with the Contract Documents and is included in the design calculations as required above. The interface between the cast-in-place and precast units shall be sealed to provide a watertight structure, and all mechanical connections between the precast units and cast-in-place concrete bottom shall be 316 stainless steel.

1.04 QUALITY ASSURANCE

- A. Fabricator Qualifications: Fabrication shall be by a firm experienced in the manufacturing of precast concrete units similar to the ones indicated for this project and with a record of successful in-service performance.
- B. Design Standards: Comply with ACI 350 "Building Code Requirements for Environmental Engineering Concrete Structures" and the design recommendations of PCI MNL 120, "PCI Design Handbook—Precast and Prestressed Concrete".

1.05 DELIVERY, STORAGE AND HANDLING

- A. Store precast concrete units at the project site in a manner to prevent cracking, distorting, warping, or other physical damage, and so that markings are visible.
- B. Lift and support precast concrete units only at designated lifting and supporting points as shown on approved shop drawings.

1.06 JOB CONDITIONS

- A. Verify dimensions at the project site and prepare shop drawings to reflect actual field conditions and dimensions.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Subject to compliance with requirements, manufacturers that may be used include:
1. Concrete Pipe & Precast,
 2. Gillespie Precast,
 3. Monarch Products Company, Inc.

2.02 MATERIALS

- A. Concrete Materials
1. Portland Cement: ASTM C150, Type II.
 2. Aggregates: Except as modified by PCI MNL 116, use ASTM C33 coarse aggregates.
 3. Water: Potable, in accordance with ACI 318 and 350.
 4. Air-Entraining Admixture: ASTM C260, certified by manufacturer to be compatible with other required admixtures.
 5. Water-Reducing; Retarding; Water-Reducing and Retarding; High-Range, Water-Reducing; and High-Range, Water-Reducing and Retarding Admixtures: ASTM C494.
 6. Fly Ash or Natural Pozzolans: ASTM C618.
 7. Silica Fume: ASTM C1240.
 8. Calcium chloride or admixtures containing chlorides shall not be used.
- B. Reinforcing Steel
1. Reinforcing Bars: ASTM A615, Grade 60, deformed, epoxy coated.
 2. Welded Wire Reinforcement: ASTM A1064, furnish in flat sheets, epoxy coated or galvanized.
 3. Epoxy Coating: Epoxy coated reinforcing steel shall be fusion bonded epoxy powder. The epoxy protective coating shall be a one coat, heat curable, thermosetting powdered coating that is electro-statically applied on metal surfaces. For reinforcement steel the color shall be a bright color to contrast with the normal color of reinforcement steel and rust (e.g., orange, red,

green, yellow, etc., and not brown or any color in the rust family). If reinforcement steel is coated before fabrication, all hairline cracks and minor damage on fabrication bends shall be patched, even if there is no bond loss. Epoxy coatings shall conform to ASTM D3963.

C. Joints

1. Joints between precast concrete units shall comply with ASTM C990, and shall be sealed watertight using CS-102 as Manufactured by Concrete sealants, Inc., or approved equal.

2.03 CONCRETE MIXES

- A. Compressive Strength: 5,000 psi at 28-days.
- B. Maximum Water-Cement Ratio: 0.40.
- C. Add air-entraining admixture at manufacturer's prescribed rate to result in normal-weight concrete at point of placement having an air-content as follows, with a tolerance of plus or minus 1½ percent:
 1. Air Content: 5 percent for 1½-inch nominal maximum aggregate size.
 2. Air Content: 6 percent for ¾-inch nominal maximum aggregate size.
 3. Air Content: 7 percent for ½-inch nominal maximum aggregate size.

2.04 COATINGS

- A. Coat exterior surface of precast concrete units with Carboline Bitumastic 300-M, or approved equal, 32 mil minimum thickness. Coat interior surfaces in accordance with Section 09900 unless drawings call for an interior coating in accordance with Section 09960.

2.05 FABRICATION

- A. Reinforcement: Comply with recommendations in CRSI's "Manual of Standard Practice" for fabricating, placing and supporting reinforcement.
- B. Mix concrete according to PCI MNL 116. After concrete batching, no additional water may be added.
- C. Place concrete in a continuous operation to prevent seams or planes of weakness from forming in the precast concrete units. Comply with PCI MNL 116 for measuring, mixing, transporting, and placing concrete.

- D. Thoroughly consolidate placed concrete by internal and external vibration without dislocating or damaging reinforcement and built-in items. Use equipment and procedures complying with PCI MNL 116.
- E. Cure concrete, according to requirements in PCI MNL 116, by moisture retention without heat or by accelerated heat curing using low-pressure live steam or radiant heat and moisture.
- F. Product tolerances: Fabricate precast concrete units straight and true to size and shape with exposed edges and corners precise and true so the finished units comply with PCI MNL 116 product tolerances.
- G. Pipe Openings:
 - 1. Pipe openings 12" and smaller can be core drilled in the field, provided that the Contractor coordinates the locations of pipe openings with the precast concrete manufacturer to ensure that the structural and watertight integrity of the unit remains intact. Modular casing seals shall be used to seal the annular space around pipe penetrations to maintain the watertight integrity of the unit. The distance of the core drilled hole from a riser joint, another hole, or edge of a wall or slab shall be a minimum of 4" in all directions. Otherwise, all pipe penetrations shall be cast into the precast units as described below.
 - 2. All pipe openings cast into the precast units shall be provided with a gasket cast integrally into the structure. Gasket shall be rubber, meeting the requirements of ASTM C923, and manufactured by A-Lok Products Corp., Vertex Inc., or approved equal. Pipe opening elevations are fixed. Non-standard riser units shall be provided, as necessary, so that joints do not occur within 6" of pipe openings.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install precast concrete units on undisturbed soil with a stone bedding, which has been leveled and compacted as shown on the Contract Drawings. Excavation shall be free of standing water until backfilling is complete.
- B. Install precast concrete units level, plumb, square and true, without exceeding the recommended erection tolerances in PCI MNL 127, "Recommended Practice for Erection of Precast Concrete".

3.02 WATERTIGHTNESS OF STRUCTURES

- A. The provisions of this section are applicable to precast concrete structures used as underground vaults that are intended to be dry, and precast concrete structures used as tanks that are intended to be wet.
- B. The Contractor shall provide all labor, materials, tools, equipment and devices for testing the water-tightness of new structures, constructed under this Contract. Testing shall be performed prior to the acceptance or placing the structure in operation. All structures, both water holding and dry, are meant to be watertight and free from discernible infiltration and exfiltration.
- C. Structures Designed to Contain Liquid
 - 1. Structures designed to contain liquid shall be thoroughly cleaned prior to the introduction of water for test purposes. Before testing a structure, all pipelines connecting to the structure shall have been tested and approved for leakage. All structures shall be tested for leakage and shall be tested in accordance with ACI 350.1. Testing shall be conducted prior to back filling soil around structures, unless otherwise noted.
 - 2. If any structure fails to meet the above requirements for water tightness, then the Contractor shall drain the structure, locate and repair all leaks and retest the structure as many times as is necessary to obtain a watertight structure as defined herein, all to the satisfaction of the Engineer and at no extra cost to the Owner.
- D. Structures designed to be dry shall have the interior thoroughly cleaned below finished grade and pumped dry if necessary. Openings below grade shall be bulkheaded and made tight. After a period of 5 days, interior surfaces will be inspected for accumulation of moisture and any excess accumulation indicative of defects in the structure in the judgment of the Engineer shall be repaired by the Contractor at no cost to the Owner and to the satisfaction of the Engineer.
- E. All leaks and defects in structures shall be repaired or remedied without additional compensation at whatever time during the course of the Contract they become apparent.
- F. Potable water shall be used for filling structures for leakage tests. It shall be the Contractor's responsibility to convey all water from hydrants or other approved source, as needed for the leak testing. The Contractor shall notify and coordinate with the appropriate Fire Department prior to using hydrants.
- G. No separate payment will be made for testing structures neither for water tightness nor for the cost of the water used. The cost thereof shall be considered as included in the lump sum bid for this Contract.

END OF SECTION

03410-6

SECTION 03600

GROUT

PART 1 - GENERAL

1.01 DESCRIPTION

- A. The work of this section includes grouting as indicated on the drawings or specified in other sections. Unless otherwise specified, all grouting shall be done with non-shrinking grout.
- B. This section also covers epoxy grouting of anchor bolts and threaded rod anchors to be installed in hardened concrete.

1.02 REFERENCES

- A. American Concrete Institute:
 - 1. ACI 308, Recommended Practice for Curing Concrete.
- B. American Society for Testing and Materials:
 - 1. ASTM C33; Concrete Aggregates.
 - 2. ASTM C109; Test Method for Compressive Strength of Hydraulic Cement Mortars (Using two inch or 50-mm Cube Specimens).
 - 3. ASTM C150; Specification for Portland Cement.
 - 4. ASTM C191; Test Method for Time of Setting of Hydraulic Cement by Vicat Needle.
 - 5. ASTM C596; Test Method for Drying Shrinkage of Mortar Containing Portland Cement.
 - 6. ASTM C827; Test Method for Early Volume Change of Cementitious Mixtures.
 - 7. ASTM C1107; Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Non-shrink).

1.03 SUBMITTALS

- A. Submit a statement of compliance, together with supporting data, from the materials suppliers attesting to the conformance of products and ingredients with these specifications.

- B. Submit manufacturer's instructions for mixing, handling, surface preparation, and placing the epoxy type and the non-shrink, non-metallic type grouts.

1.04 QUALITY ASSURANCE

- A. Manufacturer's Qualifications: Grout manufacturer shall furnish copies of current independent laboratory test results showing the non-shrink, non-metallic grout as non-shrink from time of placement according to the following:
 - 1. The grout indicates no expansion after final set according to ASTM C827.
 - 2. The grout indicates 4,000-psi strength developed with a trowelable mix within 24 hours according to ASTM C109.
 - 3. The grout indicates placement time limitation based on initial set of not less than 60 minutes according to ASTM C191.
 - 4. Test results, as supplied by the grout manufacturer, shall indicate that in projects of similar scope and size, the effective bearing area was between 95 and 100 percent.

1.05 DELIVERY, STORAGE AND HANDLING

- A. Provide protection for the products to prevent moisture damage and contamination of the grout materials.
- B. Store the grout in undamaged condition with seals and labels intact as packaged by the manufacturer.

1.06 PROJECT CONDITIONS

- A. Protect freshly poured grout against high and low temperatures and unfavorable environmental conditions in accordance with ACI Standards 308.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Portland Cement: ASTM C150, Type II.
- B. Water: Potable; containing no impurities, suspended particles, algae, organic substances, acids, alkalis, or dissolved natural salts in quantities that will cause:
 - 1. Corrosion of steel,

2. Volume change that will increase shrinkage cracking,
 3. Efflorescence, or
 4. Excess air entraining.
- C. Fine Aggregate:
1. Washed natural sand.
 2. Gradation in accordance with ASTM C33 and represented by a smooth granulometric curve within the required limits.
 3. Free from injurious amounts of organic impurities as determined by ASTM C40.

2.02 RAPID-CURING EPOXY GROUT

- A. High strength, three-component epoxy grout formulated with thermosetting resins and inert fillers.
- B. Grout shall be rapid curing, have high adhesion, and be resistant to ordinary chemicals, acids and alkalis.

<u>Physical Properties</u>		<u>Reference Spec.</u>
Compressive Strength	12,000 psi (7-day)	ASTM C579
Tensile Strength	2,000 psi minimum	ASTM C307
Coefficient of Expansion	3×10^{-6} in/in/°F	ASTM C531
Shrinkage	None	ASTM C827

2.03 NON-SHRINK, NON-METALLIC CEMENTITIOUS GROUT

- A. Pre-mixed ready for use formulation requiring only the addition of water; non-shrink, non-corrosive, non-metallic, non-gas forming, no chlorides. No more water shall be used than is necessary to produce a flowable grout, and ASTM C1107.
- B. Certified to maintain initial placement volume or expand after set and meet the following minimum properties when tested in accordance with Corps of Engineers Specification CRD-C621, for Type D non-shrink grout:

Setting Time:	Initial	2 hours (Approx.)
ASTM C191	Final	3 hours (Approx.)
Expansion:		0.4% Maximum
Compressive Strength:		

Time	Consistency		
	Plastic (PSI)	Flowable (PSI)	Fluid (PSI)
1 Day	4,000	3,000	2,500
7 Day	7,000	6,000	5,000
28 Day	10,000	8,500	7,500

PART 3 - EXECUTION

3.01 SURFACE PREPARATION

- A. Remove defective concrete, laitance, dirt, oil, grease and other foreign material from concrete surfaces by brushing, hammering, chipping or other similar means until a sound, clean concrete surface is achieved. Perform additional surface preparation in accordance with non-shrink, non-metallic grout manufacturer's instructions.
- B. Lightly roughen the concrete, but not enough to interfere with the proper placement of grout.
- C. Remove foreign materials from metal surfaces in contact with grout.
- D. Align, level and maintain final positioning of components to be grouted.
- E. Take special precautions during periods of extreme weather conditions in accordance with the manufacturer's written instructions.
- F. Saturate concrete surfaces with clean water; remove excess water, leave none standing.

3.02 FORMWORK

- A. Construct leakproof forms anchored and shored to withstand grout pressures, so that no movement is possible.
- B. Provide clearance between the formwork and the area to be grouted to permit proper placement of grout.
- C. Forms shall be provided where structural components of baseplates or bedplates will not confine the grout.
- D. Pre-treat wood forms with forming oils so that they do not absorb moisture.
- E. Remove supports only after grout has hardened.

3.03 MIXING

A. Portland Cement Grout:

1. Prepare grout composed of Portland cement, sand and water; do not use ferrous aggregate or staining ingredients in grout mix.
2. Use proportions of 2 parts sand and 1 part cement, measured by volume.
3. Prepare grout with sufficient water to obtain consistency to permit placing and packing.
4. Mix water and grout in two steps; pre-mix using approximately $\frac{2}{3}$ of the water; after partial mixing, add the remaining amount of water to bring mix to the desired placement consistency and continue mixing 2-3 minutes.
5. Mix only that quantity of grout that can be placed within 30 minutes after mixing.
6. After the grout has been mixed, do not add more water for any reason.

B. Epoxy Grout & Non-Shrink Cementitious Grout: Mix and prepare epoxy grout and non-shrink cementitious grout in strict accordance with the manufacturer's instructions.

C. Mix grout components as close to the work area as possible and transport the mixture quickly and in a manner that does not permit segregation of materials.

3.04 PLACING

A. Unless otherwise specified or indicated on the drawings, the thickness of grout under baseplates shall be 1½ inches. Grout shall be placed in strict accordance with the directions of the manufacturer so that all spaces and cavities below the top of baseplates and bedplates are completely filled, without voids.

B. Place grout material quickly and continuously.

C. Do not use pneumatic-pressure or dry-packing methods (Plastic Consistency).

D. Apply grout from one side only to avoid entrapping air. The final installation shall be thoroughly compacted and free of air pockets.

E. Do not vibrate the placed grout mixture or permit it to be placed if the area is being vibrated by nearby equipment.

- F. In all locations where the edge of the grout will be exposed to view, the grout shall be finished smooth after it has reached its initial set. Except where shown to be finished on a slope, the edges of grout shall be cut off flush at the baseplate, bedplate, member, or piece of equipment.
- G. Do not remove leveling shims for at least 48 hours after grout has been placed.
- H. Unless otherwise noted in the drawings, anchor bolts and threaded rod anchors shall be epoxy grouted in holes drilled into hardened concrete. Diameters of holes shall be as follows:

<u>Item</u>	<u>Diameter of Hole</u>
Threaded Rod Anchors Anchor Bolts	1/8-inch larger than the bar or rod outside diameter Per manufacturer's instructions

- I. The embedment depth for epoxy grouted anchor bolts and threaded rod anchors, shall be not less than 15 bolt or rod diameters, unless otherwise indicated on the drawings. Holes shall be prepared for grouting as recommended by the grout manufacturer.
- J. Anchor bolts and threaded rod anchors shall be clean, dry, and free of grease and other foreign matter at time of installation. The bolts, rods, and bars shall be set and positioned, and the epoxy grout shall be placed and finished in accordance with the recommendations of the grout manufacturer. Particular care shall be taken to ensure that all space and cavities are filled with epoxy grout, without voids.
- K. During assembly of all threaded stainless steel components, anti-seize thread lubricant shall be liberally applied to the threaded portion not embedded in concrete.

3.05 CURING

- A. After grout has attained its initial set, keep damp for a minimum of 3 days.
- B. Prevent rapid loss of water from the grout during the first 48 hours by the use of an approved membrane-curing compound or with the use of the wet burlap method.

END OF SECTION

SECTION 05500

METAL FABRICATIONS

PART 1 - GENERAL

1.01 SUMMARY

- A. This Section specifies steel supports, loose bearing and leveling plates, steel weld plates and angles, fixed metal bollards, loose steel lintels, anchor bolts, steel pipe sleeves, and other miscellaneous metal fabrications and accessories.
- B. All metal fabrications that are to be located within the pumping station wetwell, manholes, and other similar structures containing sewage and/or hydrogen sulfide gases, shall be stainless steel Type 316.
- C. No attempt is made to enumerate each item required, but to indicate parts and describe general construction and certain special items; perform work in strict conformity with the Contract Documents, approved Shop Drawings, and the Specifications; and obtain field measurements of adjoining work required to locate and fit work.

1.02 PERFORMANCE REQUIREMENTS

- A. Structural Performance of Ladders: Provide ladders capable of withstanding the effects of loads and stresses within limits and under conditions specified in ANSI A14.3.
- B. Structural Performance of Stairs: Provide metal stairs and a complete stair system, capable of withstanding the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
 - 1. Uniform Load: 100 lbf/sq. ft.
 - 2. Concentrated Load: 300 lbf applied on an area of 4 sq. in.
 - 3. Uniform and concentrated loads need not be assumed to act concurrently.
 - 4. Stair Framing: Capable of withstanding stresses resulting from railing loads in addition to loads specified above.
 - 5. Limit deflection of treads, platforms, and framing members to L/360 deflection ratio or ¼ inch, whichever is less.

- C. Structural Performance of Railings: Provide railings capable of withstanding the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
1. Handrails:
 - a. Uniform loads of 50 lbf/ft. applied in any direction.
 - b. Concentrated load of 200 lbf applied in any direction.
 - c. Uniform and concentrated loads need not be assumed to act concurrently.
 2. Top Rails of Guards:
 - a. Uniform load of 50 lbf/ft. applied in any direction.
 - b. Concentrated load of 200 lbf applied in any direction.
 - c. Uniform and concentrated loads need not be assumed to act concurrently.
 3. Infill of Guards:
 - a. Concentrated load of 50 lbf applied horizontally on an area of 1 sq. ft.
 - b. Uniform load of 25 lsf/sq. ft. applied horizontally.
 - c. Infill load and other loads need not be assumed to act concurrently.
- D. Seismic Performance: Provide metal stairs capable of withstanding the effects of earthquake motions determined according to ASCE 7, "Minimum Design Loads for Buildings and Other Structures."
- E. Thermal Movements: Provide exterior metal fabrications that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

1.03 SUBMITTALS

- A. Shop Drawings: Show fabrication and installation details for all metal fabrications.
1. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items.
 2. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld.
 3. Indicate type, size, and length of bolts, distinguishing between shop and field bolts.
 4. Provide templates for anchors and bolts. Unless otherwise noted in the drawings, all anchors bolts shall be plumb after installation.
 5. For installed products indicated to comply with design loads, include structural analysis data signed and sealed by the licensed Professional Engineer registered in the State of Maryland and responsible for their preparation.
 6. Post-Installed Concrete Anchors:
 - a. Product specifications with recommended design values and physical characteristics for epoxy dowels, and expansion and undercut anchors.
 - b. Quality Assurance Submittals:
 - (1) Test Reports: Certified test reports showing compliance with specified performance characteristics and physical properties.
 - (2) Certificates:
 - (a) ICC ES Evaluation Reports
 - (3) Manufacturer's Installation Instructions.
 - (4) Installer Qualifications and Procedures: Submit installer qualifications and letter of procedure stating method of drilling, the product proposed for use, the complete installation procedure, manufacturer training date, and a list of the personnel to be trained on anchor installation.
- B. Mill Certificates: Signed by manufacturer certifying that products furnished comply with requirements.

- C. Welding certificates.
- D. Qualification Data: For Professional Engineer.

1.04 QUALITY ASSURANCE

- A. Welding: Qualify procedures and personnel according to the following:
 - 1. AWS D1.1, "Structural Welding Code—Steel"
 - 2. AWS D1.2, "Structural Welding Code—Aluminum"
 - 3. AWS D1.3, "Structural Welding Code—Sheet Steel"
 - 4. AWS D1.6, "Structural Welding Code—Stainless Steel"
- B. Post-Installed Concrete Anchors:
 - 1. Installer Qualifications: Drilled-in anchors shall be installed by a contractor with at least five years of experience performing similar installations.
 - 2. Installer Training: Conduct thorough training with the manufacturer or the manufacturer's representative for the Contractor on the project. Training to consist of a review of the complete installation process for drilled-in anchors, to include but not be limited to:
 - a. Hole drilling procedure
 - b. Hole preparation and cleaning technique
 - c. Adhesive injection technique and dispenser training/maintenance
 - d. Reinforcing dowel preparation and installation
 - e. Proof loading/torqueing
 - 3. Certifications: Anchors shall have ICC ES Evaluation Report indicating conformance with current applicable ICC ES Acceptance Criteria.

1.05 PROJECT CONDITIONS

- A. Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication and indicate measurements on Shop Drawings.

1.06 COORDINATION

- A. Coordinate installation of anchorages for metal fabrications. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry.
- B. Coordinate installation of steel weld plates and angles for casting into concrete.

1.07 PRODUCT DELIVERY, HANDLING AND STORAGE

- A. Deliver all materials in good condition. Store in a dry place, off ground. Keep dry at all times. Handle materials to prevent damage to product or structure.
- B. Deliver all materials to the job site properly marked to identify the structure for which they are intended and at such intervals to insure uninterrupted progress of the work. Marking shall correspond to markings indicated on the shop drawings.

PART 2 - PRODUCTS

2.01 METALS, GENERAL

- A. Provide materials with smooth, flat surfaces, unless otherwise indicated. For metal fabrications exposed to view in the completed work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.

2.02 FERROUS METALS

- A. Steel Plates, Shapes, and Bars: ASTM A36.
- B. Steel W-Shapes: ASTM A992, Grade 50.
- C. Stainless Steel Sheet, Strip, Plate, and Flat Bars: ASTM A666, Type 316L.
- D. Stainless Steel Bars and Shapes: ASTM A276, Type 316L.
- E. Steel Tubing: ASTM A1085.
- F. Steel Pipe: ASTM A53, Grade B standard weight (Schedule 40), unless another weight is indicated or required by structural loads.
- G. Cast Iron: ASTM A48, Class 30, unless another class is indicated or required by structural loads.

2.03 NONFERROUS METALS

- A. Aluminum Plate and Sheet: ASTM B209, Alloy 6061-T6.

- B. Aluminum Extrusions: ASTM B221, Alloy 6061-T6.
- C. Aluminum Castings: ASTM B26, Alloy 443.0-F.
- D. Bronze Plate, Sheet, Strip and Bars: ASTM B36, Alloy UNS No. C28000 (muntz metal, 60 percent copper).
- E. Bronze Extrusions: ASTM B455, Alloy UNS No. C38500 (extruded architectural bronze).
- F. Bronze Castings: ASTM B584, Alloy UNS No. C83600 (leaded red brass) or No. C84400 (leaded semi-red brass).
- G. Nickel Silver Extrusions: ASTM B151, Alloy UNS No. C74500.
- H. Nickel Silver Castings: ASTM B584, Alloy UNS No. C97600 (20-percent leaded nickel bronze).
- I. All aluminum shall be anodized.

2.04 FASTENERS

- A. General: Provide ASTM F593 Type 316 stainless steel, Condition CW1 or CW2, fasteners for exterior use and in wetwells. Provide stainless steel fasteners, Condition CW1 or CW2, for fastening aluminum. Select fasteners for type, grade, and class required.
- B. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM F3125, Grade A325, Type 1; with ASTM A563 heavy hex nuts, and ASTM F436 hardened carbon steel washers; with hot-dip zinc coating per ASTM A153.
- C. Stainless Steel Bolts and Nuts: Regular hexagon-head annealed stainless steel bolts, nuts and flat washers; ASTM F593, Type 316 Condition CW1 or CW2 for bolts and ASTM F594 for nuts. Washers shall be ASTM A 666, Type 304.
- D. Provide a passive coating for all stainless steel fasteners and hardware.
- E. Anchor Bolts: Stainless Steel, ASTM F 593, Type 304, unless noted otherwise on the Contract Documents.
- F. Anchor Bolts: ASTM F1554, Grade 55.
 - 1. Provide hot-dip or mechanically deposited, zinc-coated anchor bolts where item being fastened is indicated to be galvanized.
- G. Eyebolts: ASTM A489.
- H. Machine Screws: ASME B18.6.3.

- I. Lag Bolts: ASME B18.2.1.
- J. Wood Screws: Flat head, ASME B18.6.1.
- K. Plain Washers: Round, ASME B18.22.1.
- L. Lock Washers: Helical, spring type, ASME B18.21.1.
- M. Concrete Fasteners and Anchors: Fasteners and anchors shall be of the type and size shown on the Contract Drawings, and as specified as follows:
 - 1. Wedge Anchors: Wedge type, torque-controlled, with impact section to prevent thread damage complete with required nuts and washers. Provide anchors with length identification markings conforming to ICC ES AC01 or ICC ES AC193. Type and size as indicated on Contract Drawings.
 - a. Provide stainless steel anchors. Stainless steel anchors shall be AISI Type 304 or 316 stainless steel as required, provided with stainless steel nuts and washers of matching alloy group and minimum proof stress equal to or greater than the specified minimum full-size tensile strength of the externally threaded fastener. Stainless steel nuts shall conform to ASTM F594 unless otherwise specified. Avoid installing stainless steel anchors in contact with galvanically dissimilar metals.
 - b. Where anchor manufacturer is not indicated, subject to compliance with requirements and acceptance by the Engineer, provide the following, or approved equal:
 - (1) Hilti Kwik Bolt 3, ICC ESR-1385 and ESR-2302
 - (2) Hilti Kwik Bolt TZ, ICC ESR-1917
 - 2. Cartridge Injection Adhesive Anchors: Threaded steel rod, inserts or reinforcing dowels, complete with nuts, washers, polymer or hybrid mortar adhesive injection system, and manufacturer's installation instructions. Type and size as indicated on Contract Drawings.
 - a. Provide stainless steel anchors. Stainless steel anchors shall be AISI Type 304 or 316 stainless steel as required, provided with stainless steel nuts and washers of matching alloy group and minimum proof stress equal to or greater than the specified minimum full-size tensile strength of the externally threaded fastener. All nuts shall conform to ASTM F594 unless otherwise specified. Avoid installing stainless steel anchors in contact with galvanically dissimilar metals.

- b. Reinforcing dowels shall be ASTM A615, Grade 60.
 - c. Where anchor manufacturer is not indicated, subject to compliance with requirements and acceptance by the Engineer, provide the following, or approved equal.
 - (1) Hilti HAS threaded rods with HIT-HY 200 Safe Set System using Hilti Hollow Drill Bit and Vacuum System for anchor and rebar anchorage to concrete, ICC ESR-3187.
 - (2) Hilti HIT-2 anchor rods with HIT-HY 200 Safe Set System for anchorage to concrete, ICC ESR-3187.
 - (3) Hilti HAS threaded rods with HIT-RE 500 V3 Safe Set System using Hilti Hollow Drill Bit and Vacuum System for anchor and rebar anchorage to concrete, ICC ESR-3814.
3. Capsule Anchors: Threaded steel rod, inserts and reinforcing dowels with 45 degree chisel point, complete with nuts, washers, glass or foil capsule anchor system containing polyvinyl or urethane methacrylate-based resin and accelerator, and manufacturer's installation instructions. Type and size as indicated on Contract Drawings.
- a. Provide chisel-pointed stainless steel anchors. Stainless steel anchors shall be AISI Type 304 or 316 stainless steel as required, provided with stainless steel nuts and washers of matching alloy group and minimum proof stress equal to or greater than the specified minimum full-size tensile strength of the externally threaded fastener. All nuts shall conform to ASTM F594 unless otherwise specified. Avoid installing stainless steel anchors in contact with galvanically dissimilar metals.
 - b. Reinforcing dowels shall be A615 Grade 60, with 45-degree chisel-point at embedded end.
 - c. Where anchor manufacturer is not indicated, subject to compliance with requirements and acceptance by the Engineer, provide the following, or approved equal.
 - (1) Hilti HVA Adhesive System with HVU capsules.
4. Substitution of the anchor types shown on the Contract Drawings shall not be permitted without approval of the Engineer.

2.05 MISCELLANEOUS MATERIALS

- A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

- B. Shop Primers: Provide primers that comply with Section 09900.
- C. Zinc-Rich Primer: Complying with SSPC-Paint 20 or SSPC-Paint 29 and compatible with topcoat.
 - 1. Use primer with a VOC content of 3.5 lb/gal or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - 2. Products shall be Carboline Carbozinc 621, Sherwin-Williams Corothane I GalvaPac Zinc Primer, Tnemec Tneme-Zinc 90-97, or approved equal.
- D. Galvanizing Repair Paint: High zinc-dust content paint for regalvanizing welds in steel, complying with SSPC-Paint 20. Cold applied galvanized repair material to be a minimum of 90% zinc.
- E. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D1187.

2.06 FABRICATION, GENERAL

- A. Shop Assembly: Preassemble items in the shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.
- B. Cut, drill and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 0.03125-inch, unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
- C. Stainless Steel beams and shapes shall be hot-rolled, extruded or continuously laser fused along their entire length. Stitch welds or intermittent welds are not permitted.
- D. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
- E. Form exposed work true to line and level with accurate angles and surfaces and straight edges.
- F. Weld corners and seams continuously to comply with the following:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove welding flux immediately.

4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
- G. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) screws or bolts, unless otherwise indicated. Locate joints where least conspicuous.
 - H. Fabricate seams and other connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.
 - I. Cut, reinforce, drill and tap metal fabrications to receive finish hardware, screws and similar items.
 - J. Provide for anchorage of type indicated; coordinate with supporting structure. Space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.
 1. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors, $\frac{1}{8}$ by 1½-inches, with a minimum 6-inch embedment and 2-inch hook, not less than 8 inches from ends and corners of units and 24 inches o.c., unless otherwise indicated.

2.07 MISCELLANEOUS FRAMING AND SUPPORTS

- A. General: Provide steel framing and supports not specified in other Sections as needed to complete the work.
- B. Fabricate units from steel shapes, plates, and bars of welded construction, unless otherwise indicated. Fabricate to sizes, shapes and profiles indicated and as necessary to receive adjacent construction retained by framing and supports. Cut, drill, and tap units to receive hardware, hangers, and similar items. Furnish inserts if units are installed after concrete is placed.
- C. Galvanize miscellaneous framing and supports.

2.08 LOOSE STEEL LINTELS

- A. Fabricate loose steel lintels from steel angles and shapes of size indicated for openings and recesses in masonry walls and partitions. Weld adjoining members together to form a single unit where indicated.
- B. Size loose lintels to provide bearing length at each side of openings equal to 0.083 of clear span, but not less than 8 inches, unless otherwise indicated.
- C. Galvanize loose steel lintels in accordance with ASTM A123.

2.09 LOOSE BEARING AND LEVELING PLATES

- A. Provide loose bearing and leveling plates for steel items bearing on masonry or concrete construction. Drill plates to receive anchor bolts and for grouting.
- B. Galvanize plates after fabrication in accordance with ASTM A123.

2.10 STEEL WELD PLATES AND ANGLES

- A. Provide steel weld plates and angles not specified in other sections, for items supported from concrete construction as needed to complete the work. Provide each unit with not less than two integrally welded steel strap anchors for embedding in concrete.

2.11 GRATINGS

- A. Open grating of a design, material thickness and strength to support all dead loads plus a uniform live load as indicated on the contract drawings, with a maximum of ¼-inch deflection at 100 psf live load. Minimum grating thickness shall be as indicated on the drawings.
- B. Grating shall be of the aluminum swage locked type with serrated bars for maximum slip resistance as manufactured by McNichols Co. or approved equal.
- C. Anchor angle frames to the supporting construction. Fabricate grating in convenient lengths for handling. Band grating along entire perimeter and at holes or other openings.

2.12 ABRASIVE METAL NOSINGS, TREADS AND THRESHOLDS

- A. Cast-Metal Units: Cast gray iron, Class 20, with an integral abrasive finish consisting of aluminum oxide, silicon carbide, or a combination of both. Fabricate units in sizes and configurations indicated and in lengths necessary to accurately fit openings or conditions.
 - 1. Available Manufacturers:
 - a. American Safety Tread Co., Inc.,
 - b. Balco Inc.,
 - c. Barry Pattern & Foundry Co., Inc.,
 - d. Granite State Casting Co.,
 - e. Safe-T-Metal Co.,
 - f. Or Equal.

2. Nosings: Cross-hatched units, 4 inches wide with 1-inch lip, for casting into concrete steps.
 3. Nosings: Cross-hatched units, 1½ by 1½ inches, for casting into concrete curbs.
 4. Treads: Cross-hatched units, full depth of tread with ¾ by-¾-inch nosing, for application over bent plate treads or existing stairs.
 5. Thresholds: Fluted-saddle-type units, 5 inches wide by ½-inch high, with tapered edges.
 6. Thresholds: Fluted-interlocking- (hook-strip-) type units, 5 inches wide by ⅝-inch high, with tapered edge.
 7. Thresholds: Plain-stepped- (stop-) type units, 5 inches wide by ½-inch high, with ½-inch step.
- B. Extruded Units: Aluminum, with abrasive filler consisting of aluminum oxide, silicon carbide, or a combination of both, in an epoxy-resin binder. Fabricate units in sizes and configurations indicated and in lengths necessary to accurately fit openings or conditions.
1. Available Manufacturers:
 - a. ACL Industries, Inc.,
 - b. American Safety Tread Co., Inc.,
 - c. Amstep Products,
 - d. Armstrong Products, Inc.,
 - e. Balco Inc.,
 - f. Or Equal.
 2. Provide ribbed units, with abrasive filler strips projecting 0.625-inch above aluminum extrusion.
 3. Provide solid-abrasive-type units without ribs.
 4. Nosings: Square-back units, 4 inches wide, for casting into concrete steps.
 5. Nosings: Beveled-back units, 4 inches wide with 1⅜-inch lip, for surface mounting on existing stairs.

6. Nosings: Two-piece units, 3 inches wide, with subchannel for casting into concrete steps.
 7. Treads: Square or Beveled-back units, full depth of tread with 1 $\frac{3}{8}$ -inch lip, for application over existing stairs.
- C. Provide anchors for embedding units in concrete, either integral or applied to units, as standard with manufacturer.
 - D. Drill for mechanical anchors and countersink. Locate not more than 4 inches from ends and not more than 12 inches o.c., evenly spaced between ends, unless otherwise indicated. Provide closer spacing if recommended by manufacturer.
 1. Provide 2 rows of holes for units more than 5 inches wide, with 2 holes aligned at ends and intermediate holes staggered.
 - E. Apply bituminous paint to concealed bottoms, sides, and edges of cast-metal units set into concrete.
 - F. Apply clear lacquer to concealed bottoms, sides, and edges of extruded units set into concrete.

2.13 RAILING

A. Railing:

The pipe handrail shall be constructed with mechanically fastened, flush-fit INTERNA-RAIL aluminum fitting system as regularly manufactured by Hollaender Manufacturing Co. or an approved equal. The fittings shall be internally connected to the pipe by means of an internal double tang, expanded by an austenitic 302 alloy stainless steel, internal, reverse knurl, cup point, hexagon socket set screw. Pop rivets, sheet metal screws and adhesives shall not be acceptable. The fittings shall be machined of austenitic stainless steel bar stock of 302 alloy conforming to ASTM A582, or machined castings of high tensile aluminum-magnesium alloy 535.0 manufactured in compliance with ASTM B26, cast from high-purity ingot 535.2 conforming to ASTM B179. Flanges shall be sand cast from high-tensile aluminum-magnesium alloy 535.0 and fastened directly to the pipe by means of an external, reverse knurl, cup point, hexagon socket set screw.

Aluminum: Handrailing shall be fabricated of standard 6061-T6 alloy, Schedule 40 extruded aluminum structural pipe, in accordance with ASTM B221; pipe shall be nominal 1 $\frac{1}{2}$ -inch, with 1.9" O.D. and 0.145" wall thickness. Pipe posts shall be 1 $\frac{1}{2}$ -inch diameter, 80 gauge.

- B. Railing shall be a two rail system designed to meet OSHA standards. Provide additional intermediate rails where indicated on the drawings. Unless otherwise

noted on the drawings, the centerline of top rail shall be 3'-6" above walking surface and the centerline of second rail shall be installed at mid-height. Top railing for stairs shall not be more than 34" and not less than 30" above tread. Provide minimum 3" clearance on single pipe stairway handrails supported on brackets from a wall.

- C. Post spacing shall be adequate to meet loading requirements but shall not exceed 6'-0" o.c.
- D. The top surface of the top railing shall be smooth and shall not be interrupted by projecting fittings.
- E. Provide removable stainless steel chains with snap hooks where indicated.
- F. Provide for expansion and contraction in the railing. Expansion joints must align with those in the structure to which the handrail is attached. Post spacing shall be located 1'-0" maximum to the right or left of expansion and contraction joints.
- G. Railings shall be capable of withstanding a concentrated load of at least 200 pounds applied in any direction at any point on the rail.
- H. Handrail post shall be base flange mounted as noted on the drawings. Stringer connections shall be as detailed on drawings.
- I. Removable Setting: Railing shall be set in close-fitting sleeves, bolted to sides of concrete walkways or aluminum walkway support structure.
- J. Permanent setting in concrete shall have posts set in sleeves and set in non-shrink grout.
- K. Finish

Aluminum: Clear satin anodized, 0.7 mil thickness, AA-M21C22A41. Ship the railing plastic wrapped. Remove plastic wrap after erection.

2.14 METAL STAIRS

- A. Metal stairs will be aluminum or steel as indicated on the drawings.
- B. Fabricate metal stairways, including stringers, stair treads, handrails, landing decks and fasteners, as indicated on the drawings.
- C. Shop fabricated welded or bolted installation; bolted stair treads; field cutting or burning not permitted; bolt holes drilled or punched; draw bolts tight, not protruding more than 1 thread, cut off and file smooth. All bolts and fasteners shall be stainless steel.
- D. All grating edges shall be banded.

- E. Provide metal riser plate welded to grating tread, unless indicated otherwise. Riser plate material shall match material used for fabrication of stair system.

2.15 TOE BOARDS

- A. Provide toe boards a minimum of 4" high at the following locations:
 - 1. At all overhead walking surfaces.
 - 2. Where indicated on the drawings.
- B. Toe boards shall be minimum 4" high extruded aluminum and attached to the posts with clamps or brackets which allow for lateral movement due to expansion and contraction between posts. Toe boards shall be set ¼-inch above the walking surface. Notch toe boards as required at post base plates.
- C. Where toe board sections terminate, splice toe board sections using a minimum 4" long bracket. The splice connection shall be a snap fit to allow expansion and contraction. Bolt, rivet, etc. type fasteners at the splice shall not be permitted. Provide a gap between the adjoining toe board sections at the splice of the dimension recommended by the manufacturer for the installation temperature.

2.16 FINISHES, GENERAL

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Finish metal fabrications after assembly.

2.17 STEEL AND IRON FINISHES

- A. Galvanizing: Hot-dip galvanize items as indicated to comply with applicable standard listed below:
 - 1. ASTM A123, for galvanizing steel and iron products.
 - 2. ASTM A153, for galvanizing steel and iron hardware.
- B. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with minimum requirements indicated below for SSPC surface preparation specifications and environmental exposure conditions of installed metal fabrications:
 - 1. Exteriors (SSPC Zone 1B) and Items Indicated to Receive Zinc-Rich Primer: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
 - 2. Interiors (SSPC Zone 1A): SSPC-SP 3, "Power Tool Cleaning."

- C. Shop Priming: Apply shop primer to uncoated surfaces of metal fabrications, except those with galvanized finishes and those to be embedded in concrete or masonry, unless otherwise indicated. Comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting. Stripe paint corners, crevices, bolts, welds, and sharp edges.

2.18 STAINLESS STEEL FINISHES

- A. Remove tool and die marks and stretch lines or blend into finish.
- B. Grind and polish surfaces to produce uniform, directionally textured, polished finish indicated, free of cross scratches. Run grain with long dimension of each piece.
- C. Dull Satin Finish: No. 6.
- D. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

2.19 ALUMINUM FINISHES

- A. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
- B. Class I, Clear Anodic Finish: AA-M12C22A41 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, clear coating (0.018 mm or thicker) complying with AAMA 611.
- C. Grind weld joints smooth with adjacent finish surface.
- D. Coat aluminum in contact with dissimilar metals, masonry or lime products with one-coat of bituminous paint.

2.20 COPPER-ALLOY FINISHES

- A. Finish designations for copper alloys comply with the system established for designating copper-alloy finish systems defined in NAAMM's "Metal Finishes Manual for Architectural and Metal Products."
- B. Cast Bronze or Nickel Silver Finish: M12 (Mechanical Finish: matte finish, as fabricated).
- C. Extruded Bronze or Nickel Silver Finish: M11 (Mechanical Finish: specular, as fabricated).
- D. Bronze Plate, Sheet, Strip and Bar Finish: M10 (Mechanical Finish: unspecified, as fabricated).

PART 3 - EXECUTION

3.01 INSTALLATION, GENERAL

- A. Cutting, Fitting, and Placement: Perform cutting, drilling and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.
- B. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.
- C. Field Welding: Comply with the following requirements:
 - 1. Use material and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove welding flux immediately.
 - 4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
- D. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction. Provide threaded fasteners for use with concrete and masonry inserts, toggle bolts, through bolts, lag bolts, wood screws, and other connectors.
- E. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.
- F. Corrosion Protection: Coat concealed surfaces of aluminum that will come into contact with grout, concrete, masonry, wood, or dissimilar metals with a heavy coat of bituminous paint.

3.02 INSTALLING MISCELLANEOUS FRAMING AND SUPPORTS

- A. General: Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on shop drawings.

3.03 INSTALLING BEARING AND LEVELING PLATES

- A. Clean concrete and masonry bearing surfaces of bond-reducing materials and roughen to improve bond to surfaces. Clean bottom surface of plates.
- B. Set bearing and leveling plates on wedges, shims, or leveling nuts. After bearing members have been positioned and plumbed, tighten anchor bolts. Do not remove wedges or shims but, if protruding, cut off flush with edge of bearing plate before packing with grout.
 - 1. Use non-shrink grout.
 - 2. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

3.04 INSTALLING NOSINGS, TREADS, AND THRESHOLDS

- A. Center nosings on tread widths.
- B. For nosings embedded in concrete steps or curbs, align nosings flush with riser faces and level with tread surfaces.
- C. Seal thresholds exposed to exterior with elastomeric sealant complying with Section 07900 – Sealants and Caulking to provide a watertight installation.

3.05 RAILING AND WALL BRACKETS

- A. Removable Setting: Railings shall be set in close-fitting sleeves; sleeves set in concrete; sleeves shall be 1" less in length than thickness of concrete. Weld 3" flanges to posts at floor level.
- B. Bolted Setting: Base plate shall be welded to bottom of posts and bolted to floor with expansion type fasteners.

3.06 ALUMINUM STAIRS

- A. Connections
 - 1. Provide welded connections wherever possible.
 - 2. Where bolted or riveted connections are used, draw connections tight; cut off or grind excess smooth.
 - 3. Make all connections tight.
- B. Make all joints true and tight.

- C. Install metal stair in accordance with the manufacturer's recommendations and approved shop drawings.
- D. Install components plumb and level, accurately fitted, free from distortion or defects.
- E. Securely bolt or anchor, plates, angles, hangers, and struts required for connecting stairs to structure.
- F. Provided welded field joints where specifically indicated or shop drawings. Perform field welding in accordance with the appropriate AWS Specification.
- G. Obtain written approval prior to site cutting or creating adjustments not scheduled.

3.07 CONNECTIONS

- A. Unless otherwise specified, all shop connections shall be welded or bolted; framing connections made in field shall be made with high strength stainless steel bolts; other connections may be made by any of the above methods (using stainless steel) or with standard strength stainless steel bolts.
- B. All connections shall develop strength required for members involved; in no case less than AISC standard.
- C. Provide lugs, clips, connections, rivets, bolts, necessary for complete fabrication, erection; bolts remaining in finished, exposed work shall be hexagon head bolts with hexagon nuts; bolts shall be of proper length to permit full thread in nut, but not project more than ¼-inch beyond face of nut. Rivets, both shop and field, power driven; shall provide 100 lbs. per sq. in. at hammer minimum.
- D. High Strength Stainless Steel Bolts: Furnish and install in accordance with Research Council or "Riveted and Bolted Structural Joints Using High Tensile Stainless Steel Bolts", latest edition.

3.08 ADJUSTING AND CLEANING

- A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
 - 1. Apply by brush or spray to provide a minimum 2-mil dry film thickness.
- B. Touchup Painting: Clean and touchup paint field welds, bolted connections, and abraded areas of shop paint in accordance with Section 09900.

- C. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A780.

3.09 BURNING AND WELDING

- A. Burning: Burning of holes in the field shall not be permitted without written approval by the Engineer; if approval is given, burned members shall be finished to an appearance equal to sheared finish; burning shapes to length with standard flame-cutting machine will be permitted.
- B. Perform both shop and field welding in accordance with recommendations of American Welding Society. Welds shall be solid and homogeneously a part of metals joined, free from pits or incorporated slag or scale; surfaces of welds shall be smooth and regular, of full area indicated or necessary to develop required strength of joint.

3.10 DRILLED-IN ANCHORS

- A. Drill holes with rotary impact hammer drills using carbide-tipped bits, hollow drill bit system, or core drills using diamond core bits. Drill bits shall be of diameters as specified by the anchor manufacturer. Unless otherwise shown on the Contract Drawings, all holes shall be drilled perpendicular to the concrete surface.
 - 1. Cored Holes: Where anchors are permitted to be installed in cored holes, use core bits with matched tolerances as specified by the manufacturer. Properly clean cored holes per manufacturer's instructions.
 - 2. Embedded Items: Contractor shall identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Exercise care in coring or drilling to avoid damaging existing reinforcing or embedded items. Notify the Engineer if reinforcing steel or other embedded items are encountered during drilling.
- B. Perform anchor installation in accordance with manufacturer's written instructions.
- C. Wedge Anchors: Protect threads from damage during anchor installation. Set anchors to manufacturer's recommended torque, using a torque wrench. Following attainment of 10% of the specified torque, 100% of the specified torque shall be reached within 7 or fewer complete turns of the nut. If the specified torque is not achieved within the required number of turns, the anchor shall be removed and replaced unless otherwise directed by the Engineer.
- D. Cartridge Injection Adhesive Anchors: Clean all holes per manufacturer instructions to remove loose material and drilling dust prior to installation of adhesive. Inject adhesive into holes proceeding from the bottom of the hole and progressing toward the surface in such a manner as to avoid introduction of air

pockets in the adhesive. Follow the manufacturer recommendations to ensure proper mixing of adhesive components. Sufficient adhesive shall be injected in the hole to ensure that the annular gap is filled to the surface. Remove excess adhesive from the surface. Shim anchors with suitable device to center the anchor in the hole. Do not disturb or load anchors before manufacturer specified cure time has elapsed.

- E. Capsule Anchors: Perform drilling and setting operations in accordance with manufacturer instructions. Clean all holes to remove loose material and drilling dust prior to installation of adhesive. Remove water from drilled holes in such a manner as to achieve a surface dry condition. Capsule anchors shall be installed with equipment conforming to manufacturer recommendations. Do not disturb or load anchors before manufacturer specified cure time has elapsed.
- F. Observe manufacturer recommendations with respect to installation temperatures for cartridge injection adhesive anchors and capsule anchors.

END OF SECTION

SECTION 07100

WATERPROOFING AND DAMPPROOFING

PART 1 - GENERAL

1.01 DESCRIPTION

- A. This section includes requirements for waterproofing and dampproofing of concrete surfaces that will be in contact with earth below grade.
- B. Principal items of work include: Waterproofing the exterior sides of walls below grade and Dampproofing as shown on the Drawings.

1.02 SUBMITTALS

- A. Manufacturer's descriptive product data and certification of compliance with referenced specifications.
- B. Manufacturer's detailed description for handling, recommendation on intended use and installation recommendations.
- C. Samples of waterproofing, dampproofing, and composite drainage panel.
- D. Complete layout and installation drawings and schedules with clearly indicated dimensions.
- E. Detailed drawings showing all anchoring details and construction details at corners, penetrations, flashing, overlaps and terminations.

1.03 STORAGE

- A. Waterproofing and dampproofing materials shall be stored in a dry protected place, up off the ground surface, complying in all respects with product manufacturers recommendations.

1.04 JOB CONDITIONS

- A. Unless otherwise recommended by the manufacturer, do not apply waterproofing or dampproofing when temperature is below 40 degrees F or when there is ice, frost or dampness visible on surfaces to be waterproofed or dampproofed.
- B. Primers and mastics are solvent-based liquids. Prior to the use of any product, consult the manufacturer's product label for handling, use and storage instructions.
- C. Adhere strictly to all manufacturer's cautions, warnings and product safety and handling instructions.

1.05 QUALITY ASSURANCE

- A. Use adequate numbers of skilled workers who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.
- B. Waterproofing membrane shall be compatible with waterproofing material and installed by methods approved by the membrane manufacturer.

PART 2 - MATERIALS

2.01 WATERPROOFING

A. ACCEPTABLE MANUFACTURERS

Subject to compliance with the Specifications provide products manufactured by one of the following:

1. W. R. Meadows, Inc.
2. Grace Construction Products
3. Polyguard Products
4. BASF
5. Soprema, Colphene® 3000
6. Or Approved Equal

B. WATERPROOFING MEMBRANE

Waterproofing membrane shall be applied to all concrete surfaces exposed to earth as shown on the Contract Drawings.

Self-adhering membrane consisting of a minimum 56 mils of rubberized asphalt laminated to a minimum 4 mils of polyethylene for a minimum of 60 mil membrane. Provide a cold-applied membrane which requires no special adhesives or heating equipment.

The adhesive side of the membrane shall be protected with a special release paper that can be easily removed for installation. The membrane shall conform to the following requirements:

	<u>Test Property</u>	<u>Test Method</u>	<u>Specification Limit</u>
1.	Tensile Strength Membrane	ASTM D412	250 psi. min.
2.	Grab Tensile Strength:	ASTM D5034	70
3.	Pliability, 180-degree bend:	ASTM D146	Unaffected
4.	Elongation	ASTM D412	300% min.
5.	Resistance to Puncture:	ASTM E154	40
6.	Permeance, Permeability:	ASTM E96-B	0.1
7.	Water Absorption	ASTM D570	0.2 max. (% by weight)
8.	Weight, oz/SY, Min.:	ASTM D3776	40
9.	Adhesion to Concrete	ASTM D903	5.0 lbs/in. width max.
10.	Primer: As recommended by manufacturer.		
11.	Mastic: As recommended by manufacturer. Use mastic to seal cut edge terminations.		

2.02 COMPOSITE DRAINAGE PANEL

- A. Composite drainage panel: Three dimensional, high impact, polystyrene core with a nonwoven filter fabric bonded to the core. Provide a polymeric sheet adhered to the flat side of the polystyrene core. Extend filter fabric beyond the edges to provide total filtering integrity of the drainage system.
- B. Physical properties:

<u>Test Property</u>	<u>Test Method</u>	<u>Specified Limit</u>
Compressive Strength (Core)	ASTM D1621	15,000 psf
Apparent Opening Size (Filter Fabric)	ASTM D4751	100 US Sieve
Water Flow Rate (Filter Fabric)	ASTM D4491	150 gpm/ft
Water Flow Rate (Composite System)	ASTM D4716	15 gpm/ft.

- C. Composite System Requirements:
 - 1. Provide one inch flange on longitudinal edge.
 - 2. Bond filter fabric to each dimple of polymeric core.
 - 3. Extend filter fabric beyond tow edge of polymeric core to provide total filtering integrity of the drainage system.
 - 4. System shall be approved for use over waterproofing membrane.

2.03 DAMPPROOFING

- A. Dampproofing material shall be solvent type asbestos-free asphalt compound that meets the U.S. EPA Architectural Coatings Rule requirements for VOC.
- B. Dampproofing shall be SEALMASTIC by W.R. Meadows, Inc.; Karnak #220AF by The Karnak Corporation; or Approved Equal.

2.04 OTHER MATERIALS

- A. Provide other materials, not specifically described but required for a complete and proper installation, as selected by the Contractor subject to the approval of the Engineer.

PART 3 - EXECUTION

3.01 PREPARATION

- A. Examine the areas and conditions under which work of this Section will be performed. Correct conditions detrimental to timely and proper completion of the work. Do not proceed until unsatisfactory conditions are corrected.
- B. Membrane waterproofing shall not be applied until curing has been completed and surfaces are protected against cold. All surfaces shall be dry, smooth and free from projections and holes.
- C. Dampproofing shall not be applied until curing has been completed and surfaces are protected against cold. All surfaces shall be dry, clean, smooth and free from projections and holes.

3.02 APPLICATION

- A. Materials shall be applied at a temperature above 40 degrees F., unless specifically listed for application below 40 degrees F. Do not apply materials when there is ice, frost, or dampness visible on the surface to be waterproofed or dampproofed.

- B. Install material in strict accordance with manufacturer's recommendations and using appropriate and approved equipment. Care shall be taken to prevent coating of parts of the structure that will be exposed to view in the completed structure. Allow each coat of dampproofing to cure 24 hours before applying subsequent coats unless otherwise recommended by the manufacturer. Dampproofing shall not be permitted when the temperature is less than 40 degrees F. Where membrane waterproofing and dampproofing are both indicated for applications, the membrane waterproofing shall be applied first.
- C. Protect waterproofing membrane during construction period to prevent damage, soiling or deterioration other than normal wear and weathering up to the time of conditional acceptance by the Owner. No backfilling shall be performed against the installed waterproofing and dampproofing until it is approved by the Owner. Damage to the membrane shall be repaired by the Contractor at no cost to the Owner. Repairs shall extend beyond the outermost damaged portion, and the second ply shall extend at least 3-inches beyond the first ply.
- D. Apply dampproofing at the manufacturer's recommended application rate. If no application rate is provided, apply at a rate of 6 gallons per 100 sf. Prepare and prime all surfaces per the manufacturer's recommendations.

END OF SECTION

SECTION 07192

UNDER-SLAB VAPOR RETARDER

PART 1 - GENERAL

1.01 DESCRIPTION

- A. Includes the installation of an under-slab vapor retarder designed to retard moisture migration through cast-in-place concrete slabs-on-grade.

1.02 SUBMITTALS

- A. Submit manufacturer's catalog data of materials and application instructions for review.

1.03 GUARANTEE

- A. Contractor to provide a written guarantee as follows:

"Vapor retarder is guaranteed against leaks, defects of workmanship and materials for a period of two years from date of Substantial Completion, and should any leaks occur within this period, repairs to retarder and damage to other portions of the building caused by such leaks will be repaired without cost to the Owner."

PART 2 - MATERIALS

2.01 SHEET VAPOR RETARDERS

- A. ASTM E1745, Class A, with a maximum perm rating of 0.02 perms, minimum 45 lb/in tensile strength, 2200 grams puncture resistance. Include manufacturer's recommended adhesive or pressure-sensitive tape for all joints, pipe penetrations, and sealing of vapor retarder. Use only materials, which are resistant to decay when tested in accordance with ASTM E154, as follows: Polyethylene sheet not less than 10 mils thick.

2.02 ACCEPTABLE MANUFACTURERS

- A. Moistop Ultra 10 by The Henry Company,
- B. Perminator 10 mil by W.R. Meadows, Inc.,
- C. VaporBlock VB10 by Raven Industries, Inc.,
- D. or approved equal.

PART 3 - EXECUTION

3.01 PREPARATION

- A. Base must be leveled and tamped.

3.02 INSTALLATION

- A. Place plastic laminated sheet with 12-inch laps. Place top lap in direction of spreading of concrete.
- B. Seal laps and seal to walls and pipes with recommended sealant.
- C. Turn up on walls a minimum of 4 inches. Stretch and weight edges and laps to maintain their position until concrete is placed.
- D. Repair all holes in vapor retarder in accordance with manufacturer's recommendations prior to placing concrete.
- E. Provide wood runways for wheeled equipment for transporting concrete. Do not displace vapor retarder during concrete placement.

END OF SECTION

SECTION 07900
SEALANTS AND CAULKING

PART 1 - GENERAL

1.01 DESCRIPTION

- A. This Section includes requirements for providing sealant, caulking, and related accessories to weather seal and fill joints.

1.02 SUBMITTALS

- A. Submit the following information in accordance with the General Conditions:
 - 1. Manufacturer's descriptive product data and certification of compliance with referenced specification.
 - 2. Manufacturer's detailed description for handling, recommendation on intended use and installation recommendations.
- B. Submit samples in accordance with the General Conditions for the following:
 - 1. One cartridge of each type of sealant and caulking compound.
 - 2. One pint of each primer.
 - 3. One linear foot of backup material.
 - 4. One linear foot of compression seal.
 - 5. One cartridge of expansion joint material.
- C. Submit full range of manufacturer's colors of each sealant and caulking compound to be used for selection by the Owner.

1.03 DELIVERY, STORAGE AND HANDLING

- A. Deliver materials in manufacturer's original unopened containers with labels intact along with referenced specification number, type and class as applicable.
- B. Handle and store product in accordance with manufacturer's recommendations.
- C. Maintain sealant and caulking at a temperature of at least 70 degrees F. for a period of not less than 24 hours prior to installation.

1.04 JOB CONDITIONS

A. Environmental Requirements

Unless otherwise recommended by the manufacturer, do not apply sealant and caulking when temperature is below 40 degrees F. and when there is ice, frost or dampness visible on surfaces to be sealed.

B. Safety Requirements

Avoid contact with skin. Wear protective clothing, goggles, gloves and/or barrier creams. Avoid breathing vapors in confined areas.

PART 2 - MATERIALS

Sealant, caulking, primers and accessories shall be the non-staining type and of a color specified or selected by the Owner from the Manufacturer's standard color chart.

2.01 CAULKING

- A. Caulking shall be a one-component gun grade butyl-rubber system, such as Butyl-Flex as manufactured by DAP, Inc., Dayton, Ohio or approved equal. Coordinate colors with adjacent work.

2.02 SEALANTS

- A. Sealant shall be a two-component base system conforming to ASTM C920, Type M, Grade NS, P or SL, Class 25, Uses NT, I, M, G, A and O. Sealant shall be Thiokol 2235M/2235SL Polysulfide Joint Sealant as manufactured by ITW PolySpec or approved equal.

2.03 PRIMERS AND ACCESSORIES

- A. Primers, where applicable, shall be in accordance with caulking/sealant manufacturer's recommendations.
- B. Provide backup materials, fillers and joint packing compatible with caulking/sealant and primer.
 - 1. Use back-up material to control caulking/sealant depth as recommended by the caulking/sealant manufacturer.
 - 2. Unless otherwise specified use closed-cell tube or rope shaped stock expanded polyethylene or polyurethane foam.
 - 3. The width or diameter of backup material shall be 1-1/3 to 1-1/2 times the width of the joint.

4. Use semi-rigid vinyl or polyethylene foam, solid neoprene rod or similar approved backing for joints subject to horizontal traffic or puncture.
5. Do not use bituminous or oily product as a backup material.

PART 3 - EXECUTION

3.01 PREPARATION

- A. Inspect joint surfaces before starting work. Verify surfaces are dry and meet caulking/sealant manufacturer's requirements.
- B. Clean joint surfaces immediately before installation of gaskets and caulking/sealant. Remove dirt, moisture, frost, coatings and other foreign substances that will interfere with performance of compression seal and caulking/sealant.
- C. Etch concrete and masonry joint surfaces as recommended by caulking/sealant manufacturer.
- D. Prime or seal joints surfaces as recommended by the caulking/sealant manufacturer and as shown.
- E. Confine primer or sealer to areas of the compression seal and caulking/sealant bond area.

3.02 APPLICATION

- A. General
 1. Install material in accordance with manufacturer's recommendations for materials intended use and instructions using appropriate and approved equipment, except where more stringent requirements are shown or specified.
 2. Prevent caulking, sealant and compounds from spilling onto adjoining surfaces or to migrate into voids of exposed finishes by using masking tape or other methods. Clean spill on adjoining surfaces immediately.
- B. Sealant and Accessories
 1. Sealant shall be used on slab and wall control and expansion joints, pipe sleeves through walls and roofs, and on joints and cracks.
 2. Install backup material to control caulking depth in accordance with sealant manufacturer's instructions.

3. Place sealant in a manner that will fill the joint without air pockets and form a smooth surface. For exposed surfaces of gun and knife grade sealant that cannot be made smooth during initial application, smooth with tool moistened with either water or sealant solvent.
4. Prepare sealant mixtures in quantities that can be applied within the time period recommended by the manufacturer. Materials mixed and not used within this time period shall be discarded.
5. Finish joint to a smooth concave surface slightly lower than adjoining surfaces except horizontal surfaces shall have joints finished so moisture and debris will not be entrapped. Finished surface shall be free of wrinkles and sags.

3.03 CAULKING

- A. Caulking compound shall be used for caulking of interior and exterior doors, windows, louvers, frames, and elsewhere as necessary and shall be applied in accordance with the manufacturer's recommendations.

3.04 CURING AND PROTECTION

- A. Cure joint sealers and accessories in accordance with manufacturer's instructions.
- B. Protect joint sealers during construction period to prevent damage, soiling or deterioration other than normal wear and weathering up to time of final acceptance. Replace or restore joint sealers damaged, soiled or deteriorated, as directed.

3.05 CLEANUP

- A. Clean adjacent surfaces of sealant and soiling resulting from the joint sealer operations. Use cleaning materials and methods recommended by manufacturer for the different surfaces.

END OF SECTION

SECTION 08220

FIBERGLASS REINFORCED PLASTIC (FRP) DOORS

PART 1 - GENERAL

1.01 SUMMARY

- A. Work performed under this section includes, but is not limited to, furnishing all labor, tools, materials and services necessary to furnish and install fiberglass reinforced plastic (FRP) doors as shown on the drawings and specified herein.
- B. The doors shall be furnished complete with fiberglass resin transfer molded door frames, transoms and removable mullions, as shown.

1.02 SUBMITTALS

- A. Shop Drawings: Submit detailed fabrication and installation drawings prior to fabrication. Include door type, frame type, size, handing, accessories and hardware. Include front and rear door elevations showing hardware, bill of materials and dimensional locations of each hardware item and FRP part or product. Provide construction and mounting detail for each frame, transom and mullion type.
- B. Product Data: Submit manufacturer's product data for all materials in this specification. Include a statement acknowledging that the products submitted meet the requirements of specifications and referenced standards. Include certificates of compliance, manufacturer's installation instructions, details of core and edge construction, and certification of manufacturer's qualifications.

1.03 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Fabrication shall be by a firm experienced in the manufacturing of FRP doors similar to those indicated for this project and with a record of 25-years of documented experience and successful in-service performance.
- B. Source Limitations: FRP doors and frames shall be obtained from one source and fabricated by a single manufacturer.

1.04 DELIVERY, STORAGE AND HANDLING

- A. Doors and frames shall be crated for protection from damage in the manufacturer's original containers, and clearly marked with the project information. Each crate shall contain all fasteners necessary for installation as well as complete installation instructions.
- B. Doors shall be stored on edge in the original container out of inclement weather.

1.05 WARRANTY

- A. Warranty FRP doors and frames for a period of 25-years against corrosion. Additionally, warranty FRP doors and frames against defects in materials and workmanship for a period of 10-years, including warp, separation or delamination, and expansion of the core.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Subject to compliance with requirements, manufacturers that may be used include:
 - 1. Chem-Pruf Door Co., Ltd., Brownsville, Texas,
 - 2. Warminster Fiberglass Company, Southampton, Pennsylvania,
 - 3. or approved equal.

2.02 FRP DOORS

- A. Door Slabs: Fiberglass reinforced plastic (FRP) construction using resins tailored to a high humidity, corrosive environment and shall have a fiberglass content of 25-percent by weight. The doors shall be flush construction, having no seams or cracks. All mortises shall be molded in at the factory. The doors shall be 1¾ inches thick with a 25-mil color gelcoat and have an R-factor of 12. Secondary painting over pultrusions to achieve color is not acceptable. Adequate reinforcing and compression members shall be used to accommodate hinges, closers, locksets, kickplates, etc.
- B. Door Plates: ½-inch thick, molded in one continuous piece, starting with a 25-mil gelcoat of the color specified, integrally molded with at least two layers of 1.5-ounce per square foot fiberglass mat and one layer of 16-ounce per square yard unidirectional roving to yield a plate weight of 0.97 lbs per square foot at a ratio of 30/70 glass to resin.
- C. Internal Stiles and Rails: The stile and rail shall be molded in one continuous piece to a U-shaped configuration and to the exact dimensions of the door, with no miter joints or disparate materials used. Hollow pultruded shapes shall not be used.
- D. Core: 2 psf expanded polyurethane foam, which completely fills all voids between door plates.
- E. Internal Reinforcement: shall be firestop of sufficient amount to adequately support required hardware and function of same.

- F. Finish: Door and frame shall be gray in color and have identical texture. At time of manufacture, 25-mil of resin-rich gelcoat shall be integrally molded into both door and frame. Secondary painting to achieve color is not acceptable.

2.03 FRP DOOR ACCESSORIES

- A. Transoms: Transoms shall be identical to the door slab in construction, materials, thickness and reinforcement, and shall be hinged similar to door. Transom shall include bolts on the interior side to lock each transom panel in the closed position.
- B. Transom and Mullion Hardware: Removable mullion shall be connected to the door frame using stainless steel angle beam clips bolted to the interior side of the frame leg and mullion header on each end, such that the mullion will remain completely level. The angles and bolts shall be designed such that the mullion can be removed and reinstalled easily an unlimited number of times without having to make any modifications or repairs to reinstall, and such that the mullion will be completely level in its original location after each re-installation. Each transom shall be held in place with a minimum of four (4) heavy-duty 304 stainless steel surface bolts mounted on the interior side. Each transom shall be provided with two (2) 304 stainless steel pull handles mounted on the interior side for ease of handling transom during installation and removal. Pull plates shall be 4" x 16", 0.050 inches thick, 8 inches long, with a 2-inch clearance.
- C. Cutout: Standard cutout for door and/or transom penetrations shall be bound with a neoprene keeper made from FRP astragal. Neoprene shall be cut in the field to fit exactly around the I-beam with a maximum clearance of 1/8-inch.
- D. Threshold: Fiberglass grooved saddle 1/2-inch threshold, 5-inches wide, color molded in to match doors with stainless steel fasteners, Chem-Pruf FRP Threshold, or approved equal.
- E. Weatherstrip: Self-adhesive, high-grade silicone V-strip door gasket/weatherstrip, Pemko, or approved equal.
- F. Astragals: Molded fiberglass 2 1/2-inch wide astragal with seal, color molded in to match doors and stainless steel screws, Chem-Pruf FRP Astragal, or approved equal.
- G. Door Sweep: Molded fiberglass with neoprene wiper, color molded in to match doors and stainless steel screws, Chem-Pruf FRP Door Sweep w/Neoprene, or approved equal.

2.04 FRAMES

- A. Frames: Fiberglass and manufactured using resin transfer method in closed rigid molds to assure uniformity in color and size. Beginning with a minimum 25-mil gelcoat and a minimum of two layers continuous strand fiberglass mat saturated with resin, the frame shall be solid, flat back, of one-piece construction with molded

stop. All frame profiles up to ¾-inch shall be solid fiberglass. All frame profiles greater than ¾-inch shall have a core material of 2 psf polyurethane foam. Metal frames or pultruded fiberglass frames are not acceptable.

- B. Finish: Door and frame shall be identical in color and texture. At time of manufacture, 25-mil of resin-rich gelcoat shall be integrally molded into both door and frame. Secondary painting to achieve color is not acceptable.
- C. Jamb/Header: Connection shall be CNC machined for a tight mitered fit.
- D. Internal Reinforcement: Continuous within the structure to allow for mounting of specified hardware. Material shall be completely non-organic with a minimum hinge screw holding value of 656 lbs. Frame screw holding value to accommodate screw shall be a minimum of 1,000 lbs. per screw.
- E. Mortises: For hardware shall be accurately machined by CNC or molded standard duty to facilitate heavy duty hinges at all hinge locations, using spacers when standard weight hinges are used.

2.05 HARDWARE

- A. General: All hardware shall be stainless steel unless otherwise noted and furnished and installed by the door and frame manufacturer.
- B. Locks:
 - 1. Entrance: Locksets shall be mortise type, suitable for receiving standard Town of Emmitsburg cylinders, and shall be keyed for the Town of Emmitsburg's standard key. Mortise lockset shall be Corbin Russwin ML 2051 LWA, US32D, or approved equal.
 - a. Contractor shall coordinate locks and keying with the Owner.
 - b. Provide one (1) key.
 - 2. Privacy: Locksets shall be suitable for bathroom applications and shall contain deadbolt by thumb turn lever inside or by emergency release tool outside. Lockset shall be Corbin Russwin ML 2030 LWA, US32D, or approved equal.
 - 3. Panic Devices:
 - a. Panic devices for single doors with a maximum opening less than 4 feet by 7 feet shall be a panic mortise exit device suitable for receiving standard Town of Emmitsburg cylinders and shall be keyed for the Town of Emmitsburg's standard key. Panic mortise exit device and mortise lockset shall be Corbin Russwin ED5600 L9M55, US32D, or approved equal.

- b. Panic devices for double doors with a maximum active door opening of 4 feet by 10 feet shall be a surface mount vertical rod panic device suitable for receiving standard Town of Emmitsburg cylinders and shall be keyed for the Town of Emmitsburg's standard key. Surface mount vertical rod panic device and lockset shall be Corbin Russwin ED5470 L955, US32D, or approved equal.
 - c. Contractor shall coordinate locks and keying with the Owner.
 - d. Provide one (1) key.
- C. Hinges: Full mortise, standard weight, ball bearing hinges with non-removable stainless steel pins.
- D. Closer: Corrosion resistant aluminum, size as recommended by the door manufacturer, with sweep speed, latch speed, backcheck cushioning, backcheck positioning, and a thumb turn hold open feature, Norton Series 7500CLP-T, or approved equal. For double doors, closers shall be furnished and installed on both active and passive doors.
- E. Bolts:
 - 1. Zinc-plated steel surface bolt and strike equipped with a strong hard-drawn wire spring, which throws the bolt automatically when chain is released, Stanley 1055 Chain Bolt, or approved equal, with extra chain as indicated.
 - 2. 304 stainless steel barrel bolt and stop, Chem-Pruf BBS 1, or approved equal.
- F. Kickplate: 304 stainless steel, Trimco Model 1034, or approved equal.
- G. Door Stops: Where possible, provide wall-mounted type bumpers. Where wall bumper is not practical, provide floor mounted dome stop.
- H. Push/Pulls: 304 stainless steel, Trimco Models 1001 and 1017, or approved equal.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install door-opening assemblies in accordance with shop drawings and manufacturer's written installation instructions, using installation methods and materials specified in installation instructions.
- B. Field alteration of doors or frames to accommodate field conditions is prohibited.

- C. Maintain plumb and level tolerances specified in manufacturer's printed installation instructions.

3.02 ADJUSTING

- A. Adjust doors in accordance with door manufacturer's maintenance instructions to swing open and shut without binding and to remain in place at any angle without being moved by gravitational influence.
- B. Adjust door hardware to operate correctly in accordance with hardware manufacturer's maintenance instructions.

3.03 FRAME SCHEDULES

- A. F-1 Frame is ¾-inch solid fiberglass.
- B. F-2 Frame is ¾-inch solid fiberglass with a 2⅝-inch return on one side, which trims the opening to conceal unsightly or rough wall surfaces.
- C. F-3 Frame is a 2-inch profile equal rabbet frame to SDI standard dimensions.
- D. F-4 Frame is a 2-inch profile single rabbet frame with a maximum width of 9 inches.

3.04 CLEANING

- A. Clean surfaces of door opening assemblies and exposed door hardware in accordance with respective manufacturer's maintenance instructions.

END OF SECTION

SECTION 08310
ACCESS HATCHES

PART 1 - GENERAL

1.01 SUMMARY

- A. Contractor shall provide all materials, labor, equipment, and services necessary to furnish and install factory-fabricated access hatches as shown on the Contract Drawings and specified herein.
- B. Access hatches installed within existing floors shall be furnished with a retrofit angle frame. The retrofit frame shall have side mounting holes to allow the frame to be fastened from within the access opening.
- C. Access hatches shall be constructed of aluminum, and shall be non-corrosive, durable and structurally sound.
- D. Not all types of access hatches specified herein are necessarily required for this project. Refer to the Access Hatch Schedule on the Contract Drawings for the specific types of hatches and quantity of each to be provided.

1.02 SUBMITTALS

- A. Shop Drawings: Submit detailed fabrication and installation drawings prior to fabrication. Show profiles, accessories, locations, and dimensions.
- B. Product Data: Submit manufacturer's product data for all materials in this specification.
- C. Warranty: Submit manufacturer's written warranty.

1.03 QUALITY ASSURANCE

- A. Fabricator Qualifications: Fabrication shall be by a firm experienced in the manufacturing of access hatches similar to the hatches indicated for this project and with a record of successful in-service performance.
- B. Design Standards: Comply with ASTM A36-93a, "Standard Specification for Structural Steel".

1.04 DELIVERY, STORAGE AND HANDLING

- A. All materials shall be delivered to the job site in manufacturer's original packaging.

- B. Store materials in a dry, protected, well-vented area. The Contractor shall thoroughly inspect product upon receipt and report damaged material immediately to delivering carrier and note such damage on the carrier's freight bill of lading.
- C. Remove protective wrapping immediately after installation.

1.05 JOB CONDITIONS

- A. Mounting surfaces shall be straight and secure; substrates shall be of proper width.
- B. Refer to the contract documents, shop drawings, and manufacturer's installation instructions.
- C. Observe all applicable OSHA safety guidelines for this work.

1.06 WARRANTY

- A. Access hatches shall be free of defects in material and workmanship for a period of ten (10) years. Should a part or material fail to function in normal use within this period, manufacturer shall furnish a new part at no charge.

PART 2 - PRODUCTS

2.01 GENERAL PURPOSE ACCESS HATCH

- A. The access hatch shall be pre-assembled from the manufacturer, suitable for installation within new concrete, and installed with the access hatch size and hinge locations as shown on the contract drawings. The access hatch shall be Model APS for single leaf hatches or Model APD for double leaf hatches, as manufactured by U.S.F. Fabrication, Inc., or approved equal.
- B. Hatch Panel: The cover of the hatch panel shall be ¼-inch thick aluminum diamond plate, reinforced to withstand 300 p.s.f. live load. The hatch panel shall open to 90 degrees, be equipped with a flush lifting handle that does not protrude above the cover, and a 316 stainless steel hold open arm with a vinyl grip that automatically keeps the panel in its upright open position. The door shall be equipped with a watertight 316 stainless steel slamlock with threaded plug, removable outside key, and fixed inside handle. The slamlock shall latch onto a 316 stainless steel striker plate that is bolted to the frame. When shown, 18-inch square aluminum swaged grating shall be centered in the hatch panel to promote ventilation. Grating shall be comprised of aluminum 1" by 3/16" bearing bars spaced at 1 3/16" center to center, cross bars spaced 4" center to center, and 1" by 3/16" banding bars.
- C. Frame: The frame shall be extruded aluminum angle frame with an integral anchor flange and door seat on all four sides. A bituminous coating shall be applied to the frame exterior where it will come in contact with concrete. The frame shall be fitted with a vinyl cushion for noise dampening, and an aluminum frame skirt for ease of

installation. The combined depth of the skirt and frame shall equal the thickness of the concrete slab.

- D. Hinges: The door shall have 316 stainless steel hinges with 316 stainless steel tamper resistant bolts/locknuts.
- E. Lifting Mechanisms: Manufacturer shall provide the required number and size of enclosed spring operators to provide smooth, easy, and controlled cover operation throughout the entire arc of opening and to act as a check in retarding downward motion of the cover when closing. Spring and spring enclosures shall be stainless steel. Operation of cover shall not be affected by temperature.
- F. Locking: The access hatch shall be equipped with a recessed staple to accept an Owner supplied padlock.
- G. Hardware: All hardware shall be Type 316 stainless steel throughout, unless otherwise noted.

2.02 GENERAL PURPOSE ACCESS HATCH (RETROFIT)

- A. The access hatch shall be pre-assembled from the manufacturer, suitable for installation within existing concrete openings, and installed with the access hatch size and hinge locations as shown on the contract drawings. The access hatch shall be Model APS RETROFIT for single leaf hatches or Model APD RETROFIT for double leaf hatches, as manufactured by U.S.F. Fabrication, Inc., or approved equal.
- B. Hatch Panel: The cover of the hatch panel shall be ¼-inch thick aluminum diamond plate, reinforced to withstand 300 p.s.f. live load. The hatch panel shall open to 90 degrees, be equipped with a flush lifting handle that does not protrude above the cover, and a 316 stainless steel hold open arm with a vinyl grip that automatically keeps the panel in its upright open position. The door shall be equipped with a watertight 316 stainless steel slamlock with threaded plug, removable outside key, and fixed inside handle. The slamlock shall latch onto a 316 stainless steel striker plate that is bolted to the frame. When shown, 18-inch square aluminum swaged grating shall be centered in the hatch panel to promote ventilation. Grating shall be comprised of aluminum 1" by 3/16" bearing bars spaced at 1 3/16" center to center, cross bars spaced 4" center to center, and 1" by 3/16" banding bars.
- C. Frame: The extruded aluminum angle frame shall have 9/16-inch diameter mounting holes on the vertical leg of the frame for bolting to the existing floor, and a horizontal flange with an integral door seat on all four sides. The horizontal leg of the frame will have a beveled edge that slopes to the floor surface. A bituminous coating shall be applied to the frame exterior where it will come in contact with concrete. The frame shall be fitted with a vinyl cushion for noise dampening.
- D. Hinges: The door shall have 316 stainless steel hinges with 316 stainless steel tamper resistant bolts/locknuts.

- E. Lifting Mechanisms: Manufacturer shall provide the required number and size of enclosed spring operators to provide smooth, easy, and controlled cover operation throughout the entire arc of opening and to act as a check in retarding downward motion of the cover when closing. Spring and spring enclosures shall be stainless steel. Operation of cover shall not be affected by temperature.
- F. Locking: The access hatch shall be equipped with a recessed staple to accept an Owner supplied padlock.
- G. Hardware: All hardware shall be Type 316 stainless steel throughout, unless otherwise noted.

2.03 WATERTIGHT ACCESS HATCH

- A. The access hatch shall be pre-assembled from the manufacturer, suitable for installation within new concrete, and installed with the access hatch size and hinge locations as shown on the contract drawings. The access hatch shall be a single leaf hatch, Model W-APS as manufactured by U.S.F. Fabrication, Inc., or approved equal.
- B. Hatch Panel: The cover of the hatch panel shall be ¼-inch thick aluminum diamond plate, reinforced to withstand 1,560 p.s.f. live load (capable of holding up to 25 feet head of water). The bottom of the cover shall have a continuous groove to securely hold a 9/16-inch diameter EPDM gasket around its perimeter. The cover shall have 316 stainless steel floodtight cam locks to compress the gasket so that the door will not leak from standing water. The hatch panel shall open to 90 degrees, be equipped with a flush floodtight handle that does not protrude above the cover, and a 316 stainless steel hold open arm with a vinyl grip that automatically keeps the panel in its upright open position.
- C. Frame: The frame shall be 3/8-inch thick angle frame with 3/16" x 1½" strap anchors welded around the frame for casting into concrete. A bituminous coating shall be applied to the frame exterior where it will come in contact with concrete. An aluminum frame skirt shall be provided for ease of installation. The combined depth of the skirt and frame shall equal the thickness of the concrete slab.
- D. Hinges: The door shall have 316 stainless steel hinges with 316 stainless steel tamper resistant bolts/locknuts.
- E. Lifting Mechanisms: Manufacturer shall provide the required number and size of enclosed spring operators to provide smooth, easy, and controlled cover operation throughout the entire arc of opening and to act as a check in retarding downward motion of the cover when closing. Spring and spring enclosures shall be stainless steel. Operation of cover shall not be affected by temperature.
- F. Locking: The access hatch shall be equipped with a staple to accept an Owner supplied padlock. The Manufacturer's watertight hatch cam lock wrench shall also be provided.

- G. Hardware: All hardware shall be Type 316 stainless steel throughout, unless otherwise noted.

2.04 WATERTIGHT ACCESS HATCH (RETROFIT)

- A. The access hatch shall be the same watertight access hatch as mentioned above, with modifications to the frame to be suitable for installation into existing concrete openings.
- B. Frame: The standard extruded aluminum angle anchor straps shall be removed from the frame by the manufacturer. The frame shall be provided to have $\frac{9}{16}$ -inch diameter mounting holes on the vertical leg of the frame for bolting to the existing floor, and a horizontal flange with an integral door seat on all four sides. A bituminous coating shall be applied to the frame exterior where it will come in contact with concrete. A continuous EPDM gasket shall be mechanically attached to the aluminum frame to create a floodtight barrier around the entire perimeter of the cover to maintain the floodtight rating of the access hatch.

2.05 H20 ACCESS HATCH

- A. The access hatch shall be pre-assembled from the manufacturer, suitable for installation within new concrete, and installed with the access hatch size and hinge locations as shown on the contract drawings. The access hatch shall be Model AHS for single leaf hatches or Model AHD for double leaf hatches, as manufactured by U.S.F. Fabrication, Inc., or approved equal.
- B. Hatch Panel: The cover of the hatch panel shall be $\frac{1}{4}$ -inch thick aluminum diamond plate, reinforced to withstand AASHTO H20-44 wheel load. The hatch panel shall open to 90 degrees, be equipped with a flush lifting handle that does not protrude above the cover, and a 316 stainless steel hold open arm with a vinyl grip that automatically keeps the panel in its upright open position. The door shall be equipped with a watertight 316 stainless steel slamlock with threaded plug, removable outside key, and fixed inside handle. The slamlock shall latch onto a 316 stainless steel striker plate that is bolted to the frame.
- C. Frame: The frame shall be extruded aluminum angle frame with an integral anchor flange and door seat on all four sides. A bituminous coating shall be applied to the frame exterior where it will come in contact with concrete. An aluminum frame skirt shall be provided for ease of installation. The combined depth of the skirt and frame shall equal the thickness of the concrete slab.
- D. Hinges: The door shall have 316 stainless steel hinges with 316 stainless steel tamper resistant bolts/locknuts.
- E. Lifting Mechanisms: Manufacturer shall provide the required number and size of enclosed spring operators to provide smooth, easy, and controlled cover operation throughout the entire arc of opening and to act as a check in retarding downward

motion of the cover when closing. Spring and spring enclosures shall be stainless steel. Operation of cover shall not be affected by temperature.

- F. Locking: The access hatch shall be equipped with a recessed staple to accept an Owner supplied padlock.
- G. Hardware: All hardware shall be Type 316 stainless steel throughout, unless otherwise noted.

2.06 H20 WATERTIGHT ACCESS HATCH

- A. The access hatch shall be pre-assembled from the manufacturer, suitable for installation within new concrete, and installed with the access hatch size and hinge locations as shown on the contract drawings. The access hatch shall be a single leaf hatch, Model W-AHS as manufactured by U.S.F. Fabrication, Inc., or approved equal.
- B. Hatch Panel: The cover of the hatch panel shall be ¼-inch thick aluminum diamond plate, reinforced to withstand an AASHTO H20-44 wheel load (capable of holding up to 25 feet head of water). The bottom of the cover shall have a continuous groove to securely hold a 9/16-inch diameter EPDM gasket around its perimeter. The cover shall have 316 stainless steel floodtight cam locks to compress the gasket so that the door will not leak from standing water. The hatch panel shall open to 90 degrees, be equipped with a flush floodtight handle that does not protrude above the cover, and a 316 stainless steel hold open arm with a vinyl grip that automatically keeps the panel in its upright open position.
- C. Frame: The frame shall be 3/8-inch thick angle frame with 3/16" x 1½" strap anchors welded around the frame for casting into concrete. A bituminous coating shall be applied to the frame exterior where it will come in contact with concrete. An aluminum frame skirt shall be provided for ease of installation. The combined depth of the skirt and frame shall equal the thickness of the concrete slab.
- D. Hinges: The door shall have 316 stainless steel hinges with 316 stainless steel flat head bolts.
- E. Lifting Mechanisms: Manufacturer shall provide the required number and size of enclosed spring operators to provide smooth, easy, and controlled cover operation throughout the entire arc of opening and to act as a check in retarding downward motion of the cover when closing. Spring and spring enclosures shall be stainless steel. Operation of cover shall not be affected by temperature.
- F. Locking: The access hatch shall be equipped with a cylinder lock and watertight screw lid. Four (4) keys, keyed to lock/unlock the hatch, shall be provided for each hatch. The Manufacturer's watertight hatch cam lock wrench shall also be provided.
- G. Hardware: All hardware shall be Type 316 stainless steel throughout, unless otherwise noted.

PART 3 - EXECUTION

3.01 INSPECTION

- A. Verify that the substrate is suitable, dry, clean and free of foreign matter. Correct any defects prior to installation.

3.02 INSTALLATION

- A. The Contractor shall field verify dimensions and project conditions and verify the manufacturer's access hatch details for accuracy to fit the application prior to fabrication. The Contractor shall comply with the access hatch manufacturer's installation instructions.
- B. The Contractor shall furnish mechanical fasteners, as necessary, in accordance with the access hatch manufacturer's instructions.
- C. Access hatches shall be installed so that the hinges are as shown on the contract drawings.
- D. Access hatches shall be installed flush with the finished floor.

END OF SECTION

SECTION 09900

PAINTING

PART 1 - GENERAL

1.01 DESCRIPTION

- A. Related Work Specified Elsewhere:
 - 1. Sealants and Caulking: Section 07900.
 - 2. Pre-finishing or shop priming requirements as specified in various other Sections of these Specifications.

1.02 QUALITY ASSURANCE

- A. Applicator Qualifications: Painting applicator shall show evidence of acceptability as a qualified applicator by the manufacturer of products specified herein. Submit such evidence with Submittals as specified herein.
- B. Referenced Standards:
 - 1. Steel Structures Painting Council Surface Preparation Specifications:
 - a. SSPC-SP1, Solvent Cleaning.
 - b. SSPC-SP2, Hand Tool Cleaning.
 - c. SSPC-SP 3, Power Tool Cleaning
 - d. SSPC-SP6, Commercial Blast Cleaning.
 - e. SSPC-SP7, Brush-Off Blast Cleaning.
 - f. SSPC-SP10, Near-White Blast Cleaning.
 - g. SSPC-SP12, Water Jet Cleaning
 - h. SSPC-SP13/NACE #6 Surface Preparation of Concrete
 - i. SSPC-SP16 "Brush-off Blast Cleaning of Coated and Uncoated Galvanized Steel, Stainless Steels, and Non-ferrous Metals"
 - 2. ASTM D6386, Standard Practice for Preparation of Zinc (Hot-Dip Galvanized) Coated Iron and Steel Product and Hardware Surfaces for Painting.

1.03 SUBMITTALS

- A. Paint Schedule and Shop Drawings as specified in Section 01000.
- B. Samples: Submit sample color chips of standard colors and samples of any intermixes required.
- C. Schedule and Product Data: Submit paint schedule in same format as the paint schedule herein and indicate which of the selected manufacturer's products are intended for use. Do not perform painting or coating work without Owner's Representative's approval of submitted paint schedule.
- D. Certificates: Paint manufacturer's direct factory representative shall certify in writing to the Owner's Representative painting and coating compliance with the following:
 - 1. Factory representative's initial site inspection of conditions pertinent to painting and coating work with Contractor or his authorized painting representative.
 - 2. Factory representative's second site inspection at completion of painting and coating work to check proper application and actual mil thickness compliance with these Specifications.
 - 3. Certification issued to Owner's Representative only following unacceptable painting and coating work being rectified to Owner Representative's satisfaction.
 - 4. Factory representative shall make his services available to the Owner's Representative for immediate consultation in regard to the painting and coating work and shall make above stated inspections in the Owner Representative's presence.
- E. Operation and Maintenance Data: Upon approval of painting schedule, submit five copies of detailed maintenance manuals, including the following information:
 - 1. Name, address and telephone number of manufacturer and local distributor.
 - 2. Product name, number and technical data sheet for each type of paint.
 - 3. Detailed procedures for routine maintenance and cleaning.
 - 4. Detailed procedure for light repairs such as dents, scratches and staining.
- F. Maintenance Materials: Turn over to Owner upon completion of the project a full set of pipeline identification stencils.

1.04 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Deliver paint materials to job site in their original unopened containers with labels intact and legible at time of use.
- B. Store approved materials at the job site in a suitable and designated area restricted to storage of paint and coating materials and related equipment.
- C. Use all means necessary to ensure safe storage and use of paint and coating materials and the prompt and safe disposal of waste. Store paint and coating products protected from weather when such products may be affected by freezing.

1.05 JOB CONDITIONS

- A. Field and Shop Coat Compatibility: To ensure satisfactory paint and coating performance, it is a Contract requirement that products applied in the shop and field be mutually compatible.
 - 1. Contractor shall require fabricators and equipment manufacturers to apply shop coats that are compatible with field coats specified herein.
 - 2. Above requirement does not apply to full factory-finished items, that is, items having both primer and final finish coatings, except as specified in the following paragraphs.
- B. Painting Factory-Finished Equipment: Equipment, such as motors, pumps and other such items, which when installed become an integral part of a system and which may be delivered fully factory-finished (that is, having finish coatings in addition to the prime coating) shall not require repainting in the field unless:
 - 1. Factory finish is unacceptable to the Owner's Representative, that is, not having generic type of paint or proper mil thickness to withstand corrosive atmosphere of wastewater facilities; or,
 - 2. Factory finish is damaged.

On factory-finished items requiring repainting, first sand existing paint to a dull finish and then repaint with scheduled finish system for the installed location of such factory-finished items.
- C. Painting Caulking Compound: Do not apply paint over caulking compound until integral solvents have been released from the compound; usually two weeks for butyl-rubber based caulking and one day for acrylic latex caulking.
- D. Color:
 - 1. As directed by the Owner's Representative.

2. Paint equipment not furnished with a factory finish, or not finished with an acceptable factory finish, and piping and conduits the same color as adjacent surface.
 3. Final work shall match Owner's Representative approved samples. Owner's Representative shall select colors where not indicated or specified with no extra compensation allowed the Contractor for such.
- E. Placing into Service: Do not place painted items into service until paints and coatings are fully cured (dry-hard).
- F. Environmental Requirements:
1. Adhere to manufacturer's data on air and surface temperature limits and relative humidity during application and curing of coatings.
 2. Do not spray-apply paint when wind velocity is above 15 mph.
 3. Schedule coating work to avoid dust and airborne contaminants.
 4. Apply exterior finishes during daylight hours only.
 5. When painting must be done in confined spaces, or because of unfavorable ambient conditions, longer drying times will be necessary.
 6. Provide supplementary ventilation such as fans and blowers in confined or enclosed areas to carry off solvents during the evaporation stage.
- G. Protection:
1. Protect paint materials before, during and after application, and protect other work and materials with drop cloths or other impervious material.
 2. Clean up or otherwise remedy without additional cost, damage by paint and coatings to public or private property.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Paint: As specified in the PAINT SCHEDULE included herein.
- B. Thinners: Only those thinners recommended for that purpose by the manufacturer of material to be thinned.

2.02 MATERIALS

- A. Paint: As specified in the PAINT SCHEDULE included herein.
- B. Thinners: Only those thinners recommended for that purpose by the manufacturer of material to be thinned.

PART 3 - EXECUTION

3.01 SURFACE PREPARATION

- A. Ferrous Metal:
 - 1. Shop Primed:
 - a. Immediately before paint application, clean sand, dust, mud, dirt and other foreign matter from shop coat.
 - b. Touch-up damaged or destroyed shop paint.
 - c. Surface preparation of surfaces to be touched-up must be as effective as those specified for shop painting.
 - d. If required by primer or finish coat manufacturer, sand or abrasive clean primer prior to finish coating. Verify maximum recoat time.
 - 2. Not Shop Primed and Submerged or Intermittently Submerged in Liquid:
 - a. Grind smooth to a rounded contour sharp edges and welds and remove weld splatter.
 - b. Except for insides of pipes, abrasive blast in accordance with SSPC-SP10.
 - c. After abrasive blasting, remove dust and spent abrasive from surface by brushing or vacuum cleaning.
 - d. Apply prime coat before surface starts to rust.
 - e. Do not allow abrasive blasted surface to stand overnight before coating.
 - 3. Not Shop Primed and Non-Submerged:
 - a. Grind smooth to a rounded contour sharp edges and welds and remove weld splatter.

- b. Abrasive blast in accordance with SSPC-SP6.
 - c. After abrasive blasting, remove dust and spent sand from surface by brushing or vacuum cleaning.
 - d. Apply prime coat before surface starts to rust.
 - e. Do not allow abrasive blasted surface to stand overnight before coating.
- B. Galvanized Metal Including Pipes and Conduits:
- 1. Clean in accordance with the ASTM D6386 and SSPC-SP16.
 - a. Apply prime coat before surface starts to rust or oxidize.
 - b. Do not allow cleaned surfaces to stand overnight before coating.
- C. Copper Pipe:
- 1. Solvent clean in accordance with SSPC-SP1.
 - 2. Allow to dry before application of paint.
- D. Shop Bituminous Coated Pipe:
- 1. Non-Submerged: Commercial blast per SSPC-SP6.
 - 2. Submerged: Near White Metal Blast per SSPC-SP10.
- E. Polyvinyl Chloride Pipe:
- 1. Lightly sand off sheen and clean.
- F. Existing Concrete:
- 1. Remove all existing coatings, contaminants, laitance, and weak concrete using impact or power tool methods per ASTM D4259 or SSPC-SP13/NACE #6 Surface Preparation of Concrete. Staining over existing paint will not be permitted.
 - 2. After removal of all existing paint, clean bare concrete surfaces free of dirt, oil, grease, dust, etc. using a cleaner recommended by the new concrete stain manufacturer. Rinse surfaces and allow them to dry thoroughly.
 - 3. Repair all cracked, damaged, and spalled concrete in accordance with the International Concrete Repair Institute (ICRI) Guideline No. 03732.

4. Prepare a surface profile in accordance with the new stain manufacturer's recommendations. Apply new stain only on clean and dry concrete surfaces.
- G. New Concrete: Clean in accordance with ASTM D4258 or SSPC-SP13
1. Remove oil, grease, dirt, etc. by steam cleaning or scrubbing with a strong commercial type detergent and flushing with water.
 2. Neutralize and flush clean chemical contamination.
 3. Fill exposed aggregate or deep pits and air holes with cement grout and trowel to a uniform surface texture.
 4. Perform work only on cured, clean and dry concrete surfaces.
- H. Pipe Insulation:
1. Clean free of dirt, dust or other foreign matter.
- I. Mechanical and Electrical Systems:
1. Clean free of dust, mud, dirt, sand and other foreign matter.
 2. Solvent clean or otherwise degrease surfaces; exercise care not to damage surfaces.
 3. Do not paint factory painted surfaces of mechanical and electrical components in such systems; does not include galvanized surfaces.
 4. Do not paint light fixtures.
- J. Wood:
1. For existing painted surfaces, remove loose and peeling paint, de-gloss surface if recommended by the paint manufacturer, sand smooth, and clean.
 2. Scrape and clean knots and apply coat of knot sealer before applying primer.
 3. Sand surfaces that will be exposed to view, and dust them off.
 4. Prime edges, ends, faces, undersides, and backsides of all wood.
 5. After priming, fill holes and imperfections in the finished surfaces with putty or plastic wood filler. Sand smooth when dried.

3.02 APPLICATION

A. General:

1. Strictly follow paint manufacturer's label instructions for mixing, thinning, proper spreading rate and drying time. In no case shall film thickness be less than manufacturer's recommendations nor shall area coverage per gallon exceed manufacturer's recommendations.
2. If material has thickened or must be diluted for application, the coating shall be built up to the same film thickness achieved with undiluted material. Do not use thinner to extend coverage of the paint.
3. Regardless of the surface, it shall be the painter's responsibility to achieve a protective and decorative finish either by decreasing the coverage or by applying additional coats of paint.

B. Method of Application:

1. Workmanship: In general, finished surface regardless of method of paint application shall show no evidence of improper application according to accepted trade practice. Do not use paint rollers having nap exceeding $\frac{3}{8}$ -inch.
2. Multi-coat Application:
 - a. Succeeding coats of paint shall show visual difference from preceding coats. Each coat shall have a uniform appearance and be tinted to the final coat. The final coat shall present solid hiding with edges of paint adjoining other paint or materials made clean with and sharp without overlap. Wipe or otherwise render undercoats dust free just prior to application of succeeding coatings.
 - b. Do not apply additional coats of paint until the film to be recoated is sufficiently cured to receive the next coat.
 - c. If the time limit is exceeded for coatings that have a maximum recoat time, consult paint manufacturer before proceeding with next coat.

C. Painting Exposed/Concealed Surfaces:

1. It is a requirement of this specification that all exposed interior surfaces be painted except as specified herein and elsewhere in the Specifications. Interior surfaces to be covered by ceiling/wall mounted equipment, electrical panels, etc. shall be painted prior to hanging/mounting the equipment. Mounting equipment and painting around it is unacceptable.
2. Exterior surfaces painted only as scheduled.

3. In interior exposed areas of structures, paint mechanical and electrical systems, including pipe, duct and conduit system, except for full factory finished items as defined previously.
4. In interior concealed areas no painting is required including mechanical and electrical systems therein, except that pipe identification is required on piping in concealed but accessible areas.
5. Paint above stated exposed mechanical and electrical systems the same color as adjacent wall and/or ceiling color. Paint materials as scheduled herein.
6. Do not paint exposed aluminum surfaces or rubber components.

D. Pipe Line Identification:

1. After finish painting, mark non-submerged piping with an applicable color band bearing the stenciled name of its contents. Identify piping at valves and fittings, piping on both sides of walls and floors where pipes pass through same and on long pipe runs approximately every 30 feet or closer when directed.
2. Also adjacent to the color band, stencil the pipe size and an arrow indicating direction of flow in the pipe. Color pipe size identification and flow arrow the same as the lettering.
3. Place legend, pipe size and flow arrow in location so that it can be easily read from the floor.
4. Where pipes are adjacent to each other, arrange legends neatly in line.
5. Use block style lettering with letter size and color band width in accordance with the following table:

<u>Pipe Outside Diameter</u>	<u>Color Band Width</u>	<u>Letter Size</u>
3/4" to 1 1/4"	8"	1/2"
1 1/2" to 2"	8"	3/4"
2 1/2" TO 6"	12"	1 1/4"
8" TO 10"	24"	2 1/2"
Over 10"	32"	3 1/2"

6. Identify pipelines less than 3/4" outside diameter with brass or aluminum tags.
7. Schedule for pipeline identification as follows:

<u>Service</u>	<u>Band Color</u>	<u>Lettering Color</u>
Drain	OSHA Safety Black	White
Fuel Oil	OSHA Safety Yellow	Black
Potable Water	Light Blue	White
Wastewater	Light Gray ANSI Z55.1	Black

E. Pump and Motor Identification:

1. Use 3½" block style lettering to paint equipment identification numbers on pumps and motors as applicable or as directed by the Engineer. Lettering color shall be black.

3.03 CLEANING

- A. Upon completion of work, remove paint and coating spots, oil and grease stains from floors, walls, fixtures, hardware and equipment, leaving their finishes in a satisfactory condition. Remove materials and debris from the site of work and leave in a clean condition so far as this work is concerned.
- B. Keep site free from accumulation of paint containers, solvents, and thinner and used cleaning cloths and legally dispose of same off premises daily.

3.04 INSPECTION & TESTING

- A. Upon completion of work, Contractor shall notify the Engineer that the work is ready to be inspected and tested. Engineer will conduct visual examination and dry film thickness (DFT) testing.
- B. If Engineer's inspection/testing determines that there are any coating holidays or DFTs less than specified, Contractor shall be required to have the coating manufacturer provide a specific action plan to correct the deficiencies, and the deficient areas shall be abraded, solvent wiped and corrected per the manufacturer's recommendations at no cost to the Owner.

3.05 PAINT SCHEDULE

- A. General: The paint systems specified are acceptable options. The following paint systems are intended to include items to be painted at the job site. Any item not specifically named herein but obviously required to be painted, shall be painted in accordance with the system selected by the Owner's Representative, or otherwise painted as directed by the Owner's Representative.
- B. Schedule: Refer to Finish Paint Schedule Table following this Section: The entire pumping station and everything therein, whether specifically listed in the Finish Paint Schedule Table or not, shall be painted to match existing colors unless directed otherwise by the Owner's Representative.

FINISH PAINT SCHEDULE TABLE					
Item No.	Items to Be Painted	TNEMEC	CARBOLINE	SHERWIN-WILLIAMS	FINISH COLOR (Remarks)
1	Misc. Ferrous Metals: vents, drainpipes, structural steel, misc. metal fabrications, roof supports, metal piping, valve handwheels, etc.	Three coats Series V69 Epoxoline II @ 4-6 mils DFT/coat. See Note 4.	One coat Carboguard 635VOC @ 4-6 mils DFT. Two coats Carboguard 690 @ 6-8 mils DFT/coat. See Note 4.	One coat of Macropoxy 646 FC @ 4.0 - 6.0 mils DFT; two coats of Macropoxy 646 FC @ 6.0 - 8.0	Aluminum or Gray (Do not paint ductwork). Valve handwheels, extension stems, and pump shafting shall be OSHA Safety Red.
2	Electrical Conduit (Non-metallic and PVC coated conduit shall not be painted)	One coat Series 1026 Enduratone @ 2.0-2.5 mils DFT. Two coats Series 1029 Enduratone @ 2.0-2.5 mils DFT/coat.	One coat Carbocrylic/ Sanitile 120 @ 2 mils DFT. Two coats Carbocrylic 3359 @ 2-3 mils DFT/coat.	One coat of ProBlock Latex Primer @ 1.5 - 2.0 mils DFT; Two coats of DTM Acrylic @ 2.5 - 3.0 mils dry	Black
3	Water Piping (steel only, copper piping shall not be painted)	One coat Series 94H ₂ O Hydro-zinc @ 2.5-3.5 mils DFT. Two coats Series V69 Epoxoline II @ 4-6 mils DFT/coat.	One coat Carbozinc 859 @ 3-5 mils DFT. Two coats Carboguard 891VOC @ 4-6 mils DFT/coat.	One coat of Zinc Clad III @ 3.0 - 5.0 mils DFT; Two coats of Macropoxy 5500 @ 4.0 - 6.0 mils DFT	Light Blue
4	Concrete Surfaces: vaults (See Specification Section 13120 for coating walls and ceiling in the Precast Concrete Building).	Two coats Series 617 WB Conformal Stain @ 150-200 ft ² /gal per coat.	See Note 1.	See Note 1	White
	Concrete Surfaces: floors and equipment bases	See Note 2.	See Note 2.	See Note 2	Clear

FINISH PAINT SCHEDULE TABLE					
Item No.	Items to Be Painted	TNEMEC	CARBOLINE	SHERWIN-WILLIAMS	FINISH COLOR (Remarks)
5	Pump Suction & Discharge Piping, Force Main (Ferrous Metals) (Wetwell Only)	One coat Series 394 Perime-Prime @ 3.0-3.5 mils DFT. One coat Series 435 Perma-Glaze @ 35-45 mils DFT/coat.	One coat Phenoline 311 @ 2-3 mils DFT. One coat Plasite 4500 S @ 45-55 mils DFT.	One coat of Macropoxy 646 FC @ 3.0 - 5.0 mils DFT; One coat of Dura-Plate UHS @ 40.0 - 50.0 mils DFT	Gray
5	Pump Suction & Discharge Piping, Pumps, Motors, Gravity Sewer, Force Main, Ventilation Fans, Heaters, etc. (Ferrous Metals) (All Other Locations)	One coat Series 394 Perime-Prime @ 3.0-3.5 mils DFT. Two coats Series V69 Epoxoline II @ 6-8 mils DFT/coat.	One coat Carboguard 890 @ 4-6 mils DFT. Two coats Carboguard 690 @ 6-8 mils DFT/coat.	One coat of Macropoxy 646 FC @ 3.0 - 5.0 mils DFT; Two Coats of Macropoxy 646 FC @ 6.0 – 8.0 mils DFT/Coat	Aluminum or Gray
6	Galvanized Piping/Steel (Wetwell Only)	One coat Series 27 WB Typoxy @ 2.5-3.5 mils DFT. One coat Series 435 Perma-Glaze @ 35-45 mils DFT/coat.	One coat Phenoline 311 @ 2-3 mils DFT. One coat Plasite 4500 S @ 45-55 mils DFT.	One coat of Macropoxy 646 FC @ 3.0 - 5.0 mils DFT; One coat of Dura-Plate UHS @ 40.0 - 50.0 mils DFT	Gray
	Galvanized Piping/Steel (All Other Locations)	One coat Series 27 WB Typoxy @ 2.5-3.5 mils DFT. Two coats Series V69 Epoxoline II @ 6-8 mils DFT/coat. See Note 4.	One coat Rustbond @ 1-2 mils DFT. Two coats Carboguard 690 @ 6-8 mils DFT/coat. See Note 4.	One coat of Macropoxy 5000 @ 1.0 – 1.5 mils DFT; Two coats of Seaguard 6100 @ 6.0 - 8.0 mils DFT	Aluminum or Gray
7	Wood	One coat Series 151-1051 Elasto-Grip @ 0.7-1.5 mils DFT. Two coats Series 1029 Enduratone @ 2.0-2.5 mils DFT.	One coat Carbocrylic/Sanitile 120 @ 2 mils DFT. Two coats Carbocrylic 3359 @ 2-3 mils DFT.	ProBlock Latex Primer @ 1.5 - 2.0 mils DFT; Two coats of DTM Acrylic @ 2.5 - 4.0 mils dry	White

Notes:

1. Two coats Sherwin Williams H & C Colortop Water-Based Solid Color Concrete Stain @ 150-250 ft²/gal per coat may be used for this item.
2. Floors and equipment bases to be clear color shall receive two coats Sherwin Williams H & C Clarishield Concrete Sealer Wet Look Water-Based @ 100-200 ft²/gal per coat. H & C Shark Grip Slip Resistant Additive shall be added to the second coat @ 3.2 ounces/gal.
3. Listed DFT mils per coat applies for spray-on application. Application of paint by roller or brush shall be in accordance with manufacturer's requirements. Additional coats required by the manufacturer to achieve overall listed DFT shall be completed by the Contractor.
4. Paint provided on exterior surfaces to be exposed to UV light shall be provided with UV protection via a final topcoat/dry film thickness as recommended by the Manufacturer.
5. In the event that a coating is no longer available and/or no longer meets the current State VOC emission requirements, the paint manufacturer's representative shall be responsible for recommending and providing a paint system that provides the minimum protection of the coating system specified at no additional cost to the Town.

END OF SECTION

SECTION 09960

CORROSION PROTECTION LINING SYSTEM

PART 1 - GENERAL

1.01 SUMMARY

- A. This section covers work, materials and equipment required for protecting the interior surface of a watertight structure by installing a multi-layer lining system to provide corrosion protection and to stop infiltration.
- B. This section includes procedures for surface preparation, cleaning, application and testing.

1.02 SUBMITTALS

- A. Submit technical data sheets on each product used, including ASTM test results indicating the product conforms to and is suitable for its intended use per these specifications.
- B. Material Safety Data Sheets (MSDS) for each product used.
- C. Submit technical data sheets and project specific data for repair materials to be top coated with the lining system products including application, cure time and surface preparation.
- D. Provide samples of the cured system including stepped samples showing stages of multi-layer applications.
- E. Applicator Qualifications:
 - 1. Manufacturer certification that the Applicator has been trained and approved in the handling, mixing and application of the products to be used.
 - 2. Certification that the equipment to be used for applying the products, has been approved by the Manufacturer, and that Applicator's personnel have been trained and certified for proper use of the equipment.
 - 3. Applicator specializing in the performance of work specified in this section with a minimum of three (3) years documented experience and 3,000 vertical feet of application.
 - 4. Five (5) references of municipal sanitary sewer projects successfully performed within the past three years for projects similar in size and scope.

5. Proof of any necessary federal, state or local permits or licenses necessary for this project.

1.03 QUALITY ASSURANCE

- A. Contractor and Applicator shall initiate and enforce quality control procedures consistent with all applicable ASTM, NACE and SSPC standards and the corrosion protection lining system manufacturer's recommendations.
- B. Lining system materials shall be produced in an ISO 9001 certified facility.
- C. Furnish materials of quality required by ASTM standards or other approved standards and specifications.
- D. Lining system products shall be capable of being installed and curing properly within the specified environments. Lining system products shall be resistant to all forms of chemical or bacteriological attack found in municipal sanitary sewer systems and capable of adhering to the substrates and repair products.
- E. Repair product(s) shall be fully compatible with lining system products including ability to bond effectively to the host substrate and lining system products forming a composite system.
- F. Applicator shall utilize equipment for the spray application of the lining system products which have been approved by the lining system Manufacturer; and, Applicator shall have received training on the operation and maintenance of said equipment from the lining system manufacturer.
- G. Applicator shall be trained by, or have their training approved and certified by, the Manufacturer for the handling, mixing, application and inspection of the lining system to be used as specified herein.
- H. Applicator shall be trained in the use of testing or inspection instrumentation and knowledgeable of the proper use, preparation and installation of the lining system to be used as specified herein.
- I. Provide guarantee against defective materials and workmanship in accordance with the requirements of these specifications.

1.04 DELIVERY, STORAGE AND HANDLING

- A. Delivery and Handling: Prevent moisture damage and contamination of materials during delivery and handling.
- B. Storage: Store materials in undamaged condition with seals and labels intact as packaged by the manufacturer.
 1. Liquid products shall be protected from freezing while being stored.

1.05 JOB CONDITIONS

A. Environmental Requirements:

1. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the lining system Manufacturer. Do not apply the products of this Section to frozen surfaces.
2. Do not apply lining system during rain or snow, or when relative humidity is outside the humidity ranges required by the lining system Manufacturer.

B. Protection:

1. Public Safety: If public safety is endangered during the progress of the rehabilitation work, provide adequate protective measures to protect public pedestrian and vehicular traffic on streets and walkways.
 - a. Signs, signals and barricades used shall conform to requirements of Federal, State and Local laws, rules, regulations, precautions, orders, and decrees.
2. Existing Facilities Protection: Protect existing structures from damage due to operations associated with work of this Section.
3. Personnel Protection: It is the responsibility of the Contractor to provide appropriate protective measures to ensure that chemicals are under the control of the Applicator at all times and are not available to unauthorized personnel or animals.

1.06 WARRANTY

- A. Manufacturer and Applicator warrant the liner system against failure for a period of 10 years. "Failure" will be deemed to have occurred if the protective lining fails to prevent the internal deterioration or corrosion of the structure or prevent groundwater infiltration. If any such failure occurs within 10 years of Substantial Completion, the damage will be repaired at no cost to the Owner. The Contractor shall provide a certificate for inclusion in the O&M Manuals documenting the Manufacturer's date of warranty commencement (Contractor's Substantial Completion date) and expiration (ten years hence).

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Subject to compliance with requirements, manufacturers that may be used include:

1. OBIC, LLC.
2. or approved equal.

2.02 REPAIR MATERIALS

- A. Subject to compliance with the lining system Manufacturer's requirements, the following products shall be acceptable as compatible repair base coat material:
1. 100% solids, solvent-free epoxy grout specifically compatible with the lining system.
 2. Factory blended, rapid setting, high early strength, fiber reinforced, non-shrink repair mortar that can be applied by trowel or pneumatically spray applied, specifically formulated to be suitable with the lining system.
 3. A hydraulic cement and/or plug shall be used to stop active infiltration. The hydraulic cement and plug shall be suitable for use with the lining system and shall be approved by the lining system manufacturer.

2.03 LINING SYSTEM MATERIALS

A. Primer Layer:

1. Primer layer shall be a fast curing modified polymer primer and shall be formulated for deep penetration into masonry/concrete surfaces. Primer shall achieve an adhesion to the masonry/concrete surface greater than 400 psi. Primer shall be OBIC Prime 1500 or approved equal.

B. Adhesion Layer:

1. Adhesion layer shall be 100% solids, no volatile organic compound (VOC), moisture tolerant, elastomeric polyurea to provide corrosion protection and stop infiltration. Adhesion layer shall be OBIC Armor 1000 or approved equal. Material shall be capable of curing properly given the project site conditions and temperatures, and shall conform to the following minimum physical requirements:

PROPERTY	VALUE
Hardness, ASTM D2240	D 52
Tensile strength, ASTM D412	4,000 psi
100% Modulus, ASTM D412	1,460 psi
200% Modulus, ASTM D412	1,960 psi
300% Modulus, ASTM D412	2,650 psi
Tear resistance/DIE-C, ASTM D624	445 pli
Ultimate elongation, ASTM D412	425 %
Taber Abrasion, CS17 Calibrase	23 mg loss

PROPERTY	VALUE
Flexibility, 1/8" Mandrel	Pass
SWAT, ASTM G210	Pass

C. Surface Layer:

1. Surface layer shall be a two-component seamless rigid polyurethane backing material with high closed cell content. Surface layer shall be OBIC Armor 1306 or approved equal. Material shall be capable of curing properly given the project site conditions and temperatures, and shall conform to the following minimum physical requirements:

PROPERTY	VALUE
Density, ASTM D1622	6-8 pcf
Compressive Strength, ASTM D1621	130-180 psi
Closed Cell Content	> 94%
Water Absorption	< 0.03 lbs/sf
Maximum Service Temp	180 deg F
Viscosity (A side) @ 72 deg F	675 cps
Viscosity (B side) @ 72 deg F	200 cps
SWAT, ASTM G210	Pass

D. Armor Layer:

1. The Armor layer shall meet the same requirements as the adhesion layer specified above.

PART 3 - EXECUTION

3.01 ACCEPTABLE APPLICATORS

- A. Repair mortar applicators shall be trained to properly apply the cementitious mortar according to the manufacturer's recommendations.
- B. Corrosion protection lining system shall be applied by a certified Applicator and in accordance with Manufacturer's requirements.

3.02 EXAMINATION

- A. Contractor and Applicator shall take appropriate actions to comply with federal, state and local regulatory and other applicable agencies with regard to environment, health and safety.
- B. Sewage flows shall be plugged and diverted so that they shall not be in contact with the lining system until fully cured.

- C. Pipe penetrations must be sealed, and no leaks shall be present prior to commencing and during work.
- D. Installation of the lining system shall not commence until the concrete substrate has been properly cured and prepared in accordance with this specification.

3.03 SURFACE PREPARATION

- A. Standard Portland cement or new concrete must be cured at least 28-days prior to application of the lining system.
- B. Conduct surface preparation program to include monitoring of atmosphere for hydrogen sulfide, methane, low oxygen or other gases, approved flow control equipment, and surface preparation equipment.
- C. Surface preparation methods may include high pressure water cleaning, hydro blasting, abrasive blasting, grinding, detergent water cleaning and shall be suited to provide a surface compatible for installation of the liner system. Applicator shall maintain strict adherence to applicable NACE and SSPC recommendations with regard to proper surface preparation.
- D. Surface preparation method shall produce a cleaned, abraded and sound surface with no evidence of laitance, loose concrete, brick or mortar, contaminants or debris, and shall display a surface profile suitable for application of liner system. Existing coatings which may affect the performance and adhesion of the lining system shall also be removed.
- E. After the defects in the structure are identified, repair all leaks with a chemical or hydraulic sealant designed for use in field sealing of ground water. Severe cracks shall be "repaired with a urethane-based chemical" sealant. Product to be utilized shall be as approved by Owner/Engineer prior to installation. Repairs to exposed rebar, defective pipe penetrations or inverts, etc. shall be repaired utilizing non-shrink grout or approved alternative method.

3.04 REPAIR MATERIALS

- A. Repair materials shall be used to fill voids, structurally reinforce and/or rebuild surfaces. Repair materials shall be compatible with the lining system and shall be applied in accordance with the manufacturer's recommendations.
- B. Subject to compliance with the lining system Manufacturer's requirements, the following products shall be acceptable as compatible repair base coat materials for lining system:
 - 1. A hydraulic cement and/or plug shall be used to stop active infiltration. The hydraulic cement and plug shall be suitable for the polyurea top coating and shall be approved by the lining system Manufacturer.

2. Hydrophobic and/or Hydrophilic polyurethane chemical grouts used to stop active infiltration. The chemical grouts shall be suitable for the polyurea top coating and shall be approved by the lining system Manufacturer.

3.05 MATERIAL INSTALLATION

- A. Application procedures shall conform to recommendations of the manufacturer, including materials handling, mixing, environmental controls during application, safety and spray equipment.
- B. Spray equipment shall be specifically designed to accurately ratio and apply the liner system.
- C. Application of multi-layer/component liner system shall be in strict accordance with the lining system Manufacturer's recommendation. Final installation shall be a minimum of ½-inch DFT (500 mils).
 1. Primer Layer: 5-10 mils DFT
 2. Adhesion Layer: 40-50 mils DFT (not intended to fill small voids)
 3. Surface Layer: 400 to 450 mils DFT (intended to fill voids, bug holes)
 4. Armor Layer: 50 to 60 mils DFT

3.06 FIELD QUALITY CONTROL

- A. Structures shall be tested using a high voltage holiday detection system to determine if any holidays (voids) exist in the lining. The sensitivity control of the holiday tester shall be set to accommodate the thickness of the applied lining, 100-125 volts for each 1 mil thickness. Follow the guidelines of the holiday detection system manufacturer for correct control settings. All detected holidays shall be marked and repaired in accordance with the liner manufacturer's recommendations.
- B. Adhesion testing shall be conducted after the lining system has cured per Manufacturer's instruction and in accordance with ASTM D4541(Steel) or ASTM D7234(Concrete). A minimum of one 20 mm dolly shall be affixed to the lined surface of the structure at the upper section, mid-section and at the bottom, unless otherwise directed by the Engineer or Owner. Each testing location shall be identified by the Owner's Inspector. The adhesive used to attach the dollies to the liner shall be rapid setting with tensile strength in excess of the liner material and permitted to cure in accordance with Manufacturer's recommendations. The lining material and dollies shall be adequately prepared to receive the adhesive. Prior to pull test, the Contractor shall utilize a scoring device to cut through the coating until the substrate is reached. Extreme care shall be required while scoring to prevent micro cracking in the coating, since cracks may cause failures at diminished strengths. Failure due to improper dolly adhesive or scoring shall require retesting. The pull tests in each area shall meet or exceed 200 psi. and shall include subbase

adhered to the back of the dolly or no visual signs of coating material in the test hole. Pull tests with results between a minimum 150 psi and 200 psi shall be acceptable if more than 50% of the subsurface is adhered to the back of the dolly. A test result can be discarded, as determined by the Engineer, if there is a valid non-statistical reason for discarding the test results as directed by Sections 8.4 and 8.5 of ASTM D4541 and ASTM D7234. If any test fails, a minimum of three additional locations in the section of the failure shall be tested, as directed by the Engineer or Owner. If any of the retests fail, all loosely adhered or unadhered liner in the failed area, as determined by the Engineer, shall be removed and replaced at the Contractor's expense. Upon acceptance of the testing, all areas shall be repaired to restore the liner to its design conditions.

3.07 INSPECTION

- A. Final liner system shall be completely free of pinholes or voids. Liner thickness shall be the minimum value as described herein.
- B. Due to the fast gel and set time of the material, thickness of the application can be verified by awl point depth checks into the surface component and physical removal of a small area of the polyurea material. Repair of the test areas to be done immediately after the test.
- C. Visual inspection shall be made by the Owner/Engineer. Any deficiencies in the finished liner system shall be marked and repaired according to the procedures set forth by Manufacturer.
- D. The structure may be returned to full operational service as soon as the final inspection has taken place.

END OF SECTION

SECTION 10211
TOILET COMPARTMENT

PART 1 - GENERAL

1.01 SUMMARY

- A. Section includes painted steel toilet compartment configured as a toilet enclosure.

1.02 SUBMITTALS

- A. Product Data: For each type of product.
- B. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for toilet compartments.
- C. Shop Drawings: For toilet compartments, include plans, elevations, sections, and attachment details. Show locations of cutouts for compartment-mounted toilet accessories. Show locations of reinforcements for compartment-mounted grab bars and locations of blocking for surface-mounted toilet accessories. Show locations of centerlines of toilet fixtures. Show locations of floor drains.
- D. Product Schedule: For toilet compartments, prepared by or under the supervision of Supplier, detailing location and selected colors for toilet compartment material.
- E. Product Certificates: For each type of toilet compartment.

1.03 PROJECT CONDITIONS

- A. Field Measurements: Verify actual locations of toilet fixtures, walls, columns, ceilings, and other construction contiguous with toilet compartments by field measurements before fabrication.

PART 2 - PRODUCTS

2.01 PAINTED STEEL TOILET COMPARTMENT

- A. Toilet-Enclosure Style: Floor anchored.
- B. Door, Panel, and Pilaster Construction: Seamless, metal facing sheets pressure laminated to core material; with continuous, interlocking molding strip or lapped-and-formed edge closures; corners secured by welding or clips and exposed

welds ground smooth. Exposed surfaces shall be free of pitting, seam marks, roller marks, stains, discolorations, telegraphing of core material, or other imperfections.

- C. Core Material: Manufacturer's standard sound-deadening honeycomb of resin-impregnated kraft paper in thickness required to provide finished thickness of 1 inch for doors and panels and 1-1/4 inches for pilasters.
- D. Grab-Bar Reinforcement: Provide concealed internal reinforcement for grab bars mounted on units of size and material adequate for panel to withstand applied downward load on grab bar of at least 250 lbf, when tested according to ASTM F446, without deformation of panel.
- E. Tapping Reinforcement: Provide concealed reinforcement for tapping (threading) at locations where machine screws are used for attaching items to units.
- F. Facing Sheets and Closures: Electrolytically coated steel sheet with nominal base-metal (uncoated) thicknesses as follows:
 - 1. Pilasters, Braced at Both Ends: Manufacturer's standard thickness, but not less than 0.036-inch.
 - 2. Pilasters, Unbraced at One End: Manufacturer's standard thickness, but not less than 0.048-inch.
 - 3. Panels: Manufacturer's standard thickness, but not less than 0.030-inch.
 - 4. Doors: Manufacturer's standard thickness, but not less than 0.030-inch.
 - 5. Pilaster Shoes and Sleeves (Caps): Stainless-steel sheet, not less than 0.031-inch nominal thickness and 3 inches high, finished to match hardware.
- G. Brackets (Fittings):
 - 1. Stirrup Type: Ear or U-brackets; stainless steel.
 - 2. Full-Height (Continuous) Type: Manufacturer's standard design; stainless steel.
- H. Steel Sheet Finish: Immediately after cleaning and pretreating, apply manufacturer's standard baked-on finish, including thermosetting, electrostatically applied, and powder coatings. Comply with coating manufacturer's written instructions for applying and baking. Color: As selected by Owner from manufacturer's full range.

2.02 HARDWARE AND ACCESSORIES

- A. Material: Stainless steel.
- B. Hardware and Accessories: Manufacturer's heavy-duty operating hardware and accessories.
- C. Hinges: Manufacturer's minimum 0.062-inch thick, stainless-steel paired, self-closing type that can be adjusted to hold doors open at any angle up to 90 degrees, allowing emergency access by lifting door. Mount with through-bolts.
- D. Latch and Keeper: Manufacturer's heavy-duty, surface-mounted, cast stainless-steel latch unit designed to resist damage due to slamming, with combination rubber-faced door strike and keeper and with provision for emergency access. Provide units that comply with regulatory requirements for accessibility at compartments designated as accessible. Mount with through-bolts.
- E. Coat Hook: Manufacturer's heavy-duty, combination cast stainless-steel hook and rubber-tipped bumper, sized to prevent in-swinging door from hitting compartment-mounted accessories. Mount with through-bolts.
- F. Door Bumper: Manufacturer's heavy-duty, rubber-tipped, cast stainless-steel bumper at out-swinging doors. Mount with through-bolts.
- G. Door Pull: Manufacturer's heavy-duty cast stainless-steel pull at out-swinging doors that complies with regulatory requirements for accessibility. Provide units on both sides of doors at compartments designated as accessible. Mount with through-bolts.
- H. Overhead Bracing: Manufacturer's standard continuous, extruded-aluminum head rail with antigrip profile and in manufacturer's standard finish.
- I. Anchorages and Fasteners: Manufacturer's standard exposed fasteners of stainless steel, finished to match the items they are securing, with theft-resistant-type heads. Provide sex-type bolts for through-bolt applications. For concealed anchors, use stainless steel, hot-dip galvanized steel, or other rust-resistant, protective-coated steel compatible with related materials.
- J. Toilet Paper Dispenser: Stainless steel vertical dual roll toilet paper dispenser compatible with the toilet compartment system.

2.03 MATERIALS

- A. Aluminum Castings: ASTM B26.
- B. Aluminum Extrusions: ASTM B221.
- C. Brass Castings: ASTM B584.

- D. Brass Extrusions: ASTM B455.
- E. Steel Sheet: Commercial steel sheet for exposed applications; mill phosphatized and selected for smoothness.
- F. Electrolytically Zinc Coated: ASTM A879, 01Z.
- G. Hot-Dip Galvanized: ASTM A653, either hot-dip galvanized or galvanized.
- H. Stainless-Steel Sheet: ASTM A666, Type 304, stretcher-leveled standard of flatness.
- I. Stainless-Steel Castings: ASTM A743.
- J. Zamac: ASTM B86, commercial zinc-alloy die castings, chrome plated.

2.04 FABRICATION

- A. Fabrication, General: Fabricate toilet compartment components to sizes indicated. Coordinate requirements and provide cutouts for through-partition toilet accessories, and solid blocking within panel where required for attachment of toilet accessories.
- B. Overhead-Braced Units: Provide manufacturer's standard corrosion-resistant supports, leveling mechanism, and anchors at pilasters to suit floor conditions. Provide shoes at pilasters to conceal supports and leveling mechanism.
- C. Floor-Anchored Units: Provide manufacturer's standard corrosion-resistant anchoring assemblies with leveling adjustment nuts at pilasters for structural connection to floor. Provide shoes at pilasters to conceal anchorage.
- D. Ceiling-Hung Units: Provide manufacturer's standard corrosion-resistant anchoring assemblies with leveling adjustment nuts at pilasters for connection to structural support above finished ceiling. Provide assemblies that support pilasters from structure without transmitting load to finished ceiling. Provide sleeves (caps) at tops of pilasters to conceal anchorage.
- E. Floor-and-Ceiling-Anchored Units: Provide manufacturer's standard corrosion-resistant anchoring assemblies with leveling adjustment at tops and bottoms of pilasters. Provide shoes and sleeves (caps) at pilasters to conceal anchorage.
- F. Door Size and Swing shall be 24-inch wide, in-swinging door for standard toilet compartment and 36-inch wide, out-swinging doors with a minimum 32-inch wide clear opening.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine substrates, areas and conditions, with Installer present, for compliance with requirements for fastening, support, alignment, operating clearances, and other conditions affecting performance of the work.
- B. Confirm location and adequacy of blocking and supports required for installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.
- D. Coordinate layout and installation of supports, inserts, and anchors built into other units of work for toilet compartment anchorage.

3.02 INSTALLATION

- A. General: Comply with manufacturer's written installation instructions. Install units rigid, straight, level, and plumb. Secure units in position indicated with manufacturer's recommended anchoring devices.
- B. Maximum Clearances:
 - 1. Pilasters and Panels: 1/2 inch.
 - 2. Panels and Walls: 1 inch.
- C. Stirrup Brackets: Secure panels to walls and to pilasters with no fewer than three brackets attached at midpoint and near top and bottom of panel.
- D. Locate wall brackets so holes for wall anchors occur in masonry or tile joints.
- E. Align brackets at pilasters with brackets at walls.
- F. Full-Height (Continuous) Brackets: Secure panels to walls and to pilasters with full-height brackets.
- G. Overhead-Braced Units: Secure pilasters to floor and level, plumb, and tighten. Set pilasters with anchors penetrating not less than 1-3/4 inches into structural floor unless otherwise indicated in manufacturer's written instructions. Secure continuous head rail to each pilaster with no fewer than two fasteners. Hang doors to align tops of doors with tops of panels, and adjust so tops of doors are parallel with overhead brace when doors are in closed position.

- H. Floor-Anchored Units: Set pilasters with anchors penetrating not less than 2 inches into structural floor unless otherwise indicated in manufacturer's written instructions. Level, plumb, and tighten pilasters. Hang doors and adjust so tops of doors are level with tops of pilasters when doors are in closed position.
- I. Ceiling-Hung Units: Secure pilasters to supporting structure and level, plumb, and tighten. Hang doors and adjust so bottoms of doors are level with bottoms of pilasters when doors are in closed position.
- J. Floor-and-Ceiling-Anchored Units: Secure pilasters to supporting construction and level, plumb, and tighten. Hang doors and adjust so doors are level and aligned with panels when doors are in closed position.

3.03 ADJUSTING

- A. Hardware Adjustment: Adjust and lubricate hardware according to hardware manufacturer's written instructions for proper operation. Set hinges on in-swinging doors to hold doors open approximately 30 degrees from closed position when unlatched. Set hinges on out-swinging doors to return doors to fully closed position.

END OF SECTION

SECTION 10520

FIRE PROTECTION SPECIALTIES

PART 1 - GENERAL

1.01 DESCRIPTION

- A. This Section includes all labor, materials, equipment, and incidentals required to provide and install wall-mounted portable fire extinguishers, as specified herein. Contractor shall furnish and install one (1) fire extinguisher in the pump station building.

1.02 SUBMITTALS

- A. Product Data: For each type of product indicated.

PART 2 - PRODUCTS

2.01 FIRE EXTINGUISHERS

- A. Fire extinguisher shall be wall-mounted, steel cylinder, nitrogen pressurized, dry chemical, multi-purpose type, with 5 lbs. capacity minimum for Class ABC fires; J. L. Industries Cosmic 5E Multi-Purpose Dry Chemical, Amerex Model B402, or approved equal.
- B. All fire fighting devices must comply with the provisions of the Occupational Safety and Health Act of 1974 (OSHA), Part 1926. Fire extinguisher shall be UL-approved.
- C. Fire extinguisher shall be furnished with an approved type wall mounting bracket, designed to mount fire extinguisher provided.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install fire fighting extinguisher in accordance with manufacturer's written instructions.
- B. Install fire extinguisher in accordance with NFPA requirements.
- C. Mounting height to top of bracket shall be 4'-8".

END OF SECTION

SECTION 11310

BASE-MOUNTED PUMPING SYSTEM

PART 1 - GENERAL

1.01 SCOPE

- A. Contractor shall furnish and install one factory built base-mounted pumping system consisting of three individual steel bases. The station shall be complete with all equipment specified herein.
- B. Principal items of equipment shall include three horizontal, self-priming, centrifugal sewage pumps, V-belt drives, motors, piping, check valves, air release valves, and integral wiring.
- C. Electrical power to be furnished to the site shall be 3-phase, 60 hertz, 460-volt, maintained within plus or minus 10 percent. Available fault current at the input to the control panel shall be limited to a maximum of 5 kA rms symmetrical. Voltage tolerance shall be plus or minus 10 percent. Phase to phase unbalance shall not exceed 1% average voltage as set forth in NEMA Standard MG-1. Control voltage shall not exceed 132 volts.
- D. The pumping equipment shall be manufactured by The Gorman-Rupp Company, Mansfield, OH as supplied by Envirep, Inc., Camp Hill, PA, or approved equal.

1.02 SUBMITTALS

- A. Product Data: Prior to fabrication, submit the following to the Engineer for approval:
 - 1. Shop drawings providing layout of the mechanical equipment and anchor bolt locations and indicating the use of Unified National Standard bolts and fasteners.
 - 2. Catalog cut sheets for major items of equipment, materials of construction, major dimensions, motor and v-belt drive data, pump characteristics curves showing design duty point capacity (GPM), head (FT), net positive suction head required (NPSHr), and hydraulic brake horsepower.
 - 3. Pump Manufacturer's v-belt drive selection calculation summary sheet showing corrected horsepower (HP) per belt, total HP developed, pitch diameter of sheaves, center distance between driver and driven shafts and combined arc-length correction factor applied to theoretical HP transmission per v-belt, and all calculations to demonstrate a minimum Safety Factor of 1.5.

4. Certified dimensional drawings indicating size, locations and the spherical solids passing capability of the primary recirculation port.
 5. Pre-startup checklist to be completed by the Contractor prior to pre-startup inspection.
 6. Sample of service agreement and service agreement checklist for the specified equipment.
 7. Letter from pump Manufacturer certifying that the pump(s), exclusive of the motor, base, drive, controls, or other associated components are constructed with cast iron, ductile iron, and steel that has been mined, melted, cast, machined, and assembled in the United States.
 8. Certified Tests: Prior to shipment of the equipment from the pump manufacturer's facility, submit the following certified tests to the Engineer for approval.
 - a. Certified copies of factory run pump performance tests.
 - (1) Tests shall be conducted in accordance with Hydraulic Institute Standards 14.6.3.4 Acceptance Grade 1U at the specified head, capacity, rated speed and horsepower.
 - (2) The performance tests shall validate the performance of the equipment at the design head, capacity and speed.
 - b. Certified reprime performance test data in accordance with procedures herein specified.
 - c. Certified copies of air release valve closure performance test.
 - d. Tests shall be certified by a registered Professional Engineer.
- B. Certification. In addition to the manufacturer's warranty for the base-mounted pumping system, the Contractor shall obtain and submit to the Engineer and Owner certification from the base-mounted pumping system manufacturer that the system meets the requirements of the intended application and contract specifications. The pumping system manufacturer shall provide a signed certification (such certification signed by a Principal Person (President, Vice-President, etc.) of the equipment manufacturer) attesting that he/she has examined all applicable contract drawings and specifications, and certifies that the equipment he/she proposes to furnish and deliver meets or exceeds the Contract Specifications, is suitable for the intended purposed stated in Specification Section 11310, is suitable for installation as presented in the Contract Drawings and Specifications, and will provide satisfactory performance at the design criteria specified. This certification shall be provided by way of the Equipment Guarantee Certification Form included herewith.

EQUIPMENT GUARANTEE CERTIFICATION FORM

Reference: **New Creamery Road Sewage Pump Station
Town of Emmitsburg, Maryland**

THE UNDERSIGNED HEREBY ATTESTS THAT HE/SHE HAS EXAMINED ALL APPLICABLE CONTRACT DRAWINGS AND SPECIFICATIONS, AND CERTIFIES THAT THE EQUIPMENT THAT HE/SHE PROPOSES TO FURNISH AND DELIVER MEETS OR EXCEEDS CONTRACT SPECIFICATIONS, IS SUITABLE FOR THE INTENDED PURPOSE STATED IN SPECIFICATION SECTION **11310**, IS SUITABLE FOR INSTALLATION AS PRESENTED IN THE CONTRACT DRAWINGS AND SPECIFICATIONS, AND WILL PROVIDE SATISFACTORY PERFORMANCE AT THE DESIGN CRITERIA SPECIFIED. THIS GUARANTEE OF SUITABILITY FOR INTENDED PURPOSE IS IN ADDITION TO AND SHALL NOT BE IN LIEU OF ANY OTHER WARRANTIES, EXPRESSED OR IMPLIED.

EQUIPMENT: **BASE-MOUNTED PUMPING SYSTEM**

MANUFACTURER: _____

Address: _____

By: _____
(Typed Name and Title)

_____/s/_____
(Signature) (Date)

(SEAL)

Equipment Guarantee Certification must be signed by a Principal Person (President, Vice-President, etc.) of the equipment manufacturer. In the event the manufacturer is not the Supplier then a Principal Person of the Supplier must also sign this form.

SUPPLIER: _____

Address: _____

By: _____
(Typed Name and Title)

_____/s/_____
(Signature) (Date)

(SEAL)

C. Operation and Maintenance Manuals:

1. Operation shall be in accordance with written instructions provided by the pump system Manufacturer. Comprehensive instructions supplied at the time of shipment shall enable personnel to properly operate and maintain all equipment supplied. Content and instructions shall assume operating personnel are familiar with pumps, motors, piping and valves, but lack experience on exact equipment supplied.
2. Documentation shall be specific to the pumping equipment supplied and collated in functional sections. Each section shall combine to form a complete system manual covering all aspects of equipment supplied by the Manufacturer. Support data for any equipment supplied by others, even if mounted or included in overall system design, shall be provided by those supplying the equipment. Instructions shall include the following as a minimum.
 - a. Functional description of each major component, complete with operating instructions.
 - b. Instructions for operating pumps.
 - c. Support data for commercially available components not produced by the system Manufacturer, but supplied in accordance with the specifications, shall be supported by literature from the prime Manufacturer and incorporated as appendices.
 - d. Mechanical layout drawing of the pumping equipment and components, prepared in accordance with good commercial practice, shall provide installation dimensions and location of all pumps, motors, valves and piping.
3. Operation and maintenance instructions, which rely on vendor cut-sheets and literature, which include general configurations, or require operating personnel to selectively read portions of a manual shall not be acceptable. Operation and maintenance instructions must be specific to equipment supplied in accordance with these specifications.

D. Manufacturer's Field Performance Test Report: The Manufacturer's technical representative shall inspect the completed installation, correct or supervise the correction of any defect or malfunction, and instruct operating personnel in the proper operation and maintenance of the equipment. A written report covering the equipment startup shall be mailed from the Manufacturer's startup technician directly to the Engineer. At a minimum, the report shall include:

1. Nameplate information.

2. Recordings of gauge readings, static discharge head, and total dynamic head for each pump.
3. Recordings of operating speed for each pump, measured with a tachometer.
4. Recordings of wetwell levels during field performance tests.
5. Certification that equipment has been properly installed and lubricated and is in accurate alignment.
6. Certification that the v-belt drive system has been properly aligned using a laser alignment instrument and that v-belts have been tensioned using a belt tensioning instrument.
7. Results of electrical tests including voltage readings and amperage readings of all motors.
8. Certification that the equipment has been operated fully loaded and that it operated satisfactorily.
9. Outline in detail any deficiencies noted and proposed remedial corrections.
10. Include the following photographs in the startup report:
 - a. Overall pump station job site
 - b. Pumps and motors
 - c. Discharge header piping
 - d. Pump control panel - closed door
 - e. Pump control panel - open door
 - f. Wetwell

1.03 QUALITY ASSURANCE

- A. Manufacturer's Qualifications: Upon request from the Engineer, the pumping equipment Manufacturer shall demonstrate the following:
 1. Proof of financial stability and ability to produce the pumping equipment within the specified delivery schedules.

2. Evidence of the facilities, equipment, and expertise to demonstrate the Manufacturer's commitment to long-term customer service and project support.
 3. Evidence of adequate local and factory spare parts inventory to provide timely delivery of spare parts.
 4. Evidence that the pump Manufacturer is an Underwriters Laboratories (UL) panel builder.
 5. Evidence that the pumps and pumping equipment are constructed, assembled and tested in the United States by the pump Manufacturer. All pump parts including the casing shall be machined at the pump Manufacturer's facility located within the United States.
 6. To ensure compatibility to existing tools and equipment, all pump internal and external nuts, bolts, and hardware, shall be Unified Thread Standard (UNC coarse series) per ASME/ANSI standards.
 7. Consideration shall be given only to pump Manufacturers meeting the following qualifications:
 - a. Twenty-five years minimum experience successfully producing pumping equipment of the type specified herein.
 - b. A minimum of twenty-five installations of pumping equipment of the type specified herein in successful operation for a minimum of ten years.
 8. Pump Manufacturer must be ISO 9001:2000 certified, with scope of registration including design control and after sales activities.
- B. Manufacturer's Representative Qualifications: Upon request from the Engineer, the equipment Manufacturer's local representative shall demonstrate the following:
1. Evidence of adequate local spare parts inventory to provide timely delivery of spare parts.
 2. Evidence of established locally based factory-trained service personnel.
 3. Evidence that representative offers comprehensive equipment service agreements for the equipment specified.
 4. List of at least ten local municipalities with installations like the specified equipment.

5. Evidence that the representative offers full-day operator training seminars on Centrifugal Pump Maintenance and Troubleshooting.
6. Evidence that the representative offers technical design assistance and hydraulic recommendations for pump station design.
7. Certification from Manufacturer that the service technician has been factory-trained and is authorized for such duties by the Manufacturer.

C. Pump Performance:

1. Design and construct the pumps in accordance with standards of the Hydraulic Institute. The efficiency of the pumps, when operating under conditions of the specified capacities and heads shall be as near peak efficiency as practicable.
2. Design the pumps designated as self-priming centrifugal to pump raw sewage containing solids up to ten percent and stringy materials with a minimum of clogging.
3. Pump motors shall be capable of operating with reduced voltage solid state (RVSS) motor starters and variable frequency drives (VFDs) as specified in Division 17 to ensure a fully functional system.

D. Source Quality Control:

1. Obtain pumping equipment, motors, and appurtenances from the pump Manufacturer whose responsibility it is to ensure that the pumping equipment is properly furnished, coordinated, and tested in accordance with these specifications.
2. The Manufacturer of the pumping equipment shall provide a listing of similar self-priming sewage pumping systems located in the Delaware-Maryland-New Jersey-Pennsylvania area, for review by the Engineer. This listing shall include locations and contract names. Project references provided should include similar size self-priming pumps utilized with the controls specified.

1.04 MANUFACTURER'S WARRANTY

- A. All components of the pumping equipment shall be manufactured, assembled and tested as a unit by the pump Manufacturer. The pumping equipment must be a standard catalog item with the Manufacturer. The pump Manufacturer shall assume system responsibility, i.e. the pumping equipment must be warranted by the Manufacturer as described herein. Individual component warranties are desirable; however, individual warranties honored solely by the manufacturers of each component will not be acceptable.

- B. The pump Manufacturer shall warrant all equipment to be of quality construction, free of defects in material and workmanship. A written warranty shall include specific details described below:
1. The pumps shall be warranted for a period of five (5) years, with no hour limitation, non-prorated. The warranty shall become effective on the date of acceptance by the purchaser or the purchaser's authorized agent, or sixty (60) days after installation, or ninety (90) days after shipment from the factory, whichever occurs first.
 2. All equipment, apparatus, and parts furnished shall be warranted for two (2) years, excepting only those items that are normally consumed in service, such as oils, grease, packing, gaskets, O-rings, etc. The pump Manufacturer shall be solely responsible for warranty of the pumping equipment components when installation and operation and maintenance is performed in accordance with the Manufacturer's recommendation.
 3. Components failing to perform as specified by the Engineer, or as represented by the Manufacturer, or as proven defective in service during the warranty period, shall be replaced, repaired, or satisfactorily modified by the Manufacturer without cost of parts or labor to the Owner.

PART 2 - PRODUCTS

2.01 PUMPS

A. Pump Description:

1. Pumps shall be Gorman-Rupp Model T10A3S-B horizontal, self-priming, centrifugal pumps, specifically designed for pumping raw, unscreened, domestic sanitary sewage or approved equal. Three (3) pumps shall be installed.
2. All openings, internal passages, and internal recirculation ports shall be large enough to permit the passage of the specified spherical solids passing capacity, and any trash or stringy material which may pass through the average wastewater collection system. Screens or any internal devices that create a maintenance nuisance or interfere with priming and performance of the pump are not permitted.

3. The pumps shall have the following characteristics:

a.	Suction connection, flanged, in	10
b.	Discharge connection, flanged, in	10
c.	Minimum shutoff head, each pump, ft	128
d.	Pump speed, rpm	1325
e.	Maximum NPSH required at design point, ft	6.0
f.	Minimum reprime lift capability, ft	22
g.	Spherical solids passing capability, in. diameter	3.0
h.	Motor horsepower	75
i.	Motor speed, rpm	1750
j.	Impeller diameter, in	14.75

B. Pump Performance:

1. Each pump must have the necessary characteristics and be properly selected to perform under these operating conditions:

a.	Capacity, GPM	1,650
b.	Total dynamic head, ft	98
2. Consideration shall be given to the sanitary sewage service anticipated, in which occasionally debris will lodge between the pump suction check valve and seat, resulting not only in loss of the suction leg, but also in the siphoning of liquid from the pump casing to the approximate center line of the impeller. Such occurrence shall be considered normal with proper installation of air release line to atmosphere.
3. In consideration of such occurrence and of the unattended operation anticipated, each pump shall be so designed as to retain adequate liquid in the pump casing to ensure unattended automatic repriming while operating at its rated speed in a completely open system without suction check valves and with a dry suction leg.
4. Pumps shall be capable of operating at a reduced speed such that they can pump 700 GPM continuously without cavitation, clogging, vibration, or other operational problems. Minimum reduced speed setpoint shall be such that they pump 960 GPM continuously to maintain a velocity of 2 feet per second in the force main.

C. NPSH available:

1. 13.5 feet @ 1,650 GPM
2. 12.2 feet @ 2,600 GPM

D. Reprime Performance:

1. Each pump must be capable of the specified reprime lift while operating at the selected speed and impeller diameter. Reprime lift is defined as the static height of pump suction centerline above liquid that the pump will prime; and delivery within five minutes on liquid remaining in the pump casing after a delivering pump is shut down with the suction check valve removed. Systems requiring ancillary vacuum generating devices are not acceptable. Additional standards under which reprime tests shall be run are:
 - a. Piping shall incorporate a discharge check valve downstream from the pump. Check valve size shall be equal (or greater than) the pump discharge diameter.
 - b. A 10-foot length of 1-inch pipe shall be installed between pump and discharge check valve. This line shall be open to atmosphere to duplicate the air displacement rate of a typical pump system fitted with an air release valve.
 - c. No restrictions shall be present in pump or suction piping that could serve to restrict the rate of siphon drop of the suction leg. Suction pipe configuration for reprime test shall incorporate a minimum horizontal run of 2 feet and one 90-degree elbow.
 - d. The pipe size used for the reprime performance test shall be the same size as the pump suction diameter.
 - e. Impeller shall be set at the clearances recommended by the Manufacturer in the pump service manual.
 - f. Reprime lift repeatability shall be demonstrated by five sequential reprime cycles.
 - g. Liquid to be used for reprime test shall be water.

E. Serviceability:

1. The pump Manufacturer shall demonstrate to the Engineer's satisfaction that due consideration has been given to reducing maintenance costs by incorporating the following features:
 - a. No special tools shall be required for replacement of any components within the pump. Threaded fasteners shall be of the Unified National Standard type.

- b. The mechanical seal shall be a one-piece cartridge type to allow for easy replacement. Mechanical seals requiring assembly of individual components are not acceptable.
- c. The pump must be equipped with a removable cover plate, allowing access for service and repair without removing suction or discharge piping.
- d. The pump shall be fitted with a replaceable wear plate. Replacement of the wear plate, impeller, seal, and suction check valve shall be accomplished through the removable cover plate without removing suction or discharge piping.
- e. The entire rotating assembly, which includes bearings, shaft, seal, and impeller, shall be removable as a unit without removing the pump volute or piping.
- f. Each pump shall incorporate a suction flap valve that can be removed or installed through the removable cover plate opening, without disturbing the suction piping. Sole function of the suction flap valve shall be to eliminate re-priming with each cycle. Pumps requiring suction flap valves to prime or reprime are not acceptable.
- g. Atmospheric isolation: The shaft bearings shall be isolated from the seal cavity with an air gap to provide positive protection of the bearings in the event of a seal leak and to provide for external monitoring of the seal integrity.
- h. Adjustment of the impeller face clearance (distance between impeller and wear plate) shall be accomplished by external means. The adjusting mechanism shall provide a means to make discrete calibrated movements in increments of 0.005 inches. No special tools, measuring devices, feeler gauges, or other tools shall be required to make these impeller-to-wear plate clearance adjustments.
- i. Clearances between the impeller and wear plate shall be maintained by a 4-point external shim-less cover plate adjustment system with four, collar and adjusting screws. Provide 4-point incremental clearance adjustment. Each of the four points shall be lockable to prevent inadvertent clearance increases or decreases due to equipment vibration. The 4-point system shall provide equal clearance gaps at all points between the impeller and wear plate. Systems that require realignment of belts, couplings, sheaves, etc., each time a clearance adjustment is performed are not acceptable. Cover plate shall be capable of being removed and reinstalled without disturbing the clearance settings.

Clearance adjustment systems that utilize less than a 4-point system will not be considered.

- j. There shall be provisions for additional clearance adjustment in the event adjustment tolerances are depleted from the cover plate side of the pump. The removal of stainless steel shims from the rotating assembly side of the pump shall allow for further adjustment as described above.
- k. Clearance adjustment which requires movement of the shaft only, thereby adversely affecting seal working length or impeller back clearance, are not acceptable.

F. Construction:

- 1. The pump, excluding the base frame and motor, shall be manufactured of iron that is melted and cast in the United States.
- 2. Pump design: Pumps shall be the original design of the pump Manufacturer.
- 3. Hardware: All hardware, nuts and bolts, shall be Unified Thread Standard (UNC coarse series) per ASME/ANSI standards.
- 4. Pump casing: Made of Gray Iron 30, shall be foot supported, and shall have a horizontal centerline suction and vertical discharge.
 - a. The casing shall have a top mounted 3¹/₂-inch priming fill port with a safety lock bar cover. In consideration for safety, hand nut threads must provide slow release of pressure, and the clamp bar shall be retained by detent lugs. A Teflon gasket shall prevent adhesion of the fill port cover to the casing.
 - b. Casing shall have no openings of smaller diameter than the specified sphere size.
 - c. Casing shall be designed to retain sufficient liquid to ensure automatic repriming and unattended operation.
 - d. A minimum 1¹/₄-inch diameter drain hole shall be provided for attachment of the pump drain kit and to ensure complete and rapid draining.
 - e. Bolts and other threaded fasteners shall have Unified National Standard threads.
 - f. Suction flap valve: Molded neoprene with integral steel and nylon reinforcement. A blow-out center shall protect the pump casing from

hydraulic shock or excessive pressure. Removal or installation of the check valve must be accomplished through the cover plate opening without disturbing the suction piping. Sole function of the suction flap valve shall be to save energy by eliminating need to reprime after each pumping cycle. Pumps requiring a suction check valve to assist reprime are not acceptable.

- g. Pump shall be provided with a separate capped threaded port for use of an optional casing heater.
5. Cover plate: Cover plate shall be Gray Iron 30.
- a. Retained by four (4) hand nuts for complete access to pump interior. Cover plate removal must provide ample clearance for removal of stoppages, and allow removal or service of the impeller, seal, wear plate or suction flap valve.
 - b. Replaceable wear plate: A replaceable front wear plate secured to the pump casing. The wear plate shall be ductile iron. The wear plate shall be of sufficient width to maintain the manufacturer's recommended clearance between the entire edge of each impeller vane and the wear plate. The wear plate shall be clamped between a machined shoulder in the pump casing and the suction head flange. The wear plate shall be provided with integral pusher bolt capability for easy removal.
 - c. In consideration for safety, a pressure relief valve shall be supplied in the cover plate. Relief valve shall open at 75 psi.
 - d. Easy-grip handle shall be mounted to face of cover plate.
6. Rotating assembly:
- a. Impeller: Two-vane, semi-open, non-clog, cast in Ductile Iron 65-45-12 with integral pump out vanes on the back shroud. Impeller shall thread onto the pump shaft and be secured with a lockscrew.
 - b. Shaft: Shaft shall be constructed of Alloy Steel No. 4150 and shall employ an Alloy Steel No. 4130 shaft sleeve.
 - c. Mechanical seal: A mechanical cartridge seal shall seal the pump shaft against leakage. The stationary sealing member and the mated rotating face shall be tungsten titanium carbide. Each of the mated surfaces shall be lapped to a flatness of three light bands (35 millionths of an inch), as measured by an optical flat under monochromatic light. The stationary seal seat shall be double floating so that faces will not lose alignment during periods of shock loads that will cause deflection, vibration, and axial movement of the

pump shaft. The seal shall be warranted for five (5) years from date of shipment.

- d. Lubrication: Separate oil filled cavities, vented to atmosphere, shall be provided for shaft seal and bearings. Oil cavities must be cooled by the liquid pumped. Three lip seals will prevent leakage of oil.
 - (1) The bearing cavity shall have an oil level sight gauge and fill plug with check valve. The clear sight gauge shall provide easy monitoring of the bearing cavity oil level and condition of oil without removal of the fill plug. The check valve shall vent the cavity but prevent introduction of moist air to the bearings.
 - (2) The seal cavity shall have an oil level sight gauge and fill plug with vent. The clear sight gauge shall provide easy monitoring of the seal cavity oil level and condition of oil without removal of the vented fill plug.
 - (3) Double lip seal shall provide an atmospheric path providing positive protection of bearings, with capability for external drainage monitoring.
- e. Atmospheric isolation: The shaft bearings shall be isolated from the seal cavity with an air gap to provide positive protection of the bearings in the event of a seal leak and to provide for external monitoring of the seal integrity.
- f. Seal plate: Replaceable seal plate shall be constructed of Gray Iron and shall be bolted to the bearing housing.
- g. Back wear plate: Replaceable back wear plate shall be constructed of carbon steel, and shall be secured to the seal plate by four welded studs and nuts.
- h. Shaft bearings: Shall be anti-friction ball bearings, of ample size and proper design to withstand all radial and thrust loads which can reasonably be expected during normal operation. Pump designs in which the same oil lubricates both the shaft bearings and the shaft seal are not acceptable.
- i. Pusher bolt capability to assist in removal of rotating assembly. Pusher bolt threaded holes shall be sized to accept same capscrews as used for retaining rotating assembly.

7. Discharge spools: Each pump shall be equipped with one-piece, cast iron spool, flanged on each end. Each spool shall have one 1¹/₄-inch NPT and one 1/4-inch NPT tapped hole with pipe plugs for mounting of gauges or other instrumentation.

2.02 PUMP ACCESSORIES

A. Spare Parts: Furnish the following spare parts:

1. Three (3) Spare Parts Kits each including one (1) mechanical cartridge seal, one (1) set of rotating assembly adjustment shims, one (1) cover plate O-ring, one (1) rotating assembly O-ring;
2. One (1) complete rotating assembly;
3. One (1) impeller;
4. One (1) front wear plate;
5. One (1) impeller shaft;
6. One (1) impeller socket head capscrew;
7. One (1) impeller washer;
8. Three (3) suction flap valve assemblies;
9. One (1) belt tensioning gauge(s) - spring loaded;
10. Two (2) quart(s) of seal lubricant;
11. Two (2) air release valve diaphragms;
12. Two (2) air release valve springs;
13. One (1) ARV spring compression tool;
14. One (1) gallon touch-up paint, white; and
15. One (1) quart touch-up paint, safety orange

B. Pump Drain Kit:

1. A pump drain kit shall be provided, including the following:
 - a. One set of drain fittings for each pump. Each set of drain fittings includes a pipe nipple, bushing, bronze ball valve and aluminum quick connect male Kamlock fitting.

- b. One drain hose for common use among all pumps. Drain hose shall consist of plastic hose with an aluminum quick connect female Kamlock fitting on one end. Routing of drain hose shall be so as to not interfere with any equipment or be a tripping hazard. Drain hose length shall be sufficient to drain to the sump pit based upon the routing above.
 - 2. All fittings shall be supplied as stainless steel, unless specified otherwise above.
- C. High Pump Temperature Sensor:
 - 1. Each pump shall have a Normally-Open high pump temperature sensor, which shall close upon pump temperature reaching 140°F. The sensor shall be wired to the pump control panel.

2.03 VALVES AND PIPING

- A. Check Valves, 10-inch x 12-inch:
 - 1. Each pump shall be equipped with a full flow type check valve, each capable of passing a 3" spherical solid, with flanged ends and be fitted with an external lever and spring. The valve seat shall be constructed of stainless steel and shall be replaceable. The valve body shall be cast iron. The valve shall be equipped with a removable cover plate to permit entry for complete removal and replacement of internal components without removing the valve from the line. Valve clapper shall have a molded neoprene seating surface incorporating low pressure sealing rings. Valve hinge pin and internal hinge arm shall be stainless steel supported on each end in brass bushings, sealing bushing shall have double o-rings. O-rings shall be easily replaceable without requiring access to interior of valve body. Valve shall be rated at 175 psi water working pressure, 350 psi hydrostatic test pressure. Valves other than full flow type or valves mounted in such a manner that prevents the passage of a 3" spherical solid are not acceptable.
 - 2. Each check valve shall be provided with a ¼-inch threaded tap with plug on the downstream side of the valve for installation of a pressure gauge.
- B. Air Release Valves (Diaphragm Type):
 - 1. Each pump shall be equipped with one pressure actuated automatic air release valve, designed to permit the escape of air to the atmosphere during initial priming or unattended repriming cycles. Upon completion of the priming or repriming cycle, the valve shall close to prevent recirculation. Valves shall provide visible indication of valve closure and shall operate solely on discharge pressure. Level/float actuated air release valves are not acceptable.

2. All valve parts exposed to sewage shall be constructed of cast iron, stainless steel, or similar corrosion resistant materials. Diaphragms shall be fabric-reinforced neoprene or similar inert material.
3. A cleanout port, 3 inches or larger in diameter, shall be provided for ease of inspection, cleanout, and service.
4. Valves shall be field adjustable for varying discharge heads.
5. Air release valves shall be connected to pump station piping using stainless steel pipe fittings.
6. Each air release valve shall be provided with an isolation ball valve.
7. Air release valve piping must discharge directly into wetwell. Air release valve piping shall not discharge to a sump.
8. Each air release valve shall have a separate air release discharge pipe back to the wetwell. Discharge pipe shall be minimum 1½-inch diameter.

C. Supports and Thrust Blocks:

1. Contractor must ensure all pipes connected to the pumping system are supported to prevent piping loads from being transmitted to pumps or system piping.
2. Pump station discharge force main piping shall be anchored with thrust blocks by the Contractor where shown on the drawings.

D. Gauge Connection Assembly:

1. The header piping shall be equipped with a gauge connection assembly located between the discharge check valve and force main isolation gate valve allowing the Operator to easily attach a discharge gauge on any pump for troubleshooting.
2. The gauge assembly shall consist of a ¼-inch brass pipe nipple, ¼-inch brass full port ball valve and a quick connect fitting.
3. The gauge connection assembly shall be installed in the discharge header piping such that the static and dynamic pressure in the force main can be read unless the force main isolation gate valve is closed for that pump.

2.04 FABRICATED STEEL BASE

- A. One fabricated steel base shall be provided for each pump and motor assembly. The base shall comprise a base plate, perimeter flange, and reinforcements. Base plate shall be fabricated of steel not less than ¼" thick, and shall incorporate openings for access to all internal cavities to permit complete grouting of unit base after installation. Perimeter flange and reinforcements shall be designed to prevent flexing or warping under operating conditions. Base plate and/or flange shall be drilled for hardware used to secure unit base to concrete pad as shown on the Contract Drawings. Unit base shall contain provisions for lifting the complete pump unit during shipping and installation.

2.05 DRIVE UNIT

- A. Motors:
 - 1. Provide motors as specified herein.
 - 2. The pump motors shall be horizontal, totally enclosed fan cooled, explosion-proof, induction type, with normal starting torque and low starting current characteristics.
 - 3. Motors shall be approved for use in areas classified by NEC as Class I, Div, 1, Group C & D Hazardous Locations, as defined and approved by UL and/or FM.
 - 4. The specified maximum motor horsepower shall be adequate so that the pump is non-overloading throughout the entire non-truncated pump performance curve from shut-off through run-out. Motor overloads resulting from pump performance that exceed the design point within acceptable HI Standards will not be accepted.
 - 5. Motors shall be suitable for use with RVSS starters and VFDs.
 - 6. Motors shall be tested in accordance with provisions of ANSI/IEEE Std. 112.
 - 7. Each motor shall be in current NEMA Design B cast iron frame with copper windings.
 - 8. Motors shall be NEMA Premium Efficient, per NEMA MG-1, Table 12-12.
 - 9. Motors shall be supplied with winding thermostat switches, one per phase.

B. Drive Transmission:

1. Power shall be transmitted from motors to pumps by means of v-belt drive assemblies. The drive assemblies shall be selected to establish proper pump speed to meet the specified operating conditions.
2. Each drive assembly shall have a minimum of two v-belts. In no case will a single belt drive be acceptable. Each v-belt drive assembly shall be selected on the basis that adequate power will be transmitted from driver to pump. Drive systems with a Safety Factor of less than 1.5 will not be considered sufficient for the service intended. Computation of the Safety Factor shall be based on performance data published by the drive manufacturer.
3. V-belts shall be the banded type.

C. Belt Guards:

1. Pump drive transmissions shall be enclosed on all sides in a guard constructed of any one or combination of materials consisting of expanded, perforated, or solid sheet metal, except that maximum perforated or expanded openings shall not exceed ½-inch.
2. Guards shall be manufactured to permit complete removal from the pump unit without interference with any unit component and shall be securely fastened to the unit base.
3. All metal shall be free of burrs and sharp edges. Structural joints shall be continuously welded. Panels may be riveted to frames with not more than 5-inch spacing. Tack welds shall not exceed 4-inch spacing.
4. The guard shall be finished with one coat of gray water reducible (W.R.) non-lift primer and one coat of orange acrylic alkyd W.R. enamel in accordance with Section 3, Color Definitions of ANSI 253.1; Safety Color Code for Marking Physical Hazards.

2.06 FINISH

A. Surface Preparation and Painting:

1. Pumps, piping, and exposed steel framework shall be cleaned prior to coating, using an approved solvent wipe or phosphatizing cleaner. The part must be thoroughly dry before paint application. Open joints shall be caulked with an approved polyurethane sealant.
2. Exposed surfaces shall be coated with one coat of Tnemec Series 69 Polyimide Epoxy Primer and one finish coat of Tnemec Series 73 Aliphatic

Acrylic Polyurethane for a total dry film thickness of 4-6 mils. Finish coat shall be semi-gloss white for optimum illumination and enhancement.

3. The finish coat shall be corrosion, moisture, oil, and solvent resistant when completely dry.
4. The factory finish shall allow for over-coating and touch up for 6 months after coating. Thereafter, sanding may be required to accept a topcoat or touch-up coating.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Contractor shall off-load equipment at installation site using equipment of sufficient size and design to prevent injury or damage. Pumping equipment Manufacturer shall provide written instructions for proper handling. Immediately after off-loading, Contractor shall inspect pumping equipment and appurtenances for shipping damage or missing parts.
- B. Any damage or discrepancy shall be noted in written claim with shipper prior to accepting delivery. Validate all serial numbers and parts lists with shipping documentation. Notify Manufacturer's representative of any unacceptable conditions noted with shipper.

3.02 INSTALLATION

- A. Install, level, and align pump station as indicated on drawings or as directed by the Engineer. Installation must be in accordance with written instructions supplied by the Manufacturer.
- B. Suction pipe connections must be vacuum tight. Fasteners at all pipe connections must be tight. Install pipe with supports and thrust blocks to prevent strain and vibration on pump system piping. Install and secure all service lines (level control, air release valve and pump drain lines), as required, in wetwell.
- C. Provide adequate clearance for removal of pump rotating assembly and cover plate.
- D. Each air release valve shall have a separate air release discharge pipe back to the wetwell. Discharge pipe shall be minimum 1½-inch diameter, and installed with constant downward slope towards the wetwell. Pipe shall be routed so as not to interfere with any equipment or be a tripping hazard.
- E. Check motor and control data plates for compatibility to site voltage. Install and test the electrical ground prior to connecting line voltage to pump control panel.

- F. Prior to applying electrical power to motors or control equipment, check all wiring for tight connection. Verify that fuses and circuit breakers conform to project requirements. Manually operate circuit breakers and switches to ensure operation without binding. Open all circuit breakers and disconnects before connecting utility power. Verify line voltage, phase sequence and ground before actual startup.
- G. After all anchor bolts and piping connections are installed, seal all openings between wetwell and pump station building.
- H. If determined by the Engineer and/or Manufacturer at startup, that grouting the pump/motor base is needed, the Contractor shall be responsible to install grout to the pump/motor base. If grout is installed, the Contractor shall ensure that the grout does not interfere with the pump/motor/belt guard adjustment or mounting hardware.

3.03 PROTECTION

- A. The pumping equipment shall be placed into service soon after delivery of the equipment. If installation is delayed, the pumping equipment and motor control center shall be stored indoors, free of excessive dust, in a low humidity, heated environment.
- B. During installation and after the pumping equipment is placed into operation the motor control center shall operate in an environment free of excessive dust, in a low humidity, heated environment.

3.04 FIELD QUALITY CONTROL

- A. Prior to acceptance by the Owner, an operational test of the pump station, including the pumps, drives, control systems and all ancillary equipment and systems, shall be conducted to determine if the installed equipment meets the purpose and intent of the specifications. Tests shall demonstrate that all equipment is electrically, mechanically, structurally, and otherwise acceptable; is safe and in optimum working condition; and conforms to the specified operating characteristics.
- B. Prior to startup, Contractor shall clean wetwell by removing construction debris and foreign material.

3.05 MANUFACTURER'S PRE-STARTUP INSPECTION

- A. Contractor shall coordinate system pre-startup with Manufacturer's factory-trained service technician. The factory-trained service technician shall inspect the installation and answer any installation questions by the Contractor, Engineer, or Owner.

- B. Manufacturer's representative shall provide pre-startup checklist to be completed by the Contractor prior to pre-startup inspection.
- C. Verify that Operation & Maintenance Manual is on site and installation instructions contained in the manual have been followed.
- D. Verify that all pumping equipment, piping, level control system, alarms and ancillary equipment have been properly installed and all wiring is complete.
- E. Verify that spare parts for the pumping equipment are on site.
- F. Pre-startup inspection shall be a separate trip and shall not be less than two weeks prior to the startup of the equipment.

3.06 MANUFACTURER'S STARTUP AND FIELD PERFORMANCE TESTING

- A. Coordinate system startup with Manufacturer's factory-trained service technician. The factory-trained service technician will inspect the completed installation, calibrate and adjust instrumentation, and correct or supervise correction of defects or malfunctions. Startup shall be performed in the presence of the Owner.
- B. Contractor shall supply clear water of adequate volume to operate the system including the force main through several pumping cycles.
- C. Contractor shall have an electrician present at startup to resolve any wiring issues.
- D. Observe and record operation of pumps, suction and discharge pressure gage readings, voltage readings, ampere draw, pump controls, and liquid level controls. Check calibration of all instrumentation equipment. Test manual and automatic control systems. Test all alarms. Report and remedy any undue noise, vibration or other operational problems.
- E. Startup shall be a separate trip.

3.07 MANUFACTURER'S OPERATION AND MAINTENANCE TRAINING

- A. The Manufacturer shall furnish the services of a qualified, factory-trained operations and maintenance serviceman to instruct and train Owner's personnel in the proper care, operation and maintenance of the equipment. The training shall include, but not be limited to, the following:
 - 1. Theory of operation.
 - 2. Actual operation.
 - 3. Mechanical maintenance.

4. Hydraulic troubleshooting.
 5. Safe operating and working practices and operation of safety devices.
- B. One (1) training session is required. Training shall be completed after startup services have been performed. Training shall be a separate trip and shall not be less than two weeks after the startup of the equipment. Time, location, and duration of all training sessions shall be coordinated with Owner's personnel.
 - C. Hands-on training and demonstrations shall use the installed equipment.
 - D. Supplier shall provide all materials for training and shall provide training manuals to all personnel being trained.

3.08 MANUFACTURER'S EQUIPMENT RE-CERTIFICATION

- A. Manufacturer's factory-trained service technician shall return to the site six (6) months after initial startup of the equipment to perform a final re-certification of the equipment.
- B. The re-certification shall consist of demonstrating and certifying that the equipment is meeting the performance requirements of the specifications. Equipment service technician shall perform field-testing of the equipment in the presence of the Owner. Results of all field-testing shall be submitted to the Engineer and the Owner.

3.09 MANUFACTURER CALL-BACKS

- A. In addition to the services specified above, the Contractor shall cover the cost in his bid for two (2) on-site call-backs to be provided to the Owner by the manufacturer's factory-trained service technician.
- B. Call-backs may be used anytime, up to one (1) year from the date of startup. Each call-back shall be a separate trip, consisting of up to eight (8) hours on-site.
- C. Use of manufacturer's call-backs shall be at the sole discretion of the Owner. Call-backs may be used for equipment repair, warranty evaluation, routine maintenance, operator training, etc.

3.10 CLEANING AND HOUSEKEEPING

- A. Prior to acceptance, inspect interior and exterior of pump station for dirt, splashed material or damaged paint. Clean or repair accordingly. Use touch-up paint to repair any painted surfaces damaged during installation or startup. Remove from the job site all tools, surplus materials, scrap and debris.

END OF SECTION

SECTION 11330

INFLUENT SEWAGE GRINDER

PART 1 - GENERAL

1.01 SUMMARY

- A. This section describes the influent sewage grinder and motor controller. The equipment shall be installed as shown on the plans, as recommended by the manufacturer, and in compliance with all OSHA, MOSHA, and local, state and federal codes and regulations. Grinder frame shall be designed to support the grinder, as shown on the plans. Grinder frames shall also be designed to accommodate an influent sluice gate, when shown in combination on the plans.
- B. Contractor shall provide all equipment, material, labor, tools and services necessary to furnish and install one (1) sewage grinder, complete with explosion-proof immersible motor, stainless steel guiderails, and all other appurtenances and accessories for a complete installation.
- C. The intended purpose of the grinder is to grind up the solids typically found in raw, unscreened sewage into small particles with a maximum theoretical size of 0.5" x 1.5" x 1.5" under the conditions and installation described in the Contract Documents.

1.02 SUBMITTALS

- A. Shop Drawings: Equipment descriptions, specifications, dimensional and assembly drawings, parts lists, and job specific drawings, including wiring diagrams. Include complete electric submersible motor data.
- B. Operation and Maintenance Manuals: The manuals shall include equipment descriptions, operating instructions, drawings, troubleshooting techniques, a recommended maintenance schedule, recommended lubricants, and complete overhaul information for all components of the system.
- C. Manufacturer's Warranty: Shall be for a period of two (2) years, with no hour limitation, non-prorated, from the date Contractor achieves Substantial Completion for the project. The warranty shall cover grinder and motor against defects in materials and workmanship, including all parts and factory or authorized service facility labor. The Contractor shall provide a certificate for inclusion in the O&M Manuals documenting the Manufacturer's date of warranty commencement (Contractor's Substantial Completion date) and expiration (two years hence).

D. Equipment Guarantee Certification Form

In addition to the manufacturer's warranty for the grinder equipment, the Contractor shall obtain and submit to the Engineer and Owner certification from the grinder manufacturer that the grinder meets the requirements of the intended application and contract drawings and specifications. This certification shall be provided by way of the Equipment Guarantee Certification Form included herewith.

EQUIPMENT GUARANTEE CERTIFICATION FORM

Reference: **New Creamery Road Sewage Pump Station
Town of Emmitsburg, Maryland**

THE UNDERSIGNED HEREBY ATTESTS THAT HE/SHE HAS EXAMINED ALL APPLICABLE CONTRACT DRAWINGS AND SPECIFICATIONS, AND CERTIFIES THAT THE EQUIPMENT THAT HE/SHE PROPOSES TO FURNISH AND DELIVER MEETS OR EXCEEDS CONTRACT SPECIFICATIONS, IS SUITABLE FOR THE INTENDED PURPOSE STATED IN SPECIFICATION SECTION **11330**, IS SUITABLE FOR INSTALLATION AS PRESENTED IN THE CONTRACT DRAWINGS AND SPECIFICATIONS, AND WILL PROVIDE SATISFACTORY PERFORMANCE AT THE DESIGN CRITERIA SPECIFIED. THIS GUARANTEE OF SUITABILITY FOR INTENDED PURPOSE IS IN ADDITION TO AND SHALL NOT BE IN LIEU OF ANY OTHER WARRANTIES, EXPRESSED OR IMPLIED.

EQUIPMENT: **INFLUENT SEWAGE GRINDER**

MANUFACTURER: _____

Address: _____

By: _____
(Typed Name and Title)

_____/s/_____
(Signature) (Date)

(SEAL)

Equipment Guarantee Certification must be signed by a Principal Person (President, Vice-President, etc.) of the equipment manufacturer. In the event the manufacturer is not the Supplier then a Principal Person of the Supplier must also sign this form.

SUPPLIER: _____

Address: _____

By: _____
(Typed Name and Title)

_____/s/_____
(Signature) (Date)

(SEAL)

1.03 QUALITY ASSURANCE

- A. Qualifications: Qualified manufacturers shall have a minimum 5 years experience at manufacturing two-shafted grinding equipment and motor controls with a minimum of 25 installations with similar equipment. Contractor shall provide a list of names and dates of installations for verification by the Engineer or Owner's Representative.
- B. Regulatory Requirements: Motor controllers shall, as applicable, meet the requirements of the following Regulatory Agencies:
 - 1. National Electrical Manufacturer's Association (NEMA) Standards.
 - 2. National Electrical Code (NEC).
 - 3. Underwriters Laboratory (UL).

1.04 DELIVERY, STORAGE AND HANDLING

- A. The equipment shall be packaged in containers constructed to protect all equipment from damage.
- B. Contractor shall comply with grinder manufacturer's written instructions for storage and handling.

1.05 IDENTIFICATION

- A. Each unit of equipment shall be identified with a stainless steel nameplate, securely affixed in a conspicuous place. Nameplate information shall include equipment model number, serial number, supplier's name, and location.

1.06 SPARE PARTS

- A. Contractor shall furnish the following spare parts for each grinder:
 - 1. Fuses (quantity of 3) of each size/type installed.
 - 2. Complete set of gaskets.
 - 3. Any special tools required for assembly or disassembly.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Grinders, immersible motors, motor controllers, support systems, frames, guide plates, guiderails, and all appurtenances and accessories shall be in compliance with these specifications and contract documents, and shall be JWC Environmental

Channel Monster Grinder Model CMD3210-XDS2.0 Wipes Ready, or Vogelsang Model XRG100-800QD HCS. Maximum Design Flow Capacity: 3,819 GPM (5.5 MGD)

- B. The manufacturer must certify that the unit can be returned for maintenance to the factory or a local repair facility. The certification shall include a statement that there will be no charge for repair labor.

2.02 SUPPORT SYSTEM

A. GENERAL

1. Provide channel frame of suitable dimension and strength to support grinder in place and direct flows from cutters to the wetwell. Channel frames shall also be designed to accommodate an influent sluice gate, when shown in combination on the plans. The channel frame shall be Type 316 stainless steel construction and firmly anchored to the wetwell wall.
2. An overflow bar rack for each grinder shall be provided to ensure screening upon failure of grinder. Overflow bar rack shall be integral to the channel frame.
3. A guiderail system for each grinder shall be provided to permit easy removal of grinder for maintenance. The manufacturer shall supply a 316 stainless steel lifting bail, such that there shall be no need for personnel to enter the wetwell.
4. Each installed grinder shall be furnished with a ¼-inch diameter 304 stainless steel wire rope as supplied by the Portable Equipment Hoist Manufacturer, a 316 stainless steel shackle, and a 316 stainless steel cable saddle for removing/installing the grinder. Each wire rope shall be of adequate length to cover the required anchor wraps, boom length, and distance between the boom end and pick point, while not exceeding the winch drum capacity. The saddle and shackle shall be of sufficient size to connect to the grinder, and of sufficient strength to not derate the Portable Equipment Hoist maximum lifting Capacity. The upper end of the cables shall be neatly hung and cable tied from a 316 stainless steel hook located within the access hatch opening.
5. An aluminum basket strainer for each grinder shall be provided for installation in the channel frame to ensure continued screening when the grinder is removed for maintenance or inspection.

2.03 GRINDER

A. GENERAL

1. Each grinder shall include cutters, spacers, shafts, bearings and seals, side

rails, end housings, covers, reducer and motor. One-piece monolithic rotors may be used instead of individual cutters and spacers.

2. The grinder shall be of two-shaft design and be capable of continuous operation, processing wet or dry. Bar screens or single-shaft devices utilizing a single rotating cutter bar with stationary cutters shall not be acceptable.
3. Two-shaft design shall consist of two parallel shafts alternately stacked with individual intermeshing cutters and spacers positioned on the shaft to form a helical pattern or equipped with monolithic cutter assemblies positioned on the shaft to form a helical pattern. The two shafts shall counter-rotate with the driven shaft operating at approximately two-thirds ($2/3$) the speed of the drive shaft. Cutter diameters on the drive shall be of equal diameter to ensure proper clean-out of the spacers.

B. COMPONENTS

1. Cutter Assembly shall be either,
 - a. Multi-Zone-Staggered and Helical Stack Configuration:
 - i. Cutters and spacers stacked with two defined zones, each with its own unique cutter and spacer type, thickness, stacking configuration, and material throughout zone. Zone 1 cutters for high abrasion resistance and Zone 2 cutter for shearing and particle size control.
 - ii. Zone 1-Grit Zone. Material Zone 1: Alloy Steel.
 - (1). Cutters: Through hardened to 45-52 HRC
 - (2). Spacers: Through hardened to 34-52 HRC.
 - iii. Cutters-Zone 1 (3-inch Grit Zone)-Staggered Stack
 - (1). 7-tooth Cam style, .438-inch effective thickness, 4.710-inch diameter. Designed specifically for waste streams containing heavy volumes of solids.
 - (2). Precision ground individual cutter elements with a thickness tolerance of $+.000/-.001$.
 - (3). Keyed to shaft with hexagon opening.
 - iv. Spacers-Zone 1 (3-inch Grit Zone)
 - (1). Smooth O.D. .446-inch thick, Alloy Steel.
 - (2). Precision ground individual spacer elements with a thickness tolerance of $+.001/-.000$.
 - (3). Keyed to shaft with hexagon opening.

- v. Configuration-Zone 1 (Grit Zone)
 - (1). Cutters and spacers form 3-inch nominal stack height
 - (2). Cutters stacked staggered with every other cutter's teeth aligned to minimize absorbed torque requirement and maximize cutter tooth force.

- vi. Zone 2-Working Zone. Material Zone 2: Alloy Steel.
 - (1). Cutters: Through hardened to 45-52 HRC
 - (2). Spacers: Through hardened to 34-52 HRC.

- vii. Cutters-Zone 2 (Working Zone)-Helical Stack
 - (1). 11-tooth Cam style, .310-inch thick, 4.710-inch diameter. Designed specifically for waste streams containing municipal waste and moderate volumes of solids.
 - (2). Precision ground individual cutter elements with a thickness tolerance of +.000/ -.001.
 - (3). Keyed to shaft with hexagon opening.

- viii. Spacers-Zone 2(Working Zone)
 - (1). Smooth O.D. .319-inch thick.
 - (2). Precision ground individual spacer elements with a thickness tolerance of +.001/ -.000.
 - (3). Keyed to shaft with hexagon opening.

- b. Or, Manufactured from a monolithic assembly
 - i. Cutting stack shall be a nominal height of 31.49 inches (800mm)
 - ii. Monolithic assembly constructed from a solid block of alloy steel surface ground to a blade thickness of .37-inches +.000/-.001 (9.5 mm +.000/-.003).
 - iii. Cutters shall be heat treated to produce a hardness of 60-65 Rockwell C.
 - iv. Cutters shall be nitrated for high corrosion resistance.
 - v. Cutters shall have eight cam shaped teeth.
 - vi. Cutter tooth height shall not be greater than ½-inch (13 mm) above the root diameter of the cutter.

- vii. Cutter assembly OD shall be 4.72-inches (120 mm) minimum. Spacer shall be cut into the monolithic cutter, and shall have a smooth outside diameter with no tooth profiles. Designs with multiple cutters and spacers shall not be acceptable.

2. Shafts

- a. Shafts shall be AISI 4140 alloy steel with a tensile strength rating of not less than 149,000 psi.
- b. Shafts shall measure a nominal 2 inches across flats of hex. Shafts shall have a minimum hardness of 38-42 Rockwell C.

3. Intermediate Shaft Support

- a. Intermediate shaft supports shall be 304 stainless steel, AISI 17-4 stainless steel and SAE 660 bearing bronze. Shaft supports shall be lubricated with high temperature marine grade grease at the factory.
- b. Grease fittings on the shaft supports shall be provided for periodic additions of grease.
- c. Intermediate shaft supports shall provide additional support to the shafts during severe grinding demands.
- d. Intermediate shaft yokes shall provide radial support to the shafts during severe grinding demands.
- e. Intermediate shaft yokes shall be constructed of 304 stainless steel, 660 bronze, and 17 4PH Stainless steel.
- f. Intermediate shaft yokes shall be factory lubricated with high temperature marine grade grease.
- g. Grease fittings shall be provided on intermediate shaft yokes for periodic maintenance.

4. Perforated Screen Drums

- a. Perforated Screen Drums
 - i. Screens cylindrically formed with ½ inch diameter holes (Orifices) with a nominal 50% open area across the surface of the screen.
 - ii. Maximum area of each orifice: 0.2 square-inches.
 - iii. Center of screen drum void of any shaft or obstruction.
 - iv. Screens deburred AISI 304 stainless steel.

- v. Trunnions top and bottom of screen drums ASTM A564 Grade 630 condition H1150 (17-4) stainless steel.
- 5. Shaft Bearings and Seals
 - a. Mechanical Seal and Bearing Cartridges-Severe Duty
 - i. Seals and bearing incorporated into a cartridge style design requiring no external seal flush or lubricants to operate wet or dry.
 - ii. Rated for maximum operating depth: 346 feet (150 psi).
 - iii. Secondary lip seal with grease barrier.
 - iv. Dynamic and Static seal faces to be Tungsten carbide with 6% nickel binder.
 - v. Cartridge bushing and housing are AISI 304 stainless steel.
 - vi. O-rings to be Viton (Fluorocarbon).
 - b. The bearings shall be housed in a replaceable cartridge that supports and aligns the bearings and seals, as well as protects the shafts and end housings. The seal elements shall be independent of the stack height therefore cutter stack tightness shall not affect seal performance. The seal elements shall maintain their factory set preload independent of the cutter stack tightness.
 - c. Seals shall meet required pressure rating regardless of cutter stack fit. The seal cartridge shall provide seal protection against axial loading on shafts and bearings during shaft deflection.
 - d. Each seal element shall be positively locked to its corresponding rotating or static cartridge element. This positive lock on the seal elements is critical.
- 6. Side Rails
 - a. The screen drum side rail shall create a baffle around part of the screen drum and support the mounting of a brush to seal the interface and clean solids from surface of screen drum.
 - b. Clearance between the cutter side rail and adjacent cutters shall not exceed 0.100 inch.
 - c. Cutter side rail shall have evenly-spaced Delta-P horizontal fingers to maximize flow and maximize capture of solids by cutter stack.
 - d. The side rails shall be cast of A536-84 ductile iron.

7. End Housings and Covers
 - a. End housings and top cover shall be ASTM A536-84 ductile iron or 1018 carbon steel housing segments. End housings shall have integral bushing deflector to guide solids from seal cartridges.
 - b. Bottom cover shall be ASTM A36 rolled steel.
8. Reducer
 - a. Reducer shall be internal planetary mechanism with cycloidal curved tooth profile. The speed reducer shall be grease-filled planetary-type of reducer with a 500% shock load capacity. The reduction ratio shall be 29:1. The input shaft of the reducer shall be directly coupled to the motor using a three-piece coupling, and the output shaft of the reducer shall be directly coupled with the grinder using a two-piece coupling.
 - b. Or, the grinder gearbox shall be a low speed, high-torque parallel shaft gearbox manufactured by Nord Gear. Maximum motor speed shall not exceed 1800 rpm, and should provide a minimum of 10% reserve hp as evidenced by specific requirements at maximum design.
9. Motor
 - a. The motor shall be a 5 hp immersible motor, capable of continuous submergence underwater without loss of watertight integrity to a depth of 40 feet for 40 days and continuous unsubmerged operation in air without overheating, rated for the electrical service shown on the electrical drawings. TECO-Westinghouse motors are not acceptable.
 - b. Motor service factor shall be 1.15, the efficiency factor not less than 91% at full load and the power factor not less than 74% at full load. Motor shall be U.L. rated NEMA 6P. Motor shall not utilize fan cooling at any time during operation. Motor shall use ceramic shaft seal requiring no oil lubrication.
10. Required Running Torque per Horsepower:
 - a. At Momentary Load Peaks: 3,995 in-lbs/hp

2.04 MOTOR CONTROLLER

A. GENERAL

1. The controller shall provide independent control of the grinder.

2. Controller shall be the supplier's standard UL listed Model PC2220 or UL listed XRG panel.
3. The controller shall be rated for the electrical service as shown on the electrical drawings and shall include a rotary panel disconnect/circuit breaker.
4. Controller shall have a minimum 10KAIC rating.

B. OPERATION

1. The controller shall be equipped with a GRINDER ON-OFF/RESET two (2) position selector switch.
 - a. In the OFF/RESET mode the grinder shall not run. In the ON mode the grinder will run.
 - b. The grinder shall only be reset by switching the GRINDER ON-OFF/RESET switch to the OFF/RESET position.

C. SAFETY FEATURES

1. When a grinder jam condition occurs in the grinder ON mode, the controller shall stop the grinder, and then reverse the grinder rotation to clear the obstruction. If the jam is cleared, the controller shall return the grinder to normal operation. Up to two (2) additional reversing cycles (3 times total) may occur within 30 seconds before the controller de-energizes the grinder motor and activates the grinder fail indicator and relay.
2. If a power failure occurs, an on-delay timer shall delay grinder restarting when power is restored. Timer shall have an operating range of 0.05 seconds to three hundred hours.
3. If a power failure occurs while a grinder is running, operation shall resume when power is restored.
4. If a power failure occurs while a grinder is in a fail condition the fail indicator shall reactivate when power is restored.
5. The controller shall provide overload protection for the motor through an overload relay mounted directly on the grinder starter.
6. Contractor shall install properly sized circuit breaker for short-circuit protection.
7. Controller reset shall be from the local panel controls only.

8. Disconnects for the grinder (where shown) shall provide contacts to indicate the status of the switches. The contacts shall open when the switches are opened (off). These signals shall be connected in series with the grinder fail signals and connected to the Pump Control Panel. The grinder fail alarm contacts shall be fail-safe by using a normally closed contact to open on a failed condition. In addition to the normal conditions that constitute a grinder fail condition, the grinder control programming shall be configured to generate a failed condition any time power is removed from the grinder controls, or any time the grinder is not running for any reason.

D. COMPONENTS

1. Enclosure

- a. Enclosure shall be NEMA 4X, fabricated of FRP, and shall be suitable for wall mounting. Doors shall have corrosion-resistant hinges and latches.
- b. Enclosure shall house the control devices, relays, terminal blocks and reversing motor starters.

2. Control Devices

- a. Pilot devices shall be mounted on the enclosure front panel door.
- b. The controller shall have indicator lights for POWER ON, RUN and each FAIL condition. The FAIL indicators shall be GRINDER JAM, MOTOR OVERLOAD, and MOTOR OVERTEMP.
- c. Indicator lights are LED pilot lights. Lamps and the selector switches shall be heavy duty NEMA 4X type.
- d. Control transformer shall be protected by two primary fuses and one secondary fuse. The 120-volt secondary shall have one leg grounded.
- e. Relay contacts shall be included for GRINDER RUN and FAIL signal outputs. The contacts shall be rated 2-amp, 240 VAC, resistive load.

3. Motor Starter

- a. Starter shall be NEMA 1 full-voltage reversing with 120-volt operating coils.
- b. Forward and reverse contactors on the starter shall have both mechanical and electrical interlocks.

- c. Overload relays (OL) shall be adjustable so that the range selected includes the FLA (full load amperes) rating and service factor.

2.05 SOURCE QUALITY CONTROL

- A. The grinder and controller shall be factory tested to ensure satisfactory operation.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Grinder and motor controller shall be installed in accordance with the supplier's installation instructions, and in compliance with all OSHA, MOSHA, and local, state and federal codes and regulations.
- B. The Contractor shall install the influent sewage grinder system and appurtenances in strict accordance with the manufacturer's recommendations and as approved by the Owner. The Contractor and Pump Control System Supplier under Division 17 shall be responsible for supervising the installation, cabling, startup, and for implementing all functions of the influent sewage grinder systems required for the Pump Control System.

3.02 MANUFACTURER'S SERVICES

- A. The manufacturer shall furnish the services of a qualified, factory-trained service representative who shall inspect the complete equipment installation under the supervision of the Contractor and Pump Control System Supplier to ensure that it is installed in accordance with the manufacturer's recommendations, make all adjustments necessary to place the system in trouble-free operation and instruct the operating personnel in the proper maintenance and operation of the equipment furnished. A minimum of two (2) days start-up assistance shall be provided.
- B. The Owner reserves the right to videotape and archive all startup instruction provided by the influent sewage grinder manufacturer or authorized representative.

END OF SECTION

SECTION 11350

SUMP PUMP

PART 1 - GENERAL

1.01 DESCRIPTION

- A. Work performed under this section includes, but is not limited to, furnishing and installing one sump pump with level sensing switch as specified herein.
- B. The physical size of the pump furnished must be capable of fitting within the sump pump pit, as shown on the drawings, with no adverse hydraulic effects.

1.02 SUBMITTALS

- A. Submit the following:
 - 1. Layout drawings showing pump, and all discharge piping, valves, fittings and supports.
 - 2. Wiring diagrams and electrical schematic indicating pump operation, control, and power supply.
 - 3. Catalog data on the sump pump, level sensing switch, and all appurtenances.
 - 4. Manufacturer's installation instructions.
 - 5. Operation and maintenance manuals for the sump pump, level sensing switch, and accessories.

1.03 WARRANTY

- A. The Contractor shall submit to the Owner a written manufacturer's warranty covering equipment defects and workmanship and shall be responsible for repairing or replacing at his own expense, including labor and shipping, all parts defective in material or workmanship for a period of two years from the date of Substantial Completion. The Contractor shall provide a certificate for inclusion in the O&M Manuals documenting the Manufacturer's date of warranty commencement (Contractor's Substantial Completion date) and expiration (two years hence).

PART 2 - PRODUCTS

2.01 SUMP PUMP

- A. Sump pump shall be a non-clog, submersible type and shall be rated for intermittent operation at 67 gpm at 17 feet of total dynamic head and handle a 1½-inch solid. The curves submitted for approval shall state, in addition to head and capacity performance, solid handling capability, amp rating, and design impeller diameter. Sump pump shall be Myers Pump Model MSP50 Series, Barnes Series SE511VF, or approved equal.
- B. Sump pump shall be provided with 2" NPT outlet. Piping shall be as specified in Section 15100. Provide an isolation gate valve and double check valves on the discharge side of pump as specified in Section 15110.
- C. Pump Construction:
 - 1. Motor Housing - Cast Iron ASTM A48, Class 30
 - 2. Pump Housing - Cast Iron ASTM A48, Class 30
 - 3. Impeller - Cast Iron, Non-Clog
 - 4. Pump Shaft - Stainless Steel or nickel plated steel
 - 5. External Fasteners - Stainless Steel
 - 6. O-rings - Buna N
 - 7. Mechanical Seals - Carbon/Ceramic
 - 8. Bearings - Heavy Duty, Single Row Ball Bearings
 - 9. Power Cord - Water Resistant, UL or CSA approved, double insulation.
- D. Motor:
 - 1. Refer to the requirements set forth in Division 16. Motor shall be 0.5- horsepower (HP) with voltage, phase and service as indicated on the Electrical Drawings. Motor shall be sized not to exceed nameplate current over the complete range of the head-capacity curve. Motor shall have a service factor of 1.0 and shall have thermal overload with automatic reset.
 - 2. The stator, rotor and bearings shall be mounted in a sealed submersible housing. Single phase motors shall be split phase or capacitor start with centrifugal switch. Full load and locked rotor amps, as well as start and run winding resistance shall be tabulated for each pump.

- E. Bearings, Shaft and Mechanical Seal:
 - 1. An upper radial and lower thrust bearing are required. The upper and lower bearings shall be heavy duty, single row ball bearings. The bearings shall be permanently and continuously lubricated and cooled by dielectric oil which fills the motor housing.
 - 2. The motor shaft shall be stainless steel or nickel plated steel and sealed from the pumped liquid with a carbon ceramic mechanical seal.
- F. Impeller:
 - 1. The impeller shall be high capacity, non-clog design with pump out vanes on the back side to wash out grit and stringy material.
- G. Automatic Control:
 - 1. Pump shall operate automatically based on level. Pump shall be furnished with either a pressure diaphragm switch or vertical float switch that features a piggy-back plug for automatic operation. The piggy-back plug shall be capable of being disconnected to allow the pump to be operated manually without removal of the pump from the sump.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. The sump pump shall be installed in accordance with the manufacturer's recommendations.

3.02 PAINTING

- A. Sump pump shall be painted with water reducible alkyd enamel, air-dried, applied in one coat with a minimum thickness of 3 to 4 mils.

3.03 TESTING

- A. Field testing shall include:
 - 1. Test manual operation with water.
 - 2. Test automatic operation with water. Operate pump by adding water to sump to ensure pump comes on. Remove water to ensure pump turns off.
 - 3. Observe for proper operation of check valves (no reverse flow).

4. Verify motor amperage does not exceed nameplate rating.

END OF SECTION

SECTION 13120

PRECAST CONCRETE BUILDING

PART 1 - GENERAL

1.01 SUMMARY

- A. This section describes the furnishing of a precast concrete transportable building and installation on prepared foundation in accordance with manufacturer's recommendations. Building shall be provided by the manufacturer with all necessary openings required by the Contract Documents in conformance with manufacturer's structural requirements.

1.02 QUALITY ASSURANCE

- A. ACI-318-02, "Building Code Requirements for Reinforced Concrete"
- B. American Society for Testing and Materials
 - 1. ASTM A185; Standard Specification for Steel Welded Wire Reinforcement, Plain for Concrete
 - 2. ASTM A615; Specification for Deformed and Plain Billet Steel Bars for Concrete Reinforcement
- C. ANSI/ASCE-7-2 "Building Code Requirements for Minimum Design Loads in Buildings and Other Structures", most recent version.
- D. International Building Code (IBC), most recent version.
- E. International Energy Conservation Code (IECC), most recent version.
- F. UL-752 test method level 4 for bullet resistance certified by an independent structural engineer.
- G. Fabricator must be producer member of National Precast Concrete Association (NPCA) and participate in its Plant Certification Program.
- H. Concrete Reinforcing Institute, "Manual of Standard Practice", most recent version.

1.03 DESIGN REQUIREMENTS.

- A. Provide a building designed in accordance with ACI-318 and local prevailing codes for reinforced concrete and manufactured under Precast Concrete Institute (PCI) standards and Quality Control Manual MNL-116. Building shall be Easi-Span Model 2427.

- B. Dimensions:
 - 1. Exterior: 23'-4" x 27'-0"
 - 2. Interior: 22'-0" x 25'-8" x 10'-2" ceiling
- C. Design Loads:
 - 1. Seismic load performance category 'C', Exposure Group III
 - 2. Standard Live Roof Load - 60 PSF
 - 3. Wind Loading - 130 MPH
- D. Roof and Walls:
 - 1. Roof panel shall have a peak and roof slope as shown on the Contract Drawings. The roof shall extend a minimum of 3 inches beyond the wall panel on each side and have a turndown design which extends ½-inch below the top edge of the wall panels to prevent water migration into the building along top of wall panels.
 - 2. Roof panel(s) shall support design loads imposed upon them. The roof panels shall achieve an R39 insulation factor by means of "sandwiching" a Thermomass Insulation System between two concrete panels. The wall panels shall achieve an R13 insulation factor by means of "sandwiching" a Thermomass Insulation System between two concrete panels.
 - 3. Roof and wall panels must each be produced as single component monolithic panels. No roof or vertical wall joints will be allowed, except at corners.

1.04 SUBMITTALS

- A. Shop drawings shall include complete details, pertinent calculations, design loads, materials, strengths, sizes and thicknesses, locations of monorail beam, door, louver, and plumbing drain vent openings, and joint and construction design and details.
- B. Contractor shall submit a complete list of all materials proposed to be furnished as part of this complete building, including all appurtenant equipment and component parts.
- C. Contractor shall provide the Owner with complete design certification signed and sealed by a Professional Engineer registered in the State of Maryland.

- D. A written acknowledgment from the Professional Engineer licensed in the State of Maryland and responsible for the design stating that seismic provisions pursuant to 7 CFR 1972, Subpart C were used in the design of the structure. Model Code/Standard and Date: International Building Code 2018 and ASCE 7-16; Seismic Use Group: Seismic Design Category – B; Seismic Factor: Seismic Risk Category – III. Contractor shall submit the written acknowledgment from the licensed Professional Engineer, as well as complete applicable USDA certification forms as part of the submittal package.
- E. Verification from the supplier via written acknowledgment of location of existing overhead power lines and method of building installation in accordance with all applicable requirements.

1.05 DELIVERY, STORAGE AND HANDLING

- A. Precast concrete building shall be considered suitable for handling for transport to the construction site after the concrete has cured to a minimum strength of 80 percent of the final design strength.
- B. Delivery of precast concrete building shall be coordinated with installation.
- C. Prefabricated building shall be unloaded with proper equipment of adequate capacity and equipped with appropriate slings and lifting devices to protect the material from damage. If damage occurs and is deemed repairable, it shall be repaired as directed by the Owner in accordance with the manufacturer's recommendations at no additional cost to the Owner. If damage is not repairable in the opinion of the Owner, such items of material will be rejected and shall be removed and replaced at the Contractor's expense.

1.06 WARRANTY

- A. Contractor shall submit to the Owner a written manufacturer's warranty covering material defects and workmanship, including labor and shipping, for a period of two years from the date of Substantial Completion.

1.07 ACCEPTABLE MANUFACTURER(S)

- A. Building shall be manufactured by M&W PRECAST, LLC, Ottsville, PA, or Smith-Midland, Midland, VA or approved equal. Products from Oldcastle Infrastructure are not acceptable and will not be approved.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Concrete: Steel-reinforced, 5,000-PSI minimum 28-day compressive strength, air-entrained (ASTM C260).

- B. Reinforcing Steel: ASTM A615, Grade 60, unless otherwise indicated.
- C. Post-tensioning Strand: 41K Polystrand CP50, .50, 270 KSI, 7-wire strand, enclosed within a greased plastic sheath (ASTM A416). Roof and floor each to be post-tensioned by a single, continuous tendon. Said tendon shall form a substantially rectangular configuration having gently curving corners wherein the positioning of the cable member results in a pattern of one or more loops and a bisecting of the loop(s). The cable member starts from one corner of the concrete building panel, forms a gentle perimeter loop(s) returning to a point where the cable member entered the concrete building panel. The tendon then turns 90 degrees and follows the cable member(s) to a point midway along the "Y" axis of the concrete building panel and then turns 90 degrees along the "X" axis of the concrete building panel. This bisects the concrete building panel and crosses the opposite parallel portion of the cable member and exits from an adjacent side of the concrete building panel.
 - 1. If post-tensioning is not used in the roof panel, the following guidelines must be followed to ensure a watertight roof design.
 - a. The entire precast concrete roof panel surface must be cleaned and primed with a material that prepares the concrete surface for proper adherence to the coating material.
 - b. The entire precast concrete roof panel surface shall be sealed with a 0.045 EPDM continuous membrane cemented to the concrete with a compound designed for this purpose.
- D. Caulking: All joints between panels shall be caulked on the exterior and interior surface of the joints. Caulking for exterior joints shall be SIKAFLEX-1A elastic sealant, or approved equal. Caulking for interior joints shall be SIKAFLEX-15LM elastic sealant, or approved equal.
- E. Panel Connections: All panels shall be securely fastened together with $\frac{3}{8}$ -inch thick powder-coated steel brackets. Steel is to be of structural quality, hot-rolled carbon complying with ASTM A283, Grade C and powder coated after fabrication. All fasteners to be $\frac{1}{2}$ -inch diameter bolts complying with ASTM A307 for low-carbon steel bolts. Cast-in anchors used for panel connections to be Meadow-Burke #FX-19, or approved equal. All inserts for corner connections must be fastened directly to form before casting panels. No floating-in of connection inserts shall be allowed.

2.02 ACCESSORIES

- A. Doors and Frames
 - 1. Doors and frames shall comply with Specification Section 08220 FIBERGLASS REINFORCED PLASTIC (FRP) DOORS.

B. HVAC

1. HVAC components shall comply with Specification Section 15500 HVAC and Specification Section 15700 Mini-Split Heat Pump Air Conditioning System. Contractor shall be responsible to coordinate all HVAC components and their installation with the Precast Concrete Building Supplier.

C. Monorail Crane System

1. Monorail crane system shall comply with Specification Section 14100 MONORAIL CRANE SYSTEM. Contractor shall be responsible to coordinate all monorail crane and hoist system components and their installation with the Precast Concrete Building Supplier.

2.03 INSULATION

A. Thermomass Building System, as supplied by Thermomass, PO Box 950, Boone, Iowa 50010 (800-232-1748), or approved equal, consisting of both:

1. Wall Insulation: 2" Thick R-13 extruded polystyrene board insulation complying with ASTM C578, Type IV; with regularly spaced holes identifying connector placement locations.
2. Roof Insulation: 5" Thick R-39 extruded polystyrene board insulation complying with ASTM C578, Type IV; with regularly spaced holes identifying connector placement locations.
3. Structurally non-composite wythe connectors: Non-conductive, non-corrosive, fiber-composite connectors, having a tensile strength of 120,000 psi, minimum glass content of 76 percent by weight, and a coefficient of thermal expansion of 5x10-6in/in/°F, nominal.

2.04 GUTTERS

- A. Subject to compliance with requirements, gutters shall be manufactured by Merchant and Evans, Inc., Southern Aluminum Finishing Company, or approved equal.
- B. Gutter Section: 0.063-inch formed aluminum, 6-inches deep. Provide slotted anchorage holes.
- C. Spacers: 0.063-inch formed aluminum, 1-inch wide, spaced at 30-inches on centers unless indicated otherwise, alternate with gutter brackets.
- D. Brackets: 0.25-inch formed aluminum, 1-inch wide, spaced at 30-inches on centers unless indicated otherwise, alternate with gutter spacers.

- E. Joint Splice: 0.063-inch formed aluminum, 5-inches wide, spaced at 10-feet on centers maximum. Splice contour shall match gutter section.
- F. Expansion Joints: 0.063-inch formed aluminum, 6-inch wide top cover, bottom cover and caps. Provide concealed 2-inch expansion space between end caps. Expansion joint shall match profile of gutter section.
- G. Finish: KYNAR 500 PVDF resin. Color shall be selected by the Owner or Engineer from the manufacturer's standard range of colors.

2.05 DOWNSPOUTS

- A. Subject to compliance with requirements, downspouts shall be manufactured by Merchant and Evans, Inc., Southern Aluminum Finishing Company, or approved equal.
- B. Starters: 0.032-inch formed aluminum.
- C. Downspouts: 0.032-inch formed aluminum, 3-inches by 4-inches unless indicated otherwise.
- D. Offset Brackets: 0.125-inch formed aluminum, 2-inches wide, fasteners shall be stainless steel screws with washers set into lead shields. Anchor holes shall be drilled into masonry walls.
- E. Elbows and Transitions: 0.032-inch formed aluminum, all welded joints, fabricate to match approved shop drawings, custom assemble to match field conditions.
- F. Finish: KYNAR 500 PVDF resin. Color shall be selected by the Owner or Engineer from the manufacturer's standard range of colors.
- G. Provide precast concrete splash block at base of all downspouts.

2.06 MISCELLANEOUS

- A. Corners: Provide mitered and welded corners to match custom gutter and fascia sections. Corner legs to be approximately 4-feet long.
- B. Anchorage Holes: Provide slotted anchorage holes for connection of gutter and fascia sections to wood nailers. Align anchorage holes of gutter and fascia sections so that gutter is installed only through slotted anchorage holes in the fascia sections.

2.07 FINISHES

A. Interior of Building

1. The walls and ceilings shall be prepared in accordance with ASTM: D4258-05 Standard Practice for Surface Cleaning Concrete for Coating. Apply two coats of Macropoxy 646 FC @ 3.0 - 5.0 mils DFT for a total DFT of 6.0 - 10.0 mils. Coordinate color per the Owner's selection from manufacturer's standard color chart.

B. Exterior of Building

1. Exterior finish combination of architectural/brick finish. Finish must be imprinted in top face of panel while in form using an impression form liner as manufactured by Architectural Polymers, Inc. Finished brick size shall be 2-3/8" x 7-5/8". Joints between each brick must be 3/8" wide x 3/8" deep. Back of joint shall be concave to simulate a hand-tooled joint. Each brick face shall be coated with H & C Concrete Stain by Sherwin & Williams. Stain shall be applied per manufacturer's recommendation. Grout joints shall be kept substantially free of stain to maintain a natural gray concrete color. Coordinate brick color with the Town. Provide manufacturer's standard color charts to the Owner in sufficient time to not impact fabrication and delivery and for selection by the Town.

PART 3 - EXECUTION

3.01 ACCESS

- A. Contractor must provide level unobstructed area large enough for crane and tractor-trailer to park adjacent to pad. Crane must be able to place outriggers within 3'-0" of edge of pad and truck and crane must be able to get side-by-side under their own power. Firm roadbed with turns that allow 65-foot lowbed tractor and trailer must be provided directly to site. Building shall not be placed closer than 2'-0" to an existing structure. Contractor shall be responsible to coordinate installation with the Precast Concrete Building Manufacturer and any overhead lines to install the building in panel sections, as may be required. Installation of insulation blankets and/or sheets shall be used as required to cover energized electrical conductors.

3.02 SITE PREPARATION

- A. Building shall bear fully on a cast-in-place concrete foundation as shown on the Contract Drawings. The foundation slab shall be level within 1/8-inch in both directions.
- B. Floor panel must have a 1/2" step-down around the entire perimeter to prevent water migration into the building along the bottom of wall panels.

- C. Precast concrete building shall be provided by one single manufacturer. Building shall be installed on the foundation in the orientation shown on the drawings.

3.03 INSTALLATION OF GUTTERS AND DOWNSPOUTS

- A. Install gutters and downspouts in accordance with the manufacturer's recommendations, approved shop drawings and the SMACNA "Architectural Sheet Metal Manual".
- B. Install gutters and downspouts straight, level and plumb.
- C. Align slotted anchorage holes in gutter and fascia. Fasten linear components through slotted anchorage holes in a manner to allow normal expansion/ contraction to occur without distortion of the materials.
- D. Install in a secure, watertight manner with anchorage which allows adequate expansion and contraction movements of all aluminum fascia and gutter sections so that no "oil canning" or other distortions of the metal work occurs.
- E. Remove and replace any sections which are warped, twisted, crimped, scraped, dented, or otherwise distorted in any manner.

END OF SECTION

SECTION 14100

MONORAIL CRANE SYSTEM

PART 1 - GENERAL

1.01 DESCRIPTION

- A. Work performed under this section includes, but is not limited to, furnishing all labor, tools, materials and services necessary to design, fabricate and install a monorail crane system, as specified herein and as indicated on the Contract Drawings.
- B. Installation must be provided by an authorized dealer of the monorail crane system manufacturer.
- C. OSHA 1926.406 shall be used to determine when a disconnect switch shall be incorporated into a project. When required, the Contractor shall furnish, mount and wire a floor operated, individual fusible electrical disconnect switch including wiring from disconnect to a junction box within two (2) feet of the conductor bar or festoon system.
- D. The intended purpose is to remove/install equipment from/to the recessed floor containing the sewage pumps and through the double door entrance, and to/from the exterior of the pump station.

1.02 QUALITY ASSURANCE

- A. Equipment furnished under this section shall comply with the applicable requirements of the following:
 - 1. Occupational Safety and Health Act (OSHA)
 - 2. NAPA-70 National Electric Code (N.E.C.)
 - 3. ANSI B30.11 "Safety Standard of Monorails and Underhung Cranes" and ANSI MH27.1 "Specifications for Underhung Cranes and Monorail Systems"
 - 4. ANSI B30.16 "Safety Standard for Overhead Hoist, HMI Standard" and ANSI/ASME HST-4M "Performance Standards for Overhead Electric Wire Rope Hoists"
 - 5. Specifications for Design, Fabrication and Erection of Steel for Buildings of the American Institute of Steel Construction (AISC)
 - 6. American Welding Society (AWS) D14.1 "Specifications for Welding Industrial and Mill Cranes" and D1.1 "Code for Welding in Building Construction"

1.03 SUBMITTALS

- A. Shop drawings showing design, fabrication, assembly and installation. Drawings shall include layout showing plan, elevation and sectional views.
- B. Catalog data for all crane system components and accessories.
- C. Wiring diagrams and electrical schematics indicating trolley and hoist motor operation, controls and power supply.
- D. Design computations.
- E. Equipment Guarantee Certification Form

In addition to the manufacturer's warranty for the monorail crane system equipment, the Contractor shall obtain and submit to the Engineer and Owner certification from the authorized dealer that the monorail crane system meets the requirements of the intended application and contract drawings and specifications. This certification shall be provided by way of the Equipment Guarantee Certification Form included herewith.

EQUIPMENT GUARANTEE CERTIFICATION FORM

Reference: **New Creamery Road Sewage Pump Station
Town of Emmitsburg, Maryland**

THE UNDERSIGNED HEREBY ATTESTS THAT HE/SHE HAS EXAMINED ALL APPLICABLE CONTRACT DRAWINGS AND SPECIFICATIONS, AND CERTIFIES THAT THE EQUIPMENT THAT HE/SHE PROPOSES TO FURNISH AND DELIVER MEETS OR EXCEEDS CONTRACT SPECIFICATIONS, IS SUITABLE FOR THE INTENDED PURPOSE STATED IN SPECIFICATION SECTION **14100**, IS SUITABLE FOR INSTALLATION AS PRESENTED IN THE CONTRACT DRAWINGS AND SPECIFICATIONS, AND WILL PROVIDE SATISFACTORY PERFORMANCE AT THE DESIGN CRITERIA SPECIFIED. THIS GUARANTEE OF SUITABILITY FOR INTENDED PURPOSE IS IN ADDITION TO AND SHALL NOT BE IN LIEU OF ANY OTHER WARRANTIES, EXPRESSED OR IMPLIED.

EQUIPMENT: **MONORAIL CRANE SYSTEM**

AUTHORIZED DEALER: _____

Address: _____

By: _____
(Typed Name and Title)

_____/s/_____
(Signature) (Date) (SEAL)

Equipment Guarantee and Certification must be signed by a Principal Person (President, Vice-President, etc.) of the equipment manufacturer. The manufacturer hereby guarantees and certifies that the equipment that he/she proposes to furnish and deliver meet or exceed contract specifications, are suitable for the intended purpose and installation, and will provide satisfactory performance at the design criteria specified.

MANUFACTURER: _____

Address: _____

By: _____
(Typed Name and Title)

_____/s/_____
(Signature) (Date) (SEAL)

F. Mill Test Reports: Signed by manufacturer certifying that the following products comply with requirements:

1. Monorail beam including chemical and physical properties.

1.04 DESIGN REQUIREMENTS

- A. All equipment shall be designed for minimum ASME Class H4 as defined by the Hoist Manufacturers Institute (HMI) and as specified in the ANSI MH27.1 specifications, and operation in normal ambient temperatures 32- to 104-degrees F and normal indoor conditions, free from excessive dust, moisture and corrosive fumes.
- B. An impact allowance shall be included in design calculations for crane and monorail tracks. The impact allowance shall be ½-percent of the rated load for each foot per minute of hoisting speed with a minimum allowance of 15% and a maximum of 50%.
- C. Hook height, hook lift, support spacing, etc., shall be as shown on the contract drawings. Hoist and monorail must be capable of traveling through the new double door and outside of the pumping station building.
- D. Capacity: 1-Ton.
- E. Hoist Speed: 39 and 6.5 FPM.
- F. Trolley Speed: 65 FPM – Variable.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Store monorail beam to permit easy access for inspection and identification. Keep monorail beam off ground and protect it from erosion and deterioration.

1.06 WARRANTY

- A. Manufacturer's authorized dealer shall provide a 2-year warranty starting on the date Contractor achieves Substantial Completion for the project. The warranty shall cover against defects of materials and workmanship.

PART 2 - MATERIALS

2.01 GENERAL

- A. The monorail crane shall have an electrically operated low headroom hoist.

2.02 MONORAIL

- A. Monorail beam shall be a W-shape steel beam in accordance with ASTM A992, Grade 50.
- B. Bottom flange shall have a minimum ultimate tensile strength of 65,000 psi. Girder shall be straight, with factory prepared ends. No rough-cut ends will be permitted. Holes shall be factory punched or drilled. All welds shall be full penetration. Girder shall be coated with a minimum of one coat of factory primer enamel and be free of corrosion.
- C. The girder size shall be computed based on the load positioned on the bridge system to produce the most severe conditions of stress and deflection.
- D. The total girder deflection shall not exceed $1/600$ of the span or $1\frac{1}{4}$ ", whichever is least.
- E. Monorail end stops shall be of the bolted type and shall be capable of withstanding the impact of a fully loaded crane or carrier traveling at 50% of the full load speed.
- F. Monorail sections shall be installed with bolted or welded type splice plates to provide flush and level connections at the operating tread of the track. The maximum gap between the adjacent ends at load carrying flange shall not exceed $1/16$ -inch.

2.03 TRACK ELECTRIFICATION

- A. Conductor bar shall be roll formed electro-galvanized steel sections, rated 100 amps continuous. Insulation cover shall be high-visibility orange color, with an operating temperature of 160° F (71° C). Conductor bar shall be bottom entry type.
- B. Conductors are to be complete with mounting brackets, insulators, couplings, end caps and current taps.
- C. Current collectors shall be the sliding shoe type, spring loaded and so designed that sparking and loss of contact will be minimized.
- D. Separate conductors shall be provided for each phase. More than one conductor in a single enclosure will not be permitted.

2.04 HOIST

- A. General
 - 1. Hoist design shall maximize hook vertical travel and clear hook height.
 - 2. Hoist shall be a low-headroom electric wire rope hoist, R&M Materials Handling, Inc.'s Spacemaster SX, or approved equal.

3. All hoists shall be supplied with two-speed hoisting contactor controls to minimize load swing and ensure accurate load positioning.

B. Mechanical

1. Reeving: Unless otherwise specified, hoists shall be single-reeved. Lateral hook drift shall not exceed 1/8-inch per foot of vertical travel.
2. Hoist Drums: The drum to rope diameter ratio shall be a minimum of 30:1 to minimize rope flex and extend rope life. Drum shall be made from steel and supported on heavy-duty anti-friction bearings; groove depth shall be at least 35% of rope diameter. The rope drum shall be equipped with a rope guide and spring loaded roller to keep the rope aligned in the grooves of the drum.
3. Hoisting Gearing: Gear reducers shall be integral components of standard hoists of manufacturers regularly engaged in the design and manufacturing of hoists for Class H4 hoists. The gear reduction units shall be fully enclosed in oil-tight housing. Operation shall be smooth and quiet. Hoisting gears shall be hardened and ground. Gears and pinions shall be spur, helical, or herringbone type only, and shall be hardened steel; open-type gearing is not acceptable. Gears and pinions shall be manufactured to AGMA 2001-B Quality Class 11 or better precision. Gear reducer shall not incorporate a mechanical load brake; the gear reducer shall not require regular internal maintenance or frequent lubricant changes due to friction material contamination and high running temperatures.
4. Load-Limit System: Each hoist shall be equipped with an electronic load-limiting device that shall prevent lifting more than 110% of the rated load.
5. Main Hoist Load Blocks/Hook Assembly: Hooks shall be made of forged alloy steel (34CrMo4 Class T). Hooks shall be fitted with spring loaded safety latches designed to preclude inadvertent displacement of slings from the hook saddle and have 360-degree rotation on anti-friction bearings. Hook shall be secured to the bottom block with a removable fastener, and shall not be welded. Hooks shall be designed and commercially rated with safety factors in accordance with ASME. Bottom block shall be totally enclosed in a steel housing. Rope sheaves shall be supported on heavy-duty anti-friction bearings. Load blocks shall be of steel construction. Load blocks shall be provided with hot-rolled or forged steel fixed crosshead separate from the sheave pin with swivel mounting for forged steel hook.
6. Sheaves: Sheaves shall be of steel or ductile iron (240 to 302 BHN hardness). Sheave grooves shall be accurately machined, smoothly finished and free of surface defects. The sheave to rope diameter ratio shall be a minimum of 20:1 to minimize rope flex and extend rope life.
7. Hoisting Ropes: Wire rope shall be constructed from galvanized steel having a steel core and a minimum safety factor of 5. Hoisting ropes shall be the

rated capacity load plus the load block weight divided by the number of rope parts, and shall not exceed 20-percent of the certified breaking strength of rope. Ropes shall be suited to meet the service requirements. Rope anchor connections shall be equal to or greater than the rope strength. Hoisting ropes shall be secured to hoist drum so that no less than 2 wraps of rope remain at each anchorage of hoist drum at the extreme low position (limit switch stop).

8. Paint: Steel load bearing parts shall have a primer coat of epoxy primer of 60 μm thick and a finish coat of epoxy paint 60 μm thick; total epoxy primer/paint thickness 120 μm . Steel and aluminum covers shall have epoxy finishing paint 80 μm thick. Prior to painting, all surfaces shall be washed, degreased and shot blasted.

C. Electrical/Control Requirements

1. General: The hoist shall be CSA approved and/or UL approved to NEMA 3R protection. Pendant control enclosure shall be rated NEMA 4.
2. Hoist Motor(s): Hoisting motors shall be two-speed/two winding squirrel cage type with a speed ratio of 6:1. Hoisting motors effective duty shall be 60% ED (30 minute rated) or higher with minimum Class F insulation. One thermal sensitive device embedded in hoist motor winding shall be provided. Thermal-sensitive device and associated circuits shall be self-restoring (automatic reset). Motors shall be designed specifically for hoist duty.
3. Hoist Controls: Hoist controls shall be full magnetic type, specially selected for hoisting service.
4. Hoist Limit Switches: Hoist shall be equipped with a geared adjustable upper and lower limit switch to limit extreme upper and lower travel of the bottom block assembly. Geared limit switch shall have four positions with the following functions: lower limit, upper slowdown, upper limit, and phase reversal supervision. The upper most limit shall be wired to the down circuit in such a manner to prevent hoisting in the event of a phase reversal. Block limit switch is not required.
5. Disconnect switch shall be provided where shown on the drawings or required by the NEC, fused or unfused as required, and shall be Square D class 3110 Heavy Duty, or equal. Any switch installed outdoors or installed in a room with base slab below grade level in the pump station shall be rated NEMA 4X, and shall be 316 stainless steel. Provide option to allow locking in open or closed position. Disconnect shall be furnished with auxiliary contacts for remote monitoring of switch position. Contacts shall be configured to be closed when the switch is closed (on) and open when the switch is opened (off).

2.05 ELECTRIFICATION

- A. One of the following types of electrical power systems shall be employed as a means of supplying power and control for hoist and trolley travel motions. Applicable electrical power system is to be selected on the basis of the “Design Requirements” and specific job application.
 - 1. Rigid enclosed conductor bar system may be mounted off the web in a down-turned position. Power and control circuits must have individual conductor bars.
 - 2. Festooned or rigid enclosed conductor bar systems may be factory mounted or mounted in the field.

2.06 CONTROLS

- A. Controls shall be housed in a NEMA 12 or IP55 enclosure for protection against dust and moisture.
- B. A magnetic mainline contactor is to be provided and operated from the pushbutton station.
- C. All motor starters shall be adequately sized for hoist duty consistent with horsepower requirements.
- D. Each motor shall be provided with thermal overload protection.
- E. Fusing shall be provided on the secondary side of the control circuit transformer.
- F. Means for controlling trolley acceleration must be provided. Trolley speed shall be variable.
- G. The complete control panel is to be factory mounted and wired. All wires within the panel are to be marked and terminated on numbered terminal strips.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. The monorail crane system shall be installed by an authorized dealer of the crane system manufacturer, who shall adjust and test all components and furnish a manufacturer’s certification statement.
- B. Stops and adjustable bumpers shall be installed on the monorail beam, and shall meet the requirements of the governing standards.
- C. Electrical power shall be connected to the hoist.

3.02 PAINTING

- A. Painting shall be as specified in Section 09900.

3.03 FIELD TESTING

- A. The monorail crane shall be tested in accordance with the following:
 1. Visually inspect all equipment and supports before attempting the load test.
 2. Operate the equipment with no load to verify correct motions and speeds of the equipment.
 3. Measure distance from floor to center of monorail span to check for track deflection before loading.
 4. Measure hook at the throat opening before loading.
 5. Load hook with 100 percent of rated load for five minutes to check for any change in hook throat opening. Lift the test load a maximum of six inches above the floor.
 6. Measure distance from floor to center of monorail to check track deflection with 100% of rated load on hook to verify deflection does not exceed the maximum allowable deflection of 1/600 of largest span for the monorail. Ensure hook is at the center of the monorail.
 7. Move the hoist down the monorail so that the maximum load is applied to the support points.
 8. Repeat testing at all support points.
 9. Test all hoist limit switches.
 10. Check voltage and amperage values under load for the hoist.
 11. Test the endstops with 50% of the rated capacity on the hoist hook.
 12. Contractor shall maneuver test load from drywell floor, through the Operating Room access hatch, and through the double door to outside of the pumping station.
 13. Provide a written report of the test results and monorail crane system manufacturer's certificate of approval to the Engineer.

END OF SECTION

SECTION 14110

DAVIT ARM PERSONNEL MAST

PART 1 - GENERAL

1.01 DESCRIPTION

- A. The Contractor shall furnish and install a davit arm personnel mast consisting of one (1) davit arm retrieval system, one (1) winch and associated bracket, one (1) permanent mount sleeve and sleeve cap, and all appurtenances specified herein complete with all bolts, pins and hardware for a complete assembly.

1.02 SUBMITTALS

- A. The Contractor shall furnish detailed shop drawings showing outline and dimensions of all equipment specified herein and details for installation of the mount sleeves into the concrete slabs.
- B. The Contractor shall submit catalog data for all components of the davit arm personnel mast assembly and a complete list of all materials and equipment to be furnished, giving the manufacturer's name, catalog number and catalog cut for each item, where applicable.
- C. Operations and Maintenance Manuals for the davit arm personnel mast and winch.
- D. Submit certificates of compliance certifying that all equipment and materials comprising the complete davit arm personnel mast system comply with specified performance characteristics and criteria.

1.03 PRODUCT HANDLING

- A. The Contractor shall protect all the equipment and materials before, during and after installation and protect the installed work and materials of all other trades.
- B. In the event of damage to equipment, Contractor shall make all repairs and replacements necessary to restore the equipment to its approved condition, at no additional cost to the Owner.

PART 2 - PRODUCTS

2.01 DAVIT ARM RETRIEVAL SYSTEM

- A. The davit arm retrieval system shall consist of one (1) offset mast, one (1) elbow section, and one (1) center post with winch mounting assembly. All davit arm components shall be made from aluminum and steel.

- B. Davit arm assemblies shall be capable of achieving multiple offset reaches and shall be man rated to 350 pounds.
- C. Offset mast shall be capable of accepting both winches and/or self-retracting lifelines.
- D. The davit arm shall be Model No. DK3036 as manufactured by the T.A. Pelsue Company or approved equal.

2.02 WINCH AND BRACKET

- A. The winch shall be man rated to 310 pounds with a 10:1 safety factor, 5.1:1 gear ratio single speed drive and retrieval rate of 23 feet per minute.
- B. The winch shall have a continuous braking drive to prevent free wheeling and double pawls on the friction brake to provide back-up safety.
- C. The winch shall have low wear, high temperature brake pads to eliminate brake maintenance for the life of the winch and anti-friction drive bearings to assure trouble free life in continuous use.
- D. The winch shall have level wind springs that prevent loosening of cable lays and a slip clutch drive that prevents back winding of cable drum.
- E. All metal parts of the winch shall have a galvanic zinc coating to prevent corrosion in harsh environments.
- F. The winch shall be supplied with 70 feet of stainless steel cable and a double action locking swivel snap hook rated for the loads specified herein.
- G. The winch shall be Model No. PH07C as manufactured by the T.A. Pelsue Company or approved equal. The bracket shall be Model No. MB-PF1 as manufactured by the T.A. Pelsue Company or approved equal.

2.03 SLEEVES AND SLEEVE CAPS

- A. The sleeves shall be flush mounted, and installed into the concrete slabs, as shown on the contract drawings, and in accordance with the manufacturer's recommendations. The flush mount sleeves shall be suitable for use with the davit arm mast furnished.
- B. The sleeves shall be made of stainless steel, allow the davit arm mast to pivot 360 degrees, and include a drain hole to eliminate water buildup.
- C. The sleeves shall have a CPVC plastic liner with PVC slip plates.

- D. A stainless steel sleeve cap shall be included with each mount sleeve to seal the sleeve and prevent entrance of water and debris when not in use. The top of the cap shall be flush with the top of the mount sleeve, so as to not create a tripping hazard.
- E. The flush mount sleeves shall be Model No. DSS-C1 for stainless steel flush floor mount set in new concrete, or DSS-F3 for stainless steel flush floor mount bolted on existing concrete as manufactured by the T.A. Pelsue Company or approved equal.
- F. The flush mount sleeve caps shall be Model No. DSC-S1 as manufactured by the T.A. Pelsue Company or approved equal.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Contractor shall install the complete davit arm personnel mast system in strict accordance with the manufacturer's recommendations.

3.02 TESTING

- A. After erection and prior to final inspection, the davit arm personnel mast shall be given a full load test. Full load test shall consist of loading the unit to its rated capacities at each boom position and raising and lowering the hook the full limit of its travel.
- B. The above test shall be performed to the satisfaction of the Owner. In the event the equipment does not satisfactorily meet the specifications, such changes as may be required shall be made and the tests repeated until complete satisfaction is obtained.
- C. Weights to perform the above test shall be provided by the Contractor.

END OF SECTION

SECTION 14600

PORTABLE EQUIPMENT HOIST

PART 1 - GENERAL

1.01 DESCRIPTION

- A. The Contractor shall furnish and install a portable equipment hoist assembly consisting of one (1) galvanized finished davit crane, one (1) winch, ¼-inch diameter 304 stainless steel wire rope, and all appurtenances specified herein complete with all bolts, pins and hardware for a complete assembly. Quantity and style of bases shall be as shown on the Contract Drawings.
- B. The portable equipment hoist will be used to lower and raise equipment as shown on the Contract Drawings. Contractor shall coordinate with the equipment manufacturer to ensure that the portable equipment hoist assembly is manufactured and installed in a manner that will permit the raising and lowering of the equipment in accordance with the equipment manufacturer's instructions for handling.

1.02 SUBMITTALS

- A. The Contractor shall furnish detailed shop drawings showing outline and dimensions of all equipment specified herein and details for installation of the base specified.
- B. The Contractor shall submit catalog data for all components of the crane assembly and a complete list of all materials and equipment to be furnished, giving the manufacturer's name, catalog number and catalog cut for each item, where applicable.
- C. Operations and Maintenance Manuals for the hoist and winch.
- D. Submit certificates of compliance certifying that all equipment and materials comprising the complete portable equipment hoist system comply with specified performance characteristics and criteria.

1.03 PRODUCT HANDLING

- A. The Contractor shall protect all the equipment and materials before, during and after installation and protect the installed work and materials of all other trades.
- B. In the event of damage to equipment, Contractor shall make all repairs and replacements necessary to restore the equipment to its approved condition, at no additional cost to the Owner.

1.04 WARRANTY

- A. The Contractor shall submit to the Owner a written manufacturer's warranty covering equipment defects and workmanship for a period of 2-years from the date Contractor achieves Substantial Completion for the project.

PART 2 - PRODUCTS

2.01 DAVIT CRANE

- A. The davit crane shall have a lifting capacity of 2,000 pounds and an adjustable boom length up to 82 inches. Hook height shall be dependent on base furnished, with a hook height up to 97 inches for a pedestal base, up to 83 inches up for a flush or wall mount base, and up to 104 inches for a wheel base. The adjustable boom shall be capable of telescoping to four (4) different lengths and adjusting in height while under load with a ratchet style screw-jack.
- B. The davit crane shall be able to rotate 360 degrees on a stainless-steel roller/ball bearing at top of base, and shall include a stainless steel lock assembly to keep crane in position during winch operation and when crane is not in use. Roller/ball bearing shall be Model No. 5PT20BRG-S, or approved equal.
- C. The davit crane shall be capable of being disassembled for storage and transporting, and shall include a quick-mount winch bracket and clevis pins.
- D. The davit crane shall be Model No. 5PT20G with a galvanized finish as manufactured by Thern, Inc., or approved equal.

2.02 WINCHES

- A. Manual Winch
 - 1. The winch shall be a machine cut spur gear with an automatic brake that provides positive load control for lifting and lowering operations. The winch shall be constructed of stainless steel, electro-polished for added corrosion resistance.
 - 2. The winch shall have a lifting capacity of 2,000 pounds with a double gear ratio of 14.7:1 so that a maximum force of 17 pounds on the crank handle is required to lift 1,000 pounds.
 - 3. The winch shall have bronze and radial ball bearings that provide smooth and efficient operation, a large diameter drum with a minimum diameter of 2½ inches to minimize wear on the wire rope, and gear covers to protect the gears and prevent injuries.

4. The winch shall be Model No. M4312PBSS-K as manufactured by Thern, Inc., or approved equal.

2.03 BASES

A. General Requirements:

1. A heavy duty base cap with lanyard shall be included with each pedestal, wall, and flush mount base, and shall fit inside the mast hole to prevent water and debris from collecting in the sockets. The top of the cover for wall and flush mount bases shall be flush with the top of the base, so as to not create a tripping hazard.
2. A 15-inch base extension shall be furnished with each wall and flush mount base, and shall be Model No. 5BE20-15G, or approved equal.
3. Base anchors for each pedestal, wall, and flush mount base shall be 316 stainless steel, shall comply with manufacturer's crane reaction loads and sizes, and shall be installed in such a manner that they do not create a tripping hazard.

B. Pedestal Bases:

1. Pedestal bases shall be fastened to the concrete floor slab in accordance with the manufacturer's recommendations, and shall be suitable for use with the davit crane furnished.
2. Pedestal bases shall be made of 316 stainless steel, allow the davit crane to pivot 360 degrees, and include a drain hole to eliminate water buildup.
3. Pedestal bases shall be Model No. 5BP20S316 as manufactured by Thern, Inc., or approved equal.

C. Flush Bases:

1. Flush bases shall be flush mounted, and installed in the concrete slab in accordance with the manufacturer's recommendations. The flush mounted bases shall be suitable for use with the davit crane furnished.
2. Flush bases shall be made of 316 stainless steel and shall allow the davit crane to pivot 360 degrees.
3. Flush bases shall be Model No. 5BF20S316 as manufactured by Thern, Inc., or approved equal.

2.04 WIRE ROPE ASSEMBLIES

- A. The wire rope shall be ¼-inch diameter and constructed of 304 stainless steel. The wire rope shall include a swivel hook suitable for lifting the intended equipment. The Contractor shall ensure the wire rope length adequately covers the required anchor wraps, boom length, and distance between the boom end and pick point, while not exceeding the winch drum capacity.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Contractor shall install the complete portable equipment hoist in strict accordance with the manufacturer's recommendations.

3.02 TESTING

- A. After erection and prior to final inspection, the portable equipment hoist shall be given a full load test. Full load test shall consist of loading the unit to its respective rated capacities at each boom position and raising and lowering the hook the full limit of its travel.
- B. The portable equipment hoist shall then be used to raise and lower the intended equipment through two complete cycles to ensure satisfactory performance of the intended application.
- C. The above tests shall be performed to the satisfaction of the Owner. In the event the equipment does not satisfactorily meet the specifications and performance criteria, such changes as may be required shall be made and the tests repeated until complete satisfaction is obtained.
- D. Weights to perform the above test shall be provided by the Contractor.

END OF SECTION

SECTION 15050

BASIC MECHANICAL MATERIALS AND METHODS

PART 1 - GENERAL

1.01 DESCRIPTION

- A. This Section includes requirements for basic mechanical materials and methods. It applies to all sections of Division 15 and to other sections that include mechanical equipment requirements except when, in these individual sections, requirements are otherwise specified. Mechanical systems shall be complete including all miscellaneous materials, and ready for operation as indicated in accordance with the Contract Documents.

1.02 QUALITY ASSURANCE

- A. Unless otherwise indicated, provide materials and equipment which are the standard products of manufacturers regularly engaged in the production of such materials and equipment. Provide the manufacturer's latest standard design that conforms to these Specifications. When two or more units of the same class of equipment are required, these units shall be the products of the same manufacturer.
- B. Where materials and equipment are specified to meet requirements of standards or organizations such as Underwriters Laboratories (UL), American Society for Mechanical Engineers (ASME), American Gear Manufacturer's Association (AGMA), American Gas Association (AGA), Air Refrigeration Institute (ARI), etc., that use a label or listing as a method of indicating compliance, such label or listing shall be attached to the material or equipment when delivered to the job site.
- C. Each major component of equipment shall have the manufacturer's name, address and model number on a metal nameplate attached to the item of equipment.
- D. Comply with requirements of the National Fire Protection Association, Air Moving and Conditioning Association, Underwriter's Laboratories, American Society of Heating, Refrigeration, and Air Conditioning Engineers, American National Standards Institute, and Sheet Metal and Air Conditioning Contractors National Association as directly related to material and workmanship.
- E. Welding shall be performed by certified welders in accordance with AWS D1.1 for the types of welding required on the work.
- F. Except where otherwise specified, structural and miscellaneous fabricated steel used in equipment shall conform to AISC standards and structural members shall be designed for appropriate shock and vibratory loads. Unless otherwise specified, steel which will be all or partially submerged during operation of equipment shall be at least ¼-inch thick.

1.03 SUBMITTALS

- A. Equipment data and information, including descriptive and published details concerning performance, capacity and noise ratings for each piece of equipment. For electrical motor driven equipment, include schematic drawings showing coordination with electrical system and provide rated horsepower, full load current requirements, and for electric motors $\frac{3}{4}$ horsepower and larger, provide temperature rating, locked rotor current, power factor at full and $\frac{3}{4}$ load, efficiency at full load and rated operation condition, type of bearings, lubrication requirements and net weight.
- B. Catalog data for materials, other than equipment, that are manufacturer's standard products.
- C. Shop drawings, including scaled mechanical layout drawings showing dimensioned plan views and elevations of mechanical equipment, equipment mounting and foundations including space requirements, coordination with building features, and other work.
- D. Submit manufacturer's instructions and recommendations for installation, handling and storage, and cleaning and maintenance of equipment and materials prior to initial energizing.
- E. Complete drawings showing identification of wire, wire numbers, terminal numbers and equipment termination for all instrumentation and electrical equipment in accordance with the control wiring identification requirements in Division 16. These control numbers shall be used in all instrumentation and electrical equipment and shall be so indicated on the shop drawings.

1.04 DELIVERY, STORAGE AND HANDLING

- A. Materials and equipment shall be boxed, crated or otherwise completely enclosed and protected during shipment, handling, and storage. Such boxes, crates or protection shall be clearly labeled with manufacturer's name, brand or model designation, type or grade, and color. Complete packing lists and bills of materials shall be included with each shipment. Each item of equipment shall be tagged or marked with the same identification number or mark as shown on the packing lists and bills of materials.
- B. Protect materials and equipment from exposure to the elements and keep dry at all times. Handle and store to prevent damage and in accordance with manufacturer's recommendations.
- C. Pumps, motors and other equipment with antifriction or sleeve bearings shall be stored in weather-tight areas maintained at a temperature above 60 degrees F.
- D. Material and equipment damaged by handling and storage shall be repaired or replaced by the Contractor as directed by the Engineer.

1.05 JOB CONDITIONS

- A. The drawings indicate the extent and general arrangement of equipment, piping and ductwork. Equipment shall fit into the space allotted and shall allow adequate clearance for entry, installation, replacement, servicing and maintenance. Actual and final arrangement, location, grade and elevations of equipment, appurtenances, piping and ducts shall be verified by the Contractor before ordering material and equipment. If adjustments and modifications are deemed necessary by the Contractor, details of such adjustments and modifications and the reasons therefore shall be submitted to the Engineer for approval as soon as practicable but not later than with the submittal of the scaled mechanical layout drawings. No adjustments or modifications shall be made without the Engineer's written approval.
- B. Coordinate the work so equipment may be moved in place without altering building components, other equipment or installations. Drops, rises or offsets not shown on the drawings but required for proper installation of the work shall be provided.

1.06 SAFETY REQUIREMENTS

- A. Enclose or provide guards for belts, pulleys, chains, gears and other rotating parts to protect operating personnel.
- B. Guard or cover high temperature equipment and piping with insulation to protect personnel and prevent a fire hazard.
- C. Provide items such as catwalks, ladders and guardrails, where required, for safe operation and maintenance of equipment.

1.07 SEQUENCING AND SCHEDULING

- A. Sequencing and scheduling of mechanical work shall be coordinated with other parts of the work including verification that all structures, piping, wiring, conduits and equipment components are compatible.

1.08 MAINTENANCE MATERIALS

- A. Spare parts listed to be furnished shall be packed in wooden boxes, labeled with the manufacturer's name, address and telephone number; local representative's name, address and telephone number; name of equipment the parts are for and list of parts contained therein, including the quantity of each part.
- B. Extra material shall be packed in strong cartons, labeled with manufacturer's name, material name, type, color and location where material was installed.
- C. Store maintenance materials in a location directed by the Owner.

1.09 MANUFACTURER'S SERVICES

- A. Manufacturers of furnished equipment shall provide qualified field representatives to provide services as required during installation, start-up, inspections/tests, and to instruct City personnel on operation and maintenance of the equipment. Field representatives shall be available to observe, instruct, guide and direct the Contractor's handling, installation, start-up and adjustment procedures of the equipment. Manufacturer's services shall be provided as follows:
 - 1. Equipment shall be installed in accordance with the manufacturer's instructions but shall not be energized or operated until a field representative of the manufacturer has inspected the installation and is available on the site to supervise the equipment start-up.
 - 2. Prior to and during the required inspections/tests, a field representative shall be available to operate and adjust the equipment to perform in accordance with the Contract Documents.
 - 3. When required in the specification sections for the equipment, provide competent factory-trained service personnel to instruct City personnel in the operation and maintenance of the equipment. Instruction sessions shall be conducted at times and locations suitable to the Owner.

PART 2 - MATERIAL

2.01 GENERAL

- A. In the design and supply of equipment, provide for interchangeability of parts and items for equipment, piping, ductwork, motors and other appurtenances.
- B. Factory assemble, coat and paint mechanical equipment as much as is permissible for shipping and handling but never less than a factory applied prime coat.

2.02 EQUIPMENT BASES

- A. Unless otherwise indicated, floor mounted equipment shall be provided with concrete bases a minimum of four inches high, and not less than 4 inches larger in both directions than supported unit, and outside, ground mounted equipment shall be provided with concrete bases with top elevation 6 inches above grade and bottom elevation 12 inches below the frost line, and not less than 6 inches larger in both directions than supported unit.
- B. Cast iron or welded steel baseplates shall be provided. Each unit and its drive assembly shall be supported on a single baseplate.

2.03 ANCHOR BOLTS

- A. Anchor bolts, nuts and washers shall be stainless steel. Unless otherwise indicated, size anchor bolts to the largest diameter that will pass through the bolt holes of the equipment base. Length of the bolts shall be long enough to permit a minimum of one inch of grout beneath the base plate and a minimum of six inches anchorage into the structural concrete.
- B. Provide anchor bolts, nuts and washers, together with template or setting drawing, sufficiently in advance to permit anchor bolts to be set either prior to or during structural concrete placement.

2.04 MECHANICAL SLEEVE SEALS

- A. Sleeve seals shall be modular sealing element units, designed for field assembly, to fill annular space between pipe and sleeve as manufactured by Pipeline Seal and Insulator, Inc., or approved equal.
- B. Sealing elements shall be EPDM or NBR, as recommended by the seal manufacturer for the specific application, interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
- C. Pressure plates shall be a composite material. Include two for each sealing element.
- D. Connecting bolts and nuts shall be stainless steel of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.05 SUPPORTS AND BRACES

- A. Provide supports and braces fabricated to meet requirements of the manufacturers and/or as indicated on the drawings.

2.06 DRIVE UNITS

- A. The nominal input horsepower rating of each gear or speed reducer shall be at least equal to the nameplate horsepower of the drive motor. Drive units shall be designed for 24 hour continuous service.
- B. Motor and drive gears shall be rated AGMA Class II and shall bear an AGMA nameplate.
- C. Gear reducers shall be totally enclosed, oil lubricated, with antifriction bearings throughout. Worm gear reducers shall have a service factor of at least 1.20. Shaft mounted gear reducers shall be rated AGMA Class II. Other helical, spiral bevel combination bevel-helical gear reducers shall have a service factor of at least 1.50. Each gear reducer shall bear an AGMA nameplate.

- D. Variable speed drives shall have a service factor of at least 1.75 at maximum speed, unless otherwise specified.
- E. V-belt drive shall include a sliding base or other suitable tension adjustment mechanism. V-belt drives shall have a service factor of at least 1.60 at maximum speed.

2.07 SAFETY GUARDS

- A. Belt and chain drives, fan blades, couplings, shafts and other moving and rotating parts shall be covered on all sides by a safety guard. Safety guards shall be fabricated from 16 or heavier gauge galvanized or aluminum-clad sheet steel or ½-inch mesh galvanized expanded metal. Each guard shall be designed for easy installation and removal. Necessary supports and accessories, including bolts, shall be provided for each guard. Supports and accessories, including bolts, shall be galvanized or painted in accordance with Section 09900 as required. Safety guards in outdoor locations shall be designed to prevent entrance of rain and dripping water. Safety guards shall meet OSHA requirements.

2.08 LUBRICATION

- A. Equipment shall be lubricated by systems that require attention no more frequent than weekly during continuous operation. Lubrication facilities, oil drains and fill opening shall be accessible from normal operating area or platform. Drain ports shall allow for collection of waste oil in containers from operating area or platform without removing the unit from its installed position.
- B. Pressure grease fittings shall be Zerk Hydraulic or Alemite type. Locations of grease fittings shall be accessible for lubricating with a grease gun.

2.09 SHOP PAINTING

- A. Surface prepare and shop coat equipment, supports, piping, duct work and appurtenances as specified in Section 09900 or as shown on the drawings except connecting ends and where it would hinder installation. These points shall be shop primed and field painted after installation. Shop primer shall be compatible with field coat.

2.10 ELECTRICAL SERVICE

- A. All mechanical equipment requiring electrical power to operate shall be rated for electrical service as shown on the electrical drawings and shall have sufficient length of cable and all other appurtenances necessary to provide an operational and fully functional unit. If the electrical service is not shown on the electrical drawings, the Contractor shall provide the service as required by the equipment manufacturer at no additional cost to the Owner.

2.11 THERMAL INSULATION

- A. Provide thermal insulation jacket for generator exhaust silencers and piping. All generator silencers and exhaust piping shall be wrapped with high temperature-flexible insulation which conforms to Military Specification MIL-I-16411-E, Type II. Insulation shall be Type E Fiberglass Insulation designed for use in insulating high temperature equipment as manufactured by Advanced Thermal Products, Inc. or approved equal. Insulation shall be flexible, lightweight and shall not compact under vibration. Insulation shall be manufactured from chopped glass fibers and shall be free from resinous binders.

2.12 SPECIAL TOOLS AND ACCESSORIES

- A. Provide special tools, instruments and accessories required to adjust, maintain or repair equipment. Equipment requiring special devices for lifting and handling shall be furnished complete with these devices.

PART 3 - EXECUTION

3.01 MECHANICAL DEMOLITION

- A. Disconnect, demolish, and remove mechanical systems, equipment, and components indicated to be removed.
 - 1. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible material.
 - 2. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible material.
 - 3. Ducts to Be Removed: Remove portions of ducts indicated to be removed and plug remaining ducts with same or compatible ductwork material.
 - 4. Ducts to Be Abandoned in Place: Cap or plug ducts with same or compatible ductwork material.
 - 5. Equipment to Be Removed: Disconnect and cap services and remove equipment.
 - 6. Equipment to Be Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.
- B. If pipe, insulation, or equipment to remain is damaged in appearance or is unserviceable, remove damaged or unserviceable portions and replace with new products of equal capacity and quality.

3.02 PREPARATION

- A. Inspect areas and surfaces to receive mechanical equipment, piping, duct work and appurtenances and verify that areas are ready for installation. Before installation, repair any defects or damaged areas, and adjust surfaces and areas so they are ready for proper installation.
- B. Field measure areas to be occupied by mechanical equipment and appurtenances and verify space is adequate and in accordance with approved shop drawings. If adjustment is required obtain approval of Engineer and adjust as approved.

3.03 INSTALLATION

- A. Equipment and appurtenances shall be installed in accordance with manufacturer's instructions. Provide complete final connections to equipment, including pipe, duct, electric and controls.
- B. Whether shown or not, isolation valves and accessory fittings shall be provided on each side of equipment to allow the equipment to be removed and isolated for servicing. High points in piping shall be provided with manual vents and low points in fluid piping provided with drain valves fitted for hose adapters. Rises and drops as required by field conditions, whether shown or not, shall be provided. The above required items shall be provided by the Contractor at no additional cost to the Owner.

3.04 FOUNDATIONS, BASES AND SUPPORTS

- A. All equipment, ductwork, electrical conduits and piping shall be supported by providing compatible frames, braces, hangers and anchors.
- B. Unless otherwise shown on the drawings, floor mounted equipment shall be set on reinforced concrete pads a minimum of four inches high, doweled to the floor, and outside ground mounted equipment shall be set on reinforced concrete pads on 6 inches of stone bedding. Provide baseplate, anchor bolts and vibratory absorption pad construction as shown on the drawings or as recommended by the equipment manufacturer. Baseplate shall be anchored to the concrete base with anchor bolts, leveled using shims or wedges and the space beneath filled with quick setting non-shrink grout. After grout has hardened, anchor bolts shall be finally tightened and cut off not more than one inch or less than ½-inch above top of the nut.
- C. Non-vibratory equipment suspended from building walls or ceilings shall be braced and supported to provide a rigid installation. Supports and hangers shall be attached to bearing walls, roof and floor supports or framing members. Cross bracing shall be provided, as required, to develop a rigid installation.
- D. Vibratory equipment suspended shall be braced, supported and provided with cushioning and anti-vibratory material as shown on the drawings or as recommended by the equipment manufacturer.

3.05 ACCESS PANELS

- A. Provide access panels and openings where it will be necessary for maintenance and servicing of concealed equipment, piping and ductwork.

3.06 LUBRICATION

- A. Equipment shall be lubricated in accordance with manufacturer's instructions after installation and prior to initial operation. Following testing and prior to final acceptance, re-lubricate as necessary.

3.07 ADJUSTMENT AND INITIAL OPERATION OF EQUIPMENT

- A. Before systems and equipment are initially started, piping, ductwork and equipment shall be cleaned. Moving parts shall be checked for freedom of movement, alignment and adjustment. Air-handling units shall have temporary filters in place to protect permanent filters.
- B. Provide manufacturer's services as required herein before equipment is energized and operated. Make adjustments as required and recommended by the manufacturer's representative.

3.08 SURFACE TOUCH-UP/FIELD PAINTING

- A. Touch-up where shop coats have been damaged using paint, coatings and film thickness identical to original shop coats.
- B. Clean field installed bolts, nuts, washers and support systems.
- C. Field paint as specified in Section 09900 or as shown on drawings.

3.09 PROTECT AND CLEAN

- A. Protect equipment during and after installation from construction dust and debris. Provide temporary protection as required until final acceptance of the project.
- B. Clean equipment, surrounding areas, piping and ductwork inside and out. Replace filters on air-handling equipment.

3.10 FIELD QUALITY CONTROL

- A. Demonstrate and inspect/test the operation of the various systems and equipment in the presence of the Engineer as specified in the specific sections for the equipment.

END OF SECTION

SECTION 15060

HANGERS AND SUPPORTS

PART 1 - GENERAL

1.01 DESCRIPTION

- A. This section includes requirements for providing pipe hangers, brackets, supports, and spacing of expansion joints in piping systems as indicated in accordance with the Contract Documents. Pipe supports shall be furnished complete with all necessary inserts, bolts, nuts, rods, washers, and other accessories.

1.02 JOB CONDITIONS

- A. In certain locations, pipe supports, and anchors are shown on the drawings, but no attempt has been made to indicate every pipe support and anchor. It shall be the Contractor's responsibility to provide complete system of pipe supports and to anchor all piping in accordance with this section.
- B. Concrete and fabricated steel supports shall be as indicated on the drawings, as specified in other sections, or, in the absence of such requirements, as permitted by the Engineer.
- C. All piping shall be rigidly supported and anchored so that there is no movement or visible sagging between supports.
- D. Pipe supports, and expansion joints are not required in buried piping, but concrete blocking or other suitable anchorage shall be provided as indicated on the drawings or specified in other sections.
- E. Any additional pipe supports or modifications to pipe supports that may be required, in the opinion of the Engineer, to eliminate or reduce vibration of pumps or other equipment, shall be provided by the Contractor at no additional cost.

1.03 SUBMITTALS

- A. Shop drawings in conjunction with Specification Sections for piping, valves and pumps, showing the location of all pipe supports for pipes two-inches and larger. Shop drawings shall show fabrication and installation details, and shall include calculations, for all hangers and supports.
- B. Catalog data for all hangers, supports and associated components to be used.
- C. Manufacturer's installation instructions.

PART 2 - PRODUCTS

2.01 GENERAL

- A. Pipe supports shall comply with ANSI/MSS SP-58 and Federal Specification WW-H-171E. Load carrying, and coating tests will not be required.
- B. Pipe supports specified are identified by manufacturer's name and catalog number.
- C. Pipe supports shall be manufactured for the size and type of pipe to which they are applied. Straphangers will not be acceptable. Threaded rods shall have threading to permit the maximum adjustment available in the support item.
- D. Pipe supports shall be furnished complete with all necessary inserts, bolts, nuts, rods, washers, and other accessories.
- E. Contact between dissimilar metals, including contact between stainless steel and carbon steel, shall be prevented. Supports for brass or copper pipe or tubing shall be copper plated. Portions of pipe supports which contact other dissimilar metals shall be rubber or vinyl coated.
- F. All pipe supports located in the pump station wetwell shall be AISI Type 316 stainless steel. Stainless steel supports fabricated by welding shall be AISI Type 316L material.

2.02 DESCRIPTION

Pipe support types and application shall comply with the following.

	<u>Description or Size</u>	<u>MSS SP-58</u>	<u>Manufacturer and Model</u>
A.	Hangers		
	2-½-inch and smaller pipe,		
	adjustable J	5	B-Line Fig. B3690, Grinnell Fig. 104, or equal.
	clevis	1	Grinnell Fig. 65, B-Line Fig. B3104, or equal.
	3-inch through 10-inch pipe		
	clevis	1	Grinnell Fig. 260, B-Line Fig. B3104, or equal.
	12 inch and larger pipe		
	clevis	1	Grinnell Fig. 260, B-Line Fig. B3102, or equal

	<u>Description or Size</u>	<u>MSS SP-58</u>	<u>Manufacturer and Model</u>
B.	Standard weight and extra strong steel pipe and stainless steel pipe (all sizes)		
	uninsulated, steel pipe clamp	4	Elcen "1", Fee & Mason "236", ITT Grinnell "212", or equal
C.	Concrete Rod Attachment Plate, 6-inch and smaller pipe	19	Grinnell Fig. 52, or equal.
D.	Turnbuckles, Steel	13	Elcen 81, Fee & Mason 2382, Grinnell Fig. 230, or equal
E.	Hanger Rods, Carbon Steel, threaded both ends, ½-inch minimum size	--	Elcen 72, Fee & Mason 267, Grinnell Fig. 140, or equal.
F.	Wall Mounted Pipe Supports and Frames, steel 12 inch and smaller pipe		
	brackets	33,34	Grinnell Fig. 195 & 199; B-Line Fig. B3066 & B3067, or equal.
	prefabricated channels, galvanized	--	12 gauge, 1 ⁵ / ₈ " x 1 ⁵ / ₈ " with suitable brackets and pipe clamps.
	offset pipe clamp, 1½-inch and smaller pipe, galvanized	--	1¼" x 3/16" steel, with 3/8" bolts.
	offset pipe clamp, 2-inch to 3½-inch pipe, galvanized	--	1¼" x 3/16" steel, with 3/8" bolts.
G.	Pipe Riser Clamps		
	cold piping system	—	Pipe Shields, Inc., "E1000", or equal
	copper tubing	—	CT-121 or CT-121C
	other piping systems	—	Grinnell "261", or equal
H.	Floor Mounted Pipe Supports, steel, cast or ductile iron, 2 inch through 24 inch pipe		

<u>Description or Size</u>	<u>MSS SP-58</u>	<u>Manufacturer and Model</u>
Flange Support	–	Standon Model S89 with galvanized extension pipe, or equal
Saddle Support	–	Standon Model S92 with neoprene liner and galvanized extension pipe, or equal
Flange Cradle Support	–	Standon Model S96 with galvanized extension pipe, or equal

PART 3 - EXECUTION

3.01 LOCATION AND SPACING

- A. Piping shall be supported approximately 1½ inches out from the face of walls and at least 3 inches below ceilings or beams. The maximum spacing for pipe supports and expansion joints shall be:

Type of Pipe	Pipe Support Maximum Spacing, Feet	Maximum Run without Expansion Joint, Loop or Bend, Feet (See Note 1)	Expansion Joint Maximum Spacing, Feet (See Note 2)	Type of Expansion Joint
<u>Ductile Iron</u>	15	80	80	Mechanical Couplings
<u>Steel:</u>				
1¼-inch and smaller	7	30	100	Note 3
1½ to 4- inch	10	30	100	Note 3
<u>Copper:</u>				
1-inch and smaller	5	--	--	None required
Over 1-inch	7	50	100	Note 3
<u>PVC:</u>				
⅝- and ¾-inch	Continuous Support	20	60	None required

Type of Pipe	Pipe Support Maximum Spacing, Feet	Maximum Run without Expansion Joint, Loop or Bend, Feet (See Note 1)	Expansion Joint Maximum Spacing, Feet (See Note 2)	Type of Expansion Joint
½- to 2-inch	4	20	60	None required
Over 2-inch	6	20	60	None required
<u>Cast Iron Soil Pipe:</u>	10	–	–	None required

Notes:

1. Unless otherwise permitted, an expansion joint shall be provided in each straight run of pipe having an overall length between loops or bends exceeding the maximum run specified herein.
2. Unless otherwise permitted, the spacing between expansion joints in any straight pipe run shall not exceed the maximum spacing specified herein.
3. Expansion joint fittings as specified in the miscellaneous piping section.
4. At least two properly padded supports for each pipe section.
5. At least one support for each pipe section.

3.02 INSTALLATION

- A. Concrete inserts or L-shaped anchor bolts shall be used to support piping from new cast-in-place concrete. Expansion anchors shall be used to fasten supports to masonry.
- B. Design loads for inserts, brackets, clamps, and other support items shall not exceed the manufacturer's recommended loads.
- C. Anchorage shall be provided to resist thrust due to temperature changes, changes in diameter or direction, or dead ending. Anchors shall be located as required to force expansion and contraction movement to occur at expansion joints, loops or elbows, and as required to prevent excessive bending stresses and opening of mechanical couplings. Anchorage for temperature changes shall be centered between elbows used as expansion joints.
- D. Provide dielectric isolation. Do not allow copper and other metals to make contact with each other.

- E. All pipe supports located in sewage wetwells shall be stainless steel.
- F. All piping shall be supported and anchored so that there is no movement or visible sagging between supports.
- G. Pipe supports shall be manufactured for the size and type of pipe to which they are applied. Straphangers will not be acceptable. Threaded rods shall have sufficient threading to permit the maximum adjustment available in the support item.
- H. Vertical Piping:
 - 1. Secure at sufficiently close intervals to keep pipe in alignment and to support weight of pipe and its contents.
 - 2. Support vertical iron and steel pipe on maximum 5'-0" centers with steel pipe riser clamps.
 - 3. Support vertical copper tubing at no more than 10'-0" spacing, using plastic coated steel pipe riser clamps or pipe clamp hangers at end of runs and at intermediate points as installation dictates.
 - 4. Support vertical plastic pipe at 4'-0" centers, using plastic coated pipe riser clamps or pipe clamp hangers at end of runs and at intermediate points as installation dictates.
- I. Horizontal Piping:
 - 1. Support at sufficiently close intervals to prevent sagging, thrust restraint, and vibration.
 - 2. Install hangers or supports at ends of runs or branches and at each change of direction or alignment.
 - 3. Install steel clevis-type pipe hangers for horizontal iron and steel pipe on maximum 10'-0" centers.
 - 4. Install steel clevis-type pipe hangers for copper tubing on 6'-0" centers for 1¼" size and smaller, and on 10'-0" centers for copper tubing larger than 1¼" size.
 - 5. Install plastic coated ring-type pipe hangers for horizontal plastic pipe on maximum 4'-0" centers, close to every joint, at ends of each branch, and at each change in direction of elevation; hangers shall not compress, distort, cut or abrade plastic piping and shall permit free movement of the pipe.
- J. The Contractor is responsible for properly bracing piping against lateral movement or sway. The Engineer shall review with the Contractor and approve method of bracing of piping at each location prior to Contractor proceeding with the installation

of the bracing. Bracing shall be installed at all locations where sway is anticipated and as directed by the Engineer.

- K. Rubber hose and flexible tubing shall be provided with continuous angle or channel support.

END OF SECTION

SECTION 15100

PIPING

PART 1 - GENERAL

1.01 DESCRIPTION

- A. This section includes requirements for providing pump piping, drain piping, and other miscellaneous piping as indicated in accordance with the Contract Documents.

1.02 SUBMITTALS

- A. Layout drawings for all piping, including sizes, types, and locations. The drawings shall also indicate location of all fittings, wall and floor penetrations, valves, and pipe supports. Layout drawings for the piping shall be coordinated with shop drawings for the base-mounted lift station specified in Section 11300 and valves specified in Section 15110.
- B. Catalog data for all pipe, fittings and appurtenances.
- C. Grooved joint couplings and fittings, when used, shall be shown on layout drawings and product submittals and shall be specifically identified with the applicable Victaulic style or series designation.
- D. Manufacturer's instructions for installation and assembly of joints and accessories, including the manufacturer's recommended maximum deflection per joint.
- E. Submit certificates of compliance for all pipe, fittings and appurtenances in this section.
- F. Submit details of joint bonding, field welded joint restraint calculations, calculations for pipe design and fittings reinforcement and/or test data.

PART 2 - MATERIALS

2.01 PIPING

Piping shall be furnished and installed complete with all fittings, jointing materials, hangers and supports, anchors, and other necessary appurtenances. Unless otherwise stated, the latest edition for any commercial standards and all manufacturing tolerances referenced therein shall apply.

- A. Ductile Iron Pipe – Exposed/Interior:

1. Pipe Flanged, ANSI A21.51 Class 54.
Grooved, ANSI/AWWA C606 Class 54.
2. Lining Ceramic Epoxy, Induron Protecto 401, or approved equal.
3. Flanges ANSI A21.15/ASME B16.1, Class 125.
4. Nuts and Bolts ASTM A307, Grade B.
ANSI B18.2.1 and B18.2.2.
Provide ASTM F593 Type 316 stainless steel,
Condition CW1 or CW2, fasteners (in wetwells).
5. Fittings ANSI A21.10 or A21.53; with factory installed flanges
in accordance with ANSI A21.15/ASME B16.1, Class
125.
6. Grooved Couplings Victaulic Style 31.
ASTM A536, Grade 65-45-12.
7. Grooved Fittings Victaulic ANSI A21.10/AWWA C-110.
8. Pipe Couplings Dresser Style 38, Rockwell Type 411, Victaulic
Depend-O-Lok®; harnessed.
9. Flange Adapters Victaulic Style 341, EBAA Iron Megaflange 2100, or
approved equal.
10. Dismantling Joints Smith Blair Model 975 or Romac Style DJ400;
AWWA C219, fusion bonded epoxy coating.
11. Gaskets Ductile iron pipe flanged joints shall conform to
ANSI/AWWA C115/A21.15. Gaskets for ductile iron
flanged joints shall be full face type SBR elastomer
per ANSI/AWWA C111/A21.11 and shall be 1/8”
thickness. Flanged gaskets shall be high-
performance type satisfying the special requirements
of ANSI/AWWA C111/A21.11 Appendix C, Sec. C.2
and have at least (3) bulb type rings molded into both
faces of the gasket. Flanged gaskets shall be U.S.
Pipe FULL FACE FLANGE-TYTE Gasket or
approved equal.

B. Ductile Iron Pipe – Buried:

1. Pipe Push-On Joint, Fastite, Tyton, ANSI A21.51 Class 54.
Grooved, ANSI/AWWA C606 Class 54.

- | | | |
|----|-------------------|--|
| 2. | Lining | Ceramic Epoxy, Induron Protecto 401, or approved equal. |
| 3. | Push-On Joints | ANSI A21.11, with factory installed restraints. |
| 4. | Restrained Joints | 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 for 4-inch thru 36-inch (350 psi for 4" – 24", 250 psi for 30" - 36"), HP LOK for 30-inch thru 64-inch (350 psi), and High Deflection Single Slot (HDSS) for 24-inch thru 48-inch (350 psi) when needing higher deflection capability; American Ductile Iron Pipe "Flex Ring"; or McWane Ductile TR-Flex Restrained Joint Pipe. Restraining fittings using set screws, restraining gaskets, gripper type glands, and field-cuts of restrained joints shall be Megalug, or approved equal. Restrained joints shall be capable of sustaining the design pressure as specified herein. The push-on restraining gaskets for 4" - 24" pipe shall be US Pipe FIELD-LOK 350 gaskets, American FastGrip gaskets, or McWane Ductile SURE STOP 350. |
| 5. | Fittings | ANSI A21.10 or A21.53; Push-On Joints with factory installed restraints or Mechanical Joints (MJ) with MJ Restraints, in accordance with ANSI A21.11. |
| 6. | Grooved Fittings | Victaulic ANSI A21.10/AWWA C-110. |
| 7. | MJ Restraints | EBAA Iron Megalug Series 1100 or approved equal. |
| 8. | Grooved Couplings | Victaulic Style 31, ASTM A536, Grade 65-45-12. Provide ASTM F593, Group 2, Type 316 stainless steel, Condition CW oval neck track bolts and ASTM F594, Group 2, 316 stainless steel, Condition CW heavy hex nuts. |

C. Steel Pipe – Exposed/Interior:

- | | | |
|----|-----------------|---|
| 1. | Pipe | Flanged, ANSI/AWWA C200, wall thickness .375". |
| 2. | Interior Lining | Epoxy paint lined in accordance with ANSI/AWWA C210. Lining shall be Tnemac H.S. Epoxy Series 104, 30 mil minimum thickness, or approved equal. |
| 3. | Coatings | Zinc chromate primer and painted in accordance with Section 09900. |

4. Flanges Flanges will be 150 lb. steel plate flanges in accordance with AWWA C207 Class D.
5. Welding Welding procedure and performance and qualification shall be in accordance with ANSI/AWS B2.1 and the structural welding code ANSI/AWS D1.1.
6. Field Welding Field welds shall be in accordance with ANSI/AWWA C206.
7. Couplings Bolted, sleeve-type couplings for plain-end shall be in accordance with ANSI/AWWA C219.
8. Dimensions The dimensions for fabricated steel shall be in accordance with ANSI/AWWA C208.

D. PVC Drain Pipe:

1. Pipe Cellular Core, ASTM F891.
2. Fittings PVC DWV fittings, ASTM D2665.
3. Joints Solvent-cemented, ASTM F656 and ASTM D2564.

E. Galvanized Steel Pipe:

1. Pipe Sch. 40 galvanized, ASTM A53.
2. Nipples Sch. 40 galvanized, ASTM A733, seamless steel pipe.
3. Unions Malleable-Iron, ASME B16.39, Class 150, hexagonal-stock body with ball-and-socket, metal-to-metal, bronze seating surface and female threaded ends.
4. Grooved Couplings Victaulic Style 07/W07 (rigid).
Victaulic Style 77/W77 (flexible).
5. Grooved Fittings Victaulic; Ductile-Iron ASTM A536; ASTM A234 wrought steel; ASTM A53 factory fabricated.
6. Threaded Fittings Gray-Iron galvanized, ASME B16.4, Class 125 standard pattern.
7. Flanged Fittings Cast-Iron galvanized, ASME B16.1, Class 125.

- F. Stainless Steel Pipe:
1. Pipe ASTM A312, Type 304/304L, Schedule 5S, full finish annealed.
 2. Fittings Precision, cold drawn, austenitic stainless steel with elastomer O-ring seals.
 3. Joints Vic-Press 304™ with Victaulic 'PFT' series tools.
- G. Pipe Couplings shall be harnessed with Dresser STAR Anchor Restraint System, restrained Victaulic Depend-O-Lock® FxF type, or approved equal, with number and size of tie rods as required by the manufacturer for the diameter and pressure rating of the pipe on which they are to be installed.
- H. Wall Castings and sleeves in walls for pipes 4 inches and larger shall be minimum ductile iron Class 250 of the lengths, shapes and sizes necessary, and shall be complete with waterstop flanges. The ductile iron wall castings and wall sleeves shall conform to ANSI A21.10.
- I. Watertight Sleeve Seals shall be PSI-ThunderLine Link-Seal EPDM modular sealing elements with composite pressure plates and type 316 stainless steel connecting bolts and nuts.
- J. Protective Coatings:
1. Buried Piping Coat buried piping and fittings with one mil thickness of asphaltic coating per AWWA C151, C110 and C153, as applicable.
- When indicated on the Contract Drawings, all buried ductile iron pipe and fittings shall have a tube-type polyethylene encasement, V-BIO enhanced polyethylene encasement as manufactured by US Pipe, or approved equal, 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.

2. Exposed/Interior Piping Furnished with a suitable shop primer and finish coated in accordance with Section 09900. Shop primer shall be approved by the finish coat paint manufacturer.

2.02 MISCELLANEOUS

- A. Pump discharge piping shall have a pressure gauge with a range of approximately twice the design operating pressure. Pressure gauges shall be Ashcroft #45-1279SSH-04L-XLL, or approved equal.
- B. Pump suction piping shall have a compound pressure and vacuum gauge graduated from 30 in. Hg vacuum to 15 psi. Gauges shall be 316 stainless steel Ashcroft Type 1279 with XLL and hermetically sealed options, or approved equal.
- C. Pressure gauges shall be installed with a 316 stainless steel, silicone-filled diaphragm seal with flushing connection, Ashcroft Type 201, or approved equal, for discharge piping pressure gauges and Ashcroft Type 741, or approved equal, for suction piping pressure gauges.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Flange bolts shall be tightened sufficiently to slightly compress the gasket and effect a seal, but not so tight as to distort the flanges.
- B. All pipes passing through walls or slabs which have one side in contact with earth or exposed to the weather shall be sealed watertight with special rubber gasketed sleeve and joint assemblies or with sleeves and modular rubber sealing elements.
- C. Pipe shall be installed as indicated, or in the absence of a detailed piping arrangement, as approved by the Engineer. Piping shall not obstruct openings or passageways.
- D. Pipe shall be cut from measurements taken at the site and not from the drawings, and all necessary provisions shall be taken in laying out piping to allow for expansion and contraction.
- E. Connections to pumps shall be made in a manner to eliminate strains on piping and pumps.
- F. Vic-Press 304™ fittings and stainless steel pipe may be used on applicable systems 2" and smaller in lieu of welded/threaded steel or flanged/threaded ductile iron. Install in accordance with the manufacturer's latest installation instructions. Pipe shall be square cut, ± 0.030 ", properly deburred, and cleaned. Mark pipe ends at the required location, using a gauge supplied by Victaulic, to ensure full insertion

into the coupling or fitting during assembly. Use a Victaulic 'PFT' series tool with the proper sized jaw for pressing.

- G. Grooved joint couplings and fittings shall be installed in accordance with the manufacturer's written installation instructions. Grooved ends shall be clean and free from indentations, projections, and roll marks in the area from pipe end to groove. Gaskets shall be verified as suitable for the intended service prior to installation. Gaskets shall be molded and produced by the coupling manufacturer. The grooved coupling manufacturer's factory trained representative shall provide on-site training for contractor's field personnel in the use of grooving tools, application of groove, and installation of grooved joint products. The manufacturer's representative shall periodically visit the jobsite and review installation. Contractor shall remove and replace any joints deemed improperly installed.
 - 1. All grooved joint couplings, fittings and specialties shall be the products of a single manufacturer. Grooving tools shall be of the same manufacturer as the grooved components.
- H. Annular space between pipe and wall sleeves shall be sealed with mechanical seals to fill the space and form a watertight seal.
- I. Tighten flange bolts so that the gasket is uniformly compressed and sealed, do not distort flanges, and do not exceed the manufacturer's recommended maximum torque.
- J. Flange bolts shall project $\frac{1}{8}$ - to $\frac{1}{4}$ -inch beyond the face of each nut after tightening.
- K. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings in accordance with manufacturer's written instructions.
- L. Install proper size increasers, reducers, and couplings where different sizes or materials of pipes and fittings are connected. Reducing size of piping in direction of flow is prohibited.
- M. Install buried PVC drain piping according to ASTM D2321 and ASTM F1668.
- N. Join PVC drain piping according to ASTM D2855 for solvent-cemented joints.

3.02 CLEANING

- A. The inside of all pipe, valves, and fittings shall be smooth, clean, and free from blisters, loose mill scale, sand, and dirt when erected. All lines shall be thoroughly blown clean before placing in service.

3.03 PAINTING

- A. Paint all piping, valves and fittings as specified in Section 09900.

- B. Color code all piping paint work as specified in Section 09900.

3.04 TESTING

- A. Discharge and force main piping systems shall be hydrostatically tested in accordance with AWWA C600 to 1½ times working pressure, but not less than 150 psi.
- B. Leakage shall be determined by loss of pressure, soap solution, or chemical indicator.
- C. Provide all necessary piping between the reach being tested and the water supply, together with all required materials and equipment.
- D. Provide dished heads, blind flange or bulkheads as necessary to isolate and test force main.
- E. Methods and scheduling of tests to be approved by the Engineer.
- F. Protect pipes and provide thrust restraint as required to complete the test.

3.05 STARTUP/TRAINING

- A. The Owner reserves the right to videotape and archive all startup and training instruction provided by the manufacturer or authorized representative.

END OF SECTION

SECTION 15110

VALVES

PART 1 - GENERAL

1.01 DESCRIPTION

- A. This section includes requirements for furnishing and installing all valves and appurtenances as indicated in accordance with the Contract Documents.

1.02 SUBMITTALS

- A. Layout drawings for valves to assure no conflict with other piping and equipment. These drawings shall be coordinated with layout drawings for the base-mounted lift station pumps specified in Section 11310, sump pump specified in Section 11350, and piping specified in Section 15100.
- B. Catalog data for all valves and appurtenances, including operators.
- C. Shop drawings for all valves and appurtenances.
- D. Manufacturer's installation recommendations.
- E. Submit operation and maintenance manuals, including procedures for operation, instructions for maintenance and overhaul, lubrication schedules, safety precautions, test procedures and parts lists.
- F. Submit manufacturer's certificates indicating that products furnished comply with the specifications.

1.03 QUALITY ASSURANCE

- A. Valve manufacturer shall be regularly engaged in the design, manufacture and maintenance of valves for sewage service and shall have furnished valves of the same general design, type and comparable size specified herein, which have been used and proved satisfactory under similar test, service and operating conditions for at least five years. The manufacturer shall furnish satisfactory evidence of adequate facilities for furnishing parts for repairs and for maintenance of valves furnished.

1.04 WARRANTY

- A. The Contractor shall submit to the Owner a written manufacturer's warranty covering equipment defects and workmanship and shall be responsible for repairing or replacing at his own expense, including labor and shipping, all parts defective in material or workmanship for a period of two years from the date Contractor achieves Substantial Completion for the project.

PART 2 - PRODUCTS

2.01 GATE VALVES

- A. Gate valves shall be ductile iron with stainless steel trim, solid wedge, tapered seat, non-rising stem, as shown on drawings, non-asbestos packing, and shall be in accordance with AWWA C500 and these specifications.
- B. Valve bodies, bonnets, glands and discs shall be ductile iron ASTM A536 Grade 65-45-12. The body and bonnet wall thickness shall exceed the minimum wall thickness stated in AWWA Standard C500, Section 4.4, Table 1. Accurately machined bronze seating rings shall be secured in the valve body. Valve wedge shall be provided with bronze seating rings, machined and scraped, if necessary, to seat truly flat against body seating rings. All 14-inch and larger valves shall have bronze rollers and scrapers located on both sides of the gate, which shall travel in a bronze or 316 stainless steel lined groove in the body to keep the gate centered between the seats throughout its length of travel.
- C. Valve stems shall be 304 stainless steel and rotate freely in the valve bonnet recess. Design of the stuffing box shall permit repacking under line pressure. Stuffing box glands shall be brass; gland followers shall be ductile iron.
- D. All gate valves shall be rated for 250 psi working pressure and 300 psi hydrostatic test pressure.
- E. Unless otherwise indicated or required, valves for above ground ductile iron pipe shall have flanged ends in accordance with ANSI B16.1, 125 pound class. All buried valves shall be provided with mechanical joint ends compatible with the adjoining pipe. Provide hand wheel and/or extension stem with operating nut, as indicated on the plans or as required by the particular installation. All valves 14-inch and larger shall be provided with a by-pass and bevel or spur gears, as applicable for the installation. When gears are required on valves smaller than 14-inch to change position or direction of the valve stem, gear ratio shall be 2:1.
- F. Provide a valve position indicator for each valve, to fit inside the specified valve boxes and are suitable for use with the valves furnished.
- G. Gate valves shall be Kennedy Metal Seat Solid Wedge Valve, or approved equal.
- H. Body and bonnet fasteners shall be of rustproof material having the physical properties of ASTM A307. Packing and gaskets shall be of non-asbestos materials.
- I. Internal and external coating (6-8 mils DFT), testing and inspections shall be in accordance with AWWA C500. Valves shall be marked with the requirements of AWWA C500 and MSS-SP25.
- J. Gate valves shall be provided with a ductile iron manual operating nut, extension stem, and a floor or valve box as indicated on the Contract Drawings. Buried valves

shall be installed with a fully adjustable valve box trench adapter. Contractor shall furnish two (2) operating nut keys. The direction of rotation of the operating nut to open the valve shall be to the left (counterclockwise). Each valve body or operator shall have cast thereon the word "OPEN" and an arrow indication the direction to open.

- K. 2-inch AWWA operating nut shall be constructed of ductile iron ASTM A536 Grade 65-45-12. The ductile iron operating nut shall be fusion bonded epoxy coated inside and out with no uncoated surface.

2.02 COMBINATION AIR VALVES

- A. Combination air valves shall be float operated valves designed to release accumulated air or gas from a piping system while the system is in operation and under pressure. The valves shall discharge large quantities of air during pipe filling operations and intake large quantities of air during pipe draining and water column separation. All combination air valves shall be A.R.I. Model D26NS with a non-slam orifice, or approved equal.
- B. The valve body shall be reinforced nylon and conical in shape to maintain an air gap between the wastewater and the sealing mechanism. Wastewater shall not come in contact with the sealing mechanism at any time during normal operation at the valve's working pressure. The working pressure shall range from 0.3 to 150 psi and the valve shall be tested to 225 psi. The maximum working temperature shall be 140 degrees F with maximum intermittent temperatures of up to 194 degrees F.
- C. The valve shall have a lower float and a funnel shaped lower body to automatically drain wastewater and other debris from the valve. The lower float shall be located in the main body of the valve and shall be constructed of reinforced nylon and polypropylene.
- D. A spring guided linkage between the sealing mechanism and float/stainless steel rod assembly shall perform without jamming or allowing air to escape due to vibrations, float bouncing related to turbulence from pump start and stop, or from flow fluctuations.
- E. The valve discharge elbow shall provide means of connecting a vent pipe or for use in valve flushing and cleaning. The valve body shall have 316 stainless intake connection and a 316 stainless steel discharge elbow connection in accordance with the schedule below.
- F. The valve shall have a 316 stainless steel ball valve connected to the lower valve body to relieve internal pressure and permit backflushing.

- G. All hardware shall be 316 stainless steel. All O-rings shall be of BUNA-N with pressure ratings equivalent to the overall working pressure of the valve.

Location	Intake Body Connection	Discharge Elbow Connection	Non-Slam Orifice
Force main as shown on the Contract Drawings	2" NPT	2" NPT	0.177"

2.03 AIR RELEASE VALVES

- A. Air release valves shall be float operated valves designed to release accumulated air or gas from a piping system while the system is in operation and under pressure. The valves shall discharge large quantities of air during pipe filling operations and intake large quantities of air during pipe draining and water column separation. All combination air valves shall be A.R.I. Model D26 with a one-way out check valve component, or approved equal.
- B. The valve body shall be reinforced nylon and conical in shape to maintain an air gap between the wastewater and the sealing mechanism. Wastewater shall not come in contact with the sealing mechanism at any time during normal operation at the valve's working pressure. The working pressure shall range from 0.3 to 150 psi and the valve shall be tested to 225 psi. The maximum working temperature shall be 140 degrees F with maximum intermittent temperatures of up to 194 degrees F.
- C. The valve shall have a lower float and a funnel shaped lower body to automatically drain wastewater and other debris from the valve. The lower float shall be located in the main body of the valve and shall be constructed of reinforced nylon and polypropylene.
- D. A spring guided linkage between the sealing mechanism and float/stainless steel rod assembly shall perform without jamming or allowing air to escape due to vibrations, float bouncing related to turbulence from pump start and stop, or from flow fluctuations.
- E. The valve discharge elbow shall provide means of connecting a vent pipe or for use in valve flushing and cleaning. The valve body shall have 316 stainless intake connection and a 316 stainless steel discharge elbow connection in accordance with the schedule below.
- F. The valve shall have a 316 stainless steel ball valve connected to the lower valve body to relieve internal pressure and permit backflushing.

- G. All hardware shall be 316 stainless steel. All O-rings shall be of BUNA-N with pressure ratings equivalent to the overall working pressure of the valve.

Location	Intake Body Connection	Discharge Elbow Connection	Check Valve
Pump Room as shown on the Contract Drawings	2" NPT	2" NPT	One-way out
Force main as shown on the Contract Drawings	2" NPT	2" NPT	One-way out

2.04 MISCELLANEOUS VALVES

- A. Gate valves 4-inch and larger shall be as specified above. Gate valves smaller than 4-inch shall be of the solid wedge type with threaded ends; Crane 431UB, Stockham B-105, or approved equal.
- B. Check valves smaller than 4-inch shall be bronze horizontal swing check valves with threaded ends; Crane 36, Stockham B-345, or approved equal.
- C. Ball valves 2-inch and smaller shall be full port 316 stainless steel 2 piece ball valves with threaded ends; Crane 9431 or approved equal.

2.05 EXTENSION STEMS

- A. Extension stems shall be provided for operation of valves where required or shown on the Contract Drawings, sized so as to transmit full torque from the operating mechanism to the valve without binding, twisting or bending. The Contractor shall confirm the lengths of each extension stem.
- B. At a minimum, extension stems shall be constructed of hot dipped galvanized 1¼-inch diameter solid ASTM A36 hot rolled steel round bar, shall include a 2-inch square, 1.875-inch tall solid ASTM A5 ductile iron nut coupling (bottom) with four (4) set screws for attachment to the valve operating nut, and shall include a 2-inch square, 1¾-inch tall solid ASTM A5 ductile iron operating nut (top) located in the floor/valve box. All extension stems for buried valve applications shall have 0.375-inch thick by 4½-inch diameter ASTM A5 ductile iron centering rings spaced 6 feet on center, with the upper most centering ring no further than 6 inches below the operating nut, such that it is contained within the top section of the valve box. Extension stems shall be manufactured by Higgins Engineering, Inc. (434) 946-7170, or approved equal. Where required, universal joints shall be provided for deflection or offset.
- C. Stem guides shall be high-strength ductile iron and installed as necessary, but at a minimum so that extension stems do not go unsupported for lengths of more than eight (8) feet. Stem guides shall be adjustable and shall include a bronze bushing with an inside diameter 1/16" larger than the outside diameter of the extension stem.

Stem guides shall be Item No. 367-XXXX as manufactured by Trumbull Industries, Inc., or approved equal. The Contractor shall provide sufficient supports as required by the valve manufacturer.

2.06 HANDWHEELS

- A. Handwheels shall be provided for operation of valves where required or shown on the Contract Drawings. Handwheels shall be 14 inches in diameter, made from either cast iron or ductile iron, and shall include a directional arrow indicating the rotation to open the valve. Handwheel shall be Item No. 367-4961 as Manufactured by Trumbull Industries, Inc., or approved equal.

2.07 VALVE BOXES

- A. Valve boxes for all buried valves shall be cast iron, screw type assembled units consisting of tops, bottoms and lids, and extensions as necessary, depending on depth of valve burial. Valve box assembly shall be fully adjustable to accommodate grade changes. Valve boxes for all interior valves shall be cast iron, slip type consisting of tops and lids, and shall be installed with the top of the valve box adaptor flush with the top of the concrete slab, as shown on the Contract Drawings. Valve boxes shall be Tyler/Union valve boxes or approved equal. Valve boxes shall be suitable to accommodate the valve box adaptor and position indicator specified.
- B. All valve boxes shall be equipped with a position indicating device to provide the position of the underlying valve and shall be directly coupled to any stem extension configuration comprised of a shaft and 2-inch AWWA nut. The indicator shall be supplied as an assembly consisting of a valve box adaptor, an indicator, and an operating stem adaptor. The valve box adaptor shall have a hole large enough to fit a 2" square socket through it so that extension stems can be added or removed without removing the valve box adaptor. The indicator shall be of a digital read out capable of reading from 0 to 9999.9 turns. The indicator body shall be shock proof, self-extinguishing techno polymer case that meet IP64 standards, and shall be encased in a transparent silicon casing which extends over the extension stem to ensure no water can penetrate the indicator where the operating stem attaches to the indicator bushing. Turns to open shall be indicated by a label next to the digital read out, and the label shall be replaceable in the event that the indicator is used for a different valve. The valve position indicator and accessories shall be Model API_OP9FB as manufactured by Troy Valve or approved equal.
- C. All lids shall be marked with "SEWER", "WATER", etc., as appropriate for the service on which they are to be installed.
- D. A 3-inch by 1-inch stainless steel nameplate with black infill text, to identify the associated valve below, shall be attached to the valve box lid using stainless steel pop rivets. Nameplate shall be an Engraved Equipment Nameplate as manufactured by Seton or approved equal.

2.08 FLOOR BOXES

- A. Floor boxes shall be installed in the concrete slab, as shown on the Contract Drawings, to provide support for extension stems of the non-rising stem type and to provide a cover for the operating nut on the extension stem. The floor boxes shall have a bronze bushing and be designed for the concrete slab thicknesses in which they are to be installed with the top of the floor box flush with the top of the concrete slab or installed with a floor box top extension so that top is flush with finish grade, as shown on the Contract Drawings.
- B. A 3-inch by 1-inch stainless steel nameplate with black infill text, to identify the associated valve below, shall be attached to the valve box lid using stainless steel pop rivets. Nameplate shall be an Engraved Equipment Nameplate as manufactured by Seton or approved equal.

PART 3 - EXECUTION

3.01 GENERAL

- A. All valves shall be installed in accordance with the manufacturer's instructions and as required herein.
- B. A flanged or union connection shall be provided within 2-feet of each valve unless otherwise approved by the Engineer.
- C. Position indicators shall be installed in accordance with the manufacturer's instructions and as required herein.

3.02 TESTING

- A. Operate all valves twice through a complete open/close cycle. Check for valve seating to be drip tight. If leaking occurs, adjust or replace valve packing, as necessary, and retest. Replace valves if persistent leaking occurs.

3.03 PAINTING

- A. Paint valves as specified in Section 09900.

END OF SECTION

SECTION 15130

SLUICE GATE

PART 1 - GENERAL

1.01 DESCRIPTION

- A. The work to be performed under this section includes, but is not limited to, furnishing all labor, tools, materials and services necessary for providing a sluice gate as indicated on the Contract Documents.

1.02 SUBMITTALS

- A. Shop Drawings: Showing dimensions, fabrication, assembly, and installation, including operating stem and lifting mechanism.
- B. Catalog Data: Providing product information and materials of construction for gate and all appurtenances including extension stem, stem guides and operator.

1.03 QUALITY ASSURANCE

- A. The manufacturer shall have experience in production of substantially similar equipment and shall show evidence of satisfactory operation in at least 15 installations. The manufacturer's shop welds, welding procedures and welders shall be qualified and certified in accordance with the requirement of the latest edition ASME section IX or AWS D1.6.
- B. The fully assembled gate shall be shop inspected, tested for operation and leakage and adjusted before shipping. There shall be no assembling or adjusting on the job site other than for the lifting mechanism.

1.04 WARRANTY

- A. The Contractor shall submit to the Owner a written manufacturer's warranty covering equipment defects and workmanship and shall be responsible for repairing or replacing at his own expense, including labor and shipping, all parts defective in material or workmanship for a period of two years from the date Contractor achieves Substantial Completion for the project.

PART 2 - MATERIALS

2.01 GENERAL

- A. Sluice gate shall be wall-mounted, self-contained, non-rising stem, constructed of Type 316 stainless steel and conforming to the applicable requirements of AWWA

C561. Sluice gate shall be Fontaine-Aquanox Series 20 or equivalent by Whipps, RW Gate, or approved equal.

- B. All parts shall be standard size and gauge so that repair parts, when furnished at any time, can be installed in the field without any fitting, chipping, or remachining. Like parts shall be interchangeable. The gate shall be completely assembled in the shop to ensure that all parts fit together properly. There shall be no assembling or adjusting on the job site other than for the lifting mechanism.
- C. Anchor bolts which are required for installation of the gate, stem guides and operators shall be Type 316 stainless steel as specified in Section 05500.

2.02 SLUICE GATE

A. Sluice gate shall meet the following design requirements:

- 1. Location: Wetwell
- 2. Quantity: 1
- 3. Dimensions: 18" x 18"
- 4. Seating Head: 20 feet of water
- 5. Unseating Head: 20 feet of water
- 6. Gate Type: Wall-mounted
- 7. Leakage: Sluice gate shall be substantially watertight under the design head conditions. Leakage shall not exceed AWWA allowable leakage rates.

B. Frames:

- 1. Gate frame shall be stainless steel conforming to ASTM A240, Type 316L. The gate frame will be constructed of structural members or formed plate welded to form a rigid one piece-frame. The frame shall be designed for the maximum head indicated with a minimum safety factor of 5 with regard to tensile, compressive, and shear strength. The frame shall be of the flange back design suitable for mounting directly to the concrete wall over an embedded wall sleeve. The guide slot shall be of ultra high molecular weight polyethylene.
- 2. The frame configuration shall allow the replacement of the top and side seals without removing the gate frame from the concrete wall.

C. Slides:

1. The slide shall consist of a flat plate reinforced with formed plates or structural members to limit its deflection to $1/720$ of the span of the gate under the design head. The frames shall be designed for the maximum head indicated with a minimum safety factor of 5 with regard to tensile, compressive, and shear strength. All components shall be Type 316 stainless steel.

D. Guides and Seals:

1. The guides shall be made of ultra high molecular weight polyethylene, ASTM D4020, and shall be of such length as to retain and support at least two thirds ($\frac{2}{3}$) of the vertical height of the slide in the fully-open position.
2. Side and top seals shall be made of ultra high molecular weight polyethylene of the self-adjusting type. A continuous compression cord made of EPDM conforming to ASTM D2000 shall ensure contact between the ultra high molecular weight polyethylene guide and the gate in all positions. The sealing system shall maintain efficient sealing in any position of the slide and allow water to flow only through the opened part of the gate. Seals shall be continuous along top and sides of gate frame.
3. The bottom seal shall be EPDM conforming to ASTM D2000, set into the bottom member of the frame.

E. Stem and Coupling:

1. Operating stem shall be Type 316 stainless steel designed to transmit in compression at least 2 times the rated output of the operating manual mechanism with a 40-pound effort on a crank or handwheel.
2. The stem shall have a slenderness ration (L/r) less than 200. The threaded portion of the stem shall have machined cut or machine rolled threads of the full depth Acme type.
3. A stem in more than one piece and with a diameter of $1\frac{3}{4}$ inches and larger, the different sections shall be joined together by solid coupling. A stem that is smaller than $1\frac{3}{4}$ inches diameter shall be solid or pinned to an extension tube. The couplings shall be bronze conforming to ASTM B584 and be grooved and keyed and shall be of greater strength than the stem.
4. Type 316L stainless steel universal joints and supports shall be provided as necessary to provide offsets, if required.

F. Stem Guides:

1. Stem guides shall be fabricated from Type 316 stainless steel with an ultra high molecular weight polyethylene bushing.
2. Guides shall be adjustable and spaced in accordance with the manufacturer's recommendation. The L/r ratio shall not be greater than 200.

2.03 LIFTING MECHANISM

- A. The extension stem shall have an AWWA 2-inch operator nut on top, which shall be mounted just below the new floor box cover in the wetwell top slab. Manufacturer shall supply a portable operator, which shall be designed specifically to operate the sluice gate furnished.
- B. Operator shall be designed to operate the gate under the seating and unseating heads by using a maximum effort of 40-pounds on the crank, and shall be able to withstand, without damage, an effort of 80-pounds.

2.04 YOKE

- A. Self-contained gate shall be provided with a yoke made of Type 316 stainless steel structural members or formed plates. The maximum deflection of the yoke shall be 1/360 of the gate's span. The self-contained sluice gate yoke shall be located such that it either permits full opening of the sluice gate or is above the HWA elevation shown on the Contract Drawings, whichever is greater.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Sluice gate and appurtenances shall be handled and installed in accordance with the manufacturer's recommendations. Sluice gate shall be installed and adjusted so that it does not leak or bind. Extension stems shall be installed in perfect alignment.
- B. All bolts shall be tightened and all items requiring lubrication shall be lubricated. Each gate assembly shall be left in perfect operating condition.

3.02 TESTING

- A. Following completion of the sluice gate installation, the gate shall be operated through at least two complete open/close cycles and check for free non-binding operation and full opening and seating. Make adjustments as necessary and repeat testing until gate is in proper operating condition.
- B. Field test the installed sluice gate seating and unseating leakage with water in accordance with AWWA C561. The use of plugs and/or the bypass pumping

system shall be utilized to allow the maximum possible water level on each side of the sluice gate to be achieved without resulting in an overflow or spillage of sewage. Leakage rate shall not exceed that specified herein. If leakage is excessive, make adjustments as necessary and repeat testing until gate performance meets the specified leakage criteria.

END OF SECTION

SECTION 15400

PLUMBING

PART 1 - GENERAL

1.01 DESCRIPTION

- A. Work performed under this section shall include installing potable water pipe, fittings, and valves, drain piping, service sink, water heater, eyewash, backflow prevention, toilet and appurtenances as shown and as specified.
- B. The Contractor shall verify all clearances and obstructions by field measurement prior to preparing working drawings for the plumbing fixtures, drain piping and appurtenances.
- C. Comply with IBC plumbing code, latest edition.

1.02 SUBMITTALS

- A. Product Data: For each type of plumbing fixture indicated. Include selected fixtures and trim, fittings, accessories, appliances, appurtenances, equipment, and supports. Indicate materials and finishes, dimensions, construction details, and flow control rates.
- B. Shop Drawings: Layout drawings for potable water piping and valves and drain piping and fittings.

1.03 QUALITY ASSURANCE

- A. NSF Standard: Comply with NSF 61, "Drinking Water System Components—Health Effects," for materials that will be in contact with potable water.
- B. Piping materials shall bear label, stamp or other markings of specified testing agency.
- C. Comply with NSF 61 for materials for water service piping and specialties for domestic water.

PART 2 - PRODUCTS

2.01 POTABLE WATER PIPE AND FITTINGS

- A. Soft Copper Tube: ASTM B88, Type K, water tube, annealed temper.
- B. Hard Copper Tube: ASTM B88, Type K or L, water tube, drawn temper.

- C. Copper Fittings: ASME B16.18, cast copper alloy or ASME B16.22, wrought copper, solder-joint pressure type.
- D. Copper Unions: MSS SP-123, cast copper alloy, hexagonal-stock body with ball-and-socket, metal-to-metal seating surfaces, and solder joint ends.

2.02 JOINING MATERIALS

- A. Transition Couplings:
 - 1. Pipe fitting same size as, with pressure rating at least equal to and ends compatible with, piping to be joined.
- B. Soldering Flux: ASTM B813, water flushable type.
- C. Solder Filler Metal: ASTM B32, lead-free type with 0.20 percent maximum lead content.

2.03 POTABLE WATER VALVES

- A. Ball Valves:
 - 1. Ball valves 2" and smaller shall be rated 100 psi SWP and 600 psi non-shock CWP. Valves shall be lead-free meeting NSF standards for potable water systems, and shall have a 2 piece silicone bronze body, reinforced PTFE seats, full port, separate pack-nut with adjustable stem packing, anti-blowout stems and Type 316 stainless steel ball. Valve ends shall be either full depth ANSI threads or extended solder connections and shall be manufactured to comply with MSS SP-110. Where piping is insulated, ball valves shall be equipped with 2" extended handles of non-thermal conductive material, and a protective sleeve that allows operation of the valve without breaking the vapor seal or disturbing the insulation. Memory stops, which shall be fully adjustable after insulation is applied, shall also be included. Valves shall be NIBCO T/S585-66LF or approved equal.
- B. Gate Valves:
 - 1. Gate valves 2½" and smaller shall be rated 100 psi SWP and 300 psi non-shock CWP. Valves shall be lead-free meeting NSF standards for potable water systems, and shall be non-rising stem, screw-in bonnet, solid wedge and manufactured in accordance with MSS SP-139. Body, bonnet, external stuffing box and wedge are to be of ASTM B584 silicone bronze alloy. Stems shall be of ASTM B371 dezincification-resistant silicon bronze or B99 low-zinc alloy, non-asbestos packing and malleable handwheel. Valve ends shall be either threaded or solder-type. Valves shall be NIBCO T/S113LF or approved equal.

2.04 DRAIN PIPING

- A. Drain piping shall be installed where required and shall, in general, conform to the locations indicated on the drawings.
- B. Pipe and fittings which are required to be buried beneath floors or underground shall be as indicated on the drawings or other applicable specification sections and shall be centrifugally cast SV hub and spigot ASTM A74 coated cast iron soil pipe. Hydrostatic tests will not be required. Joints shall be push tight with elastomeric gaskets, ASTM C564, Ty-Seal of Tyler Pipe, Charlotte-Seal of Charlotte Foundry, or approved equal. Provide plain beveled end with centering recess in the hub for use with gasket joint. Cast iron soil pipe shall be as manufactured by Charlotte Pipe and Foundry, Tyler Pipe/Utilities Division, U.S. Pipe and Foundry, or equal.
- C. Pipe and fittings above grade may be any one of the following at the Contractor's option:
 - 1. Standard weight galvanized steel conforming to ASTM A53, Schedule 40, using cast iron screwed recess pattern drainage fittings.
 - 2. Type "L" hard copper tubing ASTM B88 using DWV copper drainage fittings and lead-free tin alloy, 95-5 tin antimony solder or silver-bearing tin equal to Harris "Stay-Brite", "Stay-Brite 8" or "Bridgit".
 - 3. No-hub cast iron pipe and fittings ASTM B88 with hubless type joints consisting of neoprene gasket ASTM C564 stainless steel shield and stainless steel bands.
- D. Traps shall be same material as the connecting piping.

2.05 SERVICE SINK

- A. Service sink shall be wall-hung, acid resistant enameled cast iron with wall hanger and nominal dimensions of 22-inches by 18-inches by 12-inches deep. Service sink shall have a rim guard strainer, cast iron P-trap with cleanout and floor stand, and shall be drilled for back-mounted cold and hot water faucets. Sink shall be Kohler Model K-6714 or approved equal.
- B. Faucets shall be solid brass construction with rough chrome finish, and have wall brace, 1/2-inch NPT female union nut inlets, 3/4-inch male hose thread outlet, vacuum breaker, lever handles, and integral supply stops, Chicago Faucets No. 897, or approved equal.

2.06 SERVICE SINK ACCESSORIES

- A. Paper towel dispenser shall be a high-capacity wall mounted dispenser, and shall hold an 8-inch diameter paper towel roll. Dispenser shall measure approximately 12" wide by 10" deep by 14" high. Three (3) spare rolls of paper towels compatible with the dispenser shall be furnished to the Owner. Paper towel dispenser shall be Model No. 54338 as manufactured by Georgia Pacific or approved equal.
- B. Soap dispenser shall be a push style and wall mounted dispenser capable of holding 2000 mL of hand cleaner. Three (3) spare 2000 mL refills compatible with the dispenser shall be furnished to the Owner. Soap dispenser shall be Model Gojo PRO TDX 2000 or approved equal.
- C. Hand sanitizer dispenser shall be a push style and wall mounted dispenser capable of holding 1000 mL of sanitizing gel. Three (3) spare 1000 mL refills compatible with the dispenser shall be furnished to the Owner. Hand sanitizer dispenser shall be Model PURELL NXT Space Saver or approved equal.

2.07 WATER HEATER

- A. Water heater shall be a Rheem Model EGSP15 electric point-of-use water heater with a 15 gallon tank capacity. Heater shall have a 120V connection, rated for 1,500 watts to provide a minimum delivered water temperature of 110-degrees F and maximum delivered water temperature of 170-degrees F. Water heater shall have a recovery capacity 6 gallons per hour at a 100-degrees Fahrenheit temperature rise.
- B. Water heater shall have the UL/CSA seal of certification and be factory equipped with an CSA/ASME rated temperature and pressure relief valve. Tank(s) interior shall be coated with a high temperature porcelain enamel and furnished with an R-Tech resistored magnesium anode rod rigidly supported. Water heater(s) shall meet or exceed the energy factor requirements of ASHRAE. Tanks shall have a working pressure rating of 150 psi, and shall be completely assembled. Water heater(s) shall be equipped with a copper, resistored, "screw-in" type element. Tank shall be insulated with rigid polyurethane foam insulation. Water heater(s) shall be equipped with a surface mounted thermostat with an integral, manual reset, high limit control. Water heater(s) shall be covered by a three year limited warranty against tank leaks.
- C. Heater shall be fitted with integral 3/4-inch NPT fittings to eliminate the need for soldering.
- D. Heater shall be rated for electrical service as shown on the electrical drawings.
- E. Provide 2 gallon water heater expansion tank piped to cold water supply and water heater to ensure completely functional. Expansion tank shall be Amtrol ST-5 or approved equal.

2.08 HOSE BIBBS

- A. Hose bibbs shall be solid brass construction, angle pattern, and renewable washer. Sweat copper to standard ¾-inch hose and outlet, NIBCO QT763X, or approved equal.

2.09 HOSE-CONNECTION, BACKFLOW-PREVENTION DEVICES

- A. General: ASSE standard, tamper resistant, backflow-prevention devices with ASME B1.20.7, garden-hose threads on outlet.
- B. Hose-Connection Vacuum Breakers: ASSE 1011, copper silicon alloy body, with manual drain feature and break away set screw.
- C. Provide a Watts Series LFNF8, or approved equal, hose connection backflow preventer on all hose bibbs and on the sink faucet outlet.

2.10 EYEWASH (WALL MOUNTED)

- A. Eyewash shall be wall mounted eyewash with a stainless steel 11-inch round bowl, an antimicrobial treated eyewash head to help protect against the growth of mold and mildew on the treated components, and shall feature inverted directional laminar flow which achieves zero vertical velocity supplied by an integral 3.7 gpm flow control, chrome-plated brass stay-open ball valve equipped with stainless steel ball and stem, and chrome-plated brass in-line 50 by 50 mesh water strainer. Eyewash shall include a cast-aluminum chromate protected wall bracket, yellow plastic pop-off dust cover for eyewash head, universal sign, ½-inch IPS inlet, 1¼-inch IPS waste, and a stainless steel dust cover as supplied by the manufacturer. The eyewash shall be Haws Model 7360B-7460B or approved equal.
- B. Thermostatic mixing valve shall mix hot and cold water to provide controlled outlet tempered water to eyewash fixture. Thermostatic mixing valve shall employ a thermostatic mixing element to safely temper water supply, reduce all incoming hot water to a maximum of 0.2 GPM in the event the cold water supply is lost, and shall allow a minimum of 10 GPM cold water bypass in the event the water supply becomes interrupted or the thermostatic element fails. Thermostatic mixing valve shall be set to 85 degrees F, and shall be Haws No. 9201EFE, or approved equal.
- C. Eyewash and mixing valve shall comply with ANSI Z358.1.

2.11 BACKFLOW PREVENTER

- A. Lead free backflow preventer shall be ¾-inch of the reduced-pressure principal type, installed on the existing incoming water service line to the pumping station. Backflow preventer shall be Watts Regulator No. LF909 QT, or approved equal, with strainer and air gap. Repair Kit No. LFRK 909-RT shall be included to provide a complete set of rubber repair parts.

2.12 TOILET

- A. The elongated two-piece toilet shall be made of vitreous china, and shall have a flushing system capable of 1.28 gpf. Toilet shall be ADA compliant, Catalog Number K-3817-U as manufactured by Kohler, or approved equal.
- B. Toilet shall be equipped with elongated toilet seat, tank cover, trip lever, supply tube and supply stop, accessory packs and all other appurtenances for a complete installation.
- C. A stainless steel surface mounted toilet paper holder, including mounting plate and hardware, shall be installed with each toilet furnished. Toilet paper holder shall be Model Number 7305-B as manufactured by American Specialties, Inc., or approved equal.

2.13 WATER PRESSURE REDUCING VALVES

- A. A water pressure reducing valve with integral stainless steel strainer shall be installed where water service pressure exceeds 60 psi. The valve shall feature a lead free cast copper silicon alloy body suitable for water service pressures up to 300 psi and shall be adjustable from 25 psi – 75 psi. Pressure reducing valve shall include a gauge tapping and 160 psi gauge, and shall be Watts Series LF25AUB-Z3, or approved equal, for ½"-2" water service lines, or Watts LFN223BS, or approved equal, for 2 ½"-3" water service lines.
- B. Provide isolation gate valves on both sides of each pressure reducing valve to permit replacement without draining water distribution system.

2.14 WATER HAMMER ARRESTORS

- A. A minimum of one (1) water hammer arrestor shall be installed in the water distribution piping, downstream of the backflow preventer, to protect all plumbing fixtures and piping. Water hammer arrestor shall be Watts Series 15 or approved equal. Additional water hammer arrestors, including size and placement, shall be in accordance with manufacturer's selection and sizing tables.
- B. As necessary, water hammer arrestors used to protect individual fixtures shall be Amtrol Mini-Trol, Watts No. LF150A Series, or approved equal.
- C. Provide isolation gate valve with each water hammer arrestor to permit replacement without interruption to water distribution system.

PART 3 - EXECUTION

3.01 PIPING APPLICATION

- A. Flanges, unions, keyed couplings, and special fittings may be used, instead of joints indicated.
- B. Piping: NPS $\frac{3}{4}$ to NPS 3, hard copper tube, Type K; wrought-copper fittings; and soldered joints.
- C. Piping: NPS $\frac{3}{4}$ to NPS 3, hard copper tube, Type L; copper fittings; and soldered joints.

3.02 JOINT CONSTRUCTION

- A. Make pipe joints according to the following:
 - 1. Copper Tubing Soldered Joints: ASTM B828. Use flushable flux and lead-free solder.

3.03 INSTALLATION

- A. Install copper tube and fittings according to CDA's "Copper Tube Handbook".
- B. Drain pipe shall be reamed to remove all burrs. Horizontal pipe shall be carefully aligned to assure even pitch. The pipe shall be pitched a minimum of $\frac{1}{8}$ -inch per foot, unless indicated otherwise. All adaptors from one material to another shall be a standard manufactured product designed for that specific use. Contractor shall not run piping above electrical switchgear.
- C. Cleanouts shall be same size as pipe through 4-inch size. Maximum size of cleanouts shall be 4-inch diameter unless larger units are required for testing or special access purposes. Provide cleanouts at locations where deemed advisable. Location of cleanouts as stipulated by applicable code shall be considered as the minimum requirement.
- D. Install water heater level and in accordance with manufacturer's written instructions. Arrange unit so that controls and devices needing service are accessible. Arrange piping for easy removal of water heater.
- E. Assemble plumbing fixtures, trim, fittings, and other components in accordance with manufacturers' written instructions. Install all fixtures level and plumb.
- F. Install off-floor supports, affixed to building substrate, for wall-mounting fixtures. Install wall-mounting fixtures with tubular waste piping attached to supports.

- G. Install water-supply piping with stop on each supply to each fixture to be connected to water distribution piping. Attach supplies to supports or substrate within pipe spaces behind or under fixtures. Install stops in locations where they can be easily reached for operation. If supply stops are not specified or included with fixture, use ball, gate or globe valves.
- H. Install trap or tubular waste piping on drain outlet of each fixture and connect to sanitary drainage piping.
- I. Seal joints between fixtures and walls and floors using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color.
- J. Install each pressure reducing valve in accordance with manufacturer's written installation instructions.
- K. Install each water hammer arrestor in accordance with manufacturer's written installation instructions.

3.04 TESTING

- A. Water Piping Tests: Fill pipeline 24 hours before testing and apply pressure to stabilize system. Use only potable water.
 - 1. Hydrostatic Tests: Test at not less than 1½ times the 125 psig working pressure for two (2) hours.
 - 2. Increase pressure in 50-psig increments and inspect each joint between increments. Hold at test pressure for one (1) hour; decrease to 0-psig. Slowly increase again to test pressure and hold for one (1) more hour. Maximum allowable leakage is 2 quarts per hour per 100 joints. Remake leaking joints with new materials and repeat test until leakage is within the allowed limits.
 - 3. Prepare and submit reports of testing activities.
- B. Testing for drain piping shall include a rough test and final test, in conformance to local plumbing code requirements.
- C. Leaks discovered during testing shall not be patched. Threaded or flanged connections shall be either tightened or replaced. Small leaks in welded pipe may be chipped and rewelded.
- D. After installation of water heater, test it for leaks. Repair leaks and retest until no leaks exist. After electrical circuitry to water heater has been energized, confirm proper operation. Test and adjust controls. Replace damaged or malfunctioning controls and equipment. Remove and replace water heater if it does not pass tests and inspections and retest. Train Owner's maintenance personnel to adjust, operate, and maintain the water heater.

END OF SECTION

SECTION 15500

HEATING AND VENTILATION EQUIPMENT

PART 1 - GENERAL

1.01 DESCRIPTION

- A. This section includes requirements for providing ventilation fans, louvers, dampers, heaters, controls, ducts, grilles and registers, and requisite accessories and appurtenances necessary for furnishing and installing heating and ventilation systems in accordance with the Contract Documents.
- B. All work shall be done in accordance with the applicable Codes and Standards.
- C. Completely coordinate with work of all other trades.
- D. Not all types of heating and ventilation equipment specified herein are necessarily required for this project. Refer to the respective schedules and callouts on the Contract Drawings for the specific types of equipment and quantity of each to be provided.

1.02 QUALITY ASSURANCE

- A. All equipment shall be the product of recognized and reputable manufacturers. Equipment shall be locally serviceable and replacement parts shall be readily available.
- B. Reference Standards:
 - 1. ASHRAE: American Society of Heating, Refrigeration, and Air Conditioning Engineers.
 - 2. AMCA: Air Movement and Control Association.
 - 3. OSHA: Occupational Safety and Health Administration.
 - 4. SMACNA: Sheet Metal and Air Conditioning Contractor's National Association.

1.03 SUBMITTALS

- A. Catalog data, specifications and color selection charts for fans, louvers, dampers, heaters, grilles and registers, and appurtenances.
- B. Wiring diagrams, control diagrams and electrical schematic for the operation, control and power supply of the fans, motor operated dampers, and heaters.

- C. Layout drawings showing fans, louvers, dampers, ducts, heaters, grilles and registers, supports, and other accessories necessary for a complete ventilation system. Air flow rates shall be included on all layout drawings.
- D. Manufacturer's curves or tables for all fans, louvers, dampers, and grilles and registers indicating air flow versus static pressure losses and leakage adjusted to account for bird screen losses.
- E. Operation and Maintenance Manual for fans, louvers, dampers, controls and heaters.
- F. Manufacturer's installation instructions for all equipment.

1.04 WARRANTY

- A. The Contractor shall submit to the Owner a written manufacturer's warranty covering equipment defects and workmanship for each piece of equipment and shall be responsible for repairing or replacing at his own expense, including labor and shipping, all parts defective in material or workmanship for a period of two years from the date Contractor achieves Substantial Completion for the project.

PART 2 - MATERIALS

2.01 GENERAL

- A. All fans shall be furnished and installed complete with motors, drives, controls, and accessories as required for satisfactory operation and as herein specified. All fans shall be rated in accordance with the standards of the Air Movement and Control Association (AMCA) and shall bear the AMCA Certificate Rating label unless otherwise specified herein. All fans shall be UL listed, and all rooftop fans shall have an integral NEMA 1 disconnect.
- B. All fans shall be statically and dynamically balanced by the manufacturer before shipment.
- C. All fans shall be guaranteed to deliver the specified air quantities and pressure when tested in accordance with the latest AMCA standards. Fans shall be quiet in operation, and free from objectionable vibration. All fans shall be provided with either integral or supplementary vibration or sound-absorbing mountings.
- D. Fan motors shall be accessible for repairs and maintenance and shaft guards shall be provided in accordance with OSHA standards. TECO-Westinghouse motors are not acceptable.

2.02 CENTRIFUGAL SQUARE INLINE FANS

- A. Fan shall be duct mounted, belt driven centrifugal square inline fan; Model SQN-B as manufactured by Loren Cook Company or approved equal.
- B. Certifications: Fan shall be UL 705 listed. Fan shall bear the AMCA certified ratings seal for sound and air performance.
- C. Construction: The fan shall be of bolted construction utilizing corrosion resistant fasteners. Housing shall be minimum 18-gauge galvanized steel with integral duct collars. Bolted access doors shall be provided on three sides, sealed with closed cell neoprene gasketing. Pivoting motor plate shall utilize threaded L-bolt design for positive belt tensioning. Housing shall be pre-drilled to accommodate universal mounting feet for vertical or horizontal installation. Unit shall bear an engraved aluminum nameplate, which shall indicate design CFM, static pressure, and maximum fan RPM. Unit shall be shipped in ISTA certified transit tested packaging.
- D. Wheel: Wheel shall be centrifugal backward inclined, constructed of 100% aluminum, including a precision machined cast aluminum hub. Wheel inlet shall overlap an aerodynamic aluminum inlet cone to provide maximum performance and efficiency. Wheel shall be balanced in accordance with AMCA Standard 204-96, Balance Quality and Vibration Levels for Fans.
- E. Motor: Motor shall be premium efficiency, ODP and suitable for use with permanently lubricated sealed ball bearings and furnished at the specified voltage, phase and frequency as shown on the Electrical Drawings.
- F. Bearings: Bearings shall be designed and individually tested specifically for use in air handling applications. Construction shall be heavy duty regreasable ball type in a cast iron pillow block housing and selected for a minimum L50 life in excess of 200,000 hours at maximum operating speed.
- G. Belts and Drives: Belts shall be oil and heat resistant, non-static type. Drives shall be precision machined cast iron type, keyed and securely attached to the wheel and motor shafts. Drives shall be sized for 150-percent of the installed motor horsepower. The variable pitch motor drive must be factory set to the specified fan RPM.
- H. Flexible Duct Connectors: Fans shall be furnished with inlet and outlet flexible duct connectors where indicated on the Contract Drawings and as specified herein. The flexible duct connectors shall be constructed of reinforced neoprene coated fiberglass fabric and 0.032-inch aluminum bands.
- I. Accessories: Fan accessories, which shall be furnished in accordance with the fan schedules as shown on the Contract Drawings, are intended to be standard equipment of the specified manufacturer or approved equal.

- J. Controls: Fan controls are to be furnished in accordance with the control schematics as shown on Contract Drawings, and as specified herein.

2.03 FIBERGLASS DUCT AXIAL FANS

- A. Fan shall be fiberglass belt driven axial fan; Series 35 as manufactured by Hartzell Fan, Inc. or approved equal.
- B. Fan shall be constructed in accordance with ASTM D4167 standard specifications for fiber-reinforced plastic fans and blowers to ensure structural integrity. All parts exposed to the gas stream shall be constructed of, or encapsulated in, FRP. Fan construction and installation shall also include conductive layers, screens and grounding lugs to safely control and remove static electricity.
- C. The fan housing shall be constructed of polyester resin with an ASTM E84 Class I flame spread rating of 25 or less and shall comply with NFPA Code 91. Interior housing surfaces shall have a synthetic surfacing veil. The fan housing shall be of rugged construction with integrally molded flanged ends.
- D. The fan propeller shall be constructed of polyester resin with an ASTM E84 Class I rating of 25 or less. The FRP propeller blades shall have an airfoil design and shall be attached to a FRP hub. The propeller shall be solid fiberglass with an aluminum insert molded into the hub for secure attachment to the shaft. The cap shall be mounted to the hub with silicone sealant and stainless steel cap screws.
- E. A polypropylene shaft seal shall be furnished to isolate the drive tube from the air stream gasses. A neoprene gasket shall be furnished between the drive tube and cover plate.
- F. Motor: Motor shall be premium efficiency, explosion proof. Motor shall have permanently lubricated sealed ball bearings and furnished at the specified voltage, phase and frequency as shown on the Electrical Drawings.
- G. Motor and drive shall be protected by a fiberglass motor cover.
- H. Shafts shall be 316 stainless steel, precision turned, ground and polished. The shaft's critical speed shall be at least 125% of the fan's maximum operating speed.
- I. Bearings are to be precision anti-friction, self-aligning, flanged design. Bearings shall be designed for an average L-10 life of 50,000 hours when rated at the fan's maximum cataloged operating speed. Bearings shall be protected from the air stream by a fiberglass drive tube mounted on fiberglass supports. Nylon lubrication lines shall extend to unit exterior and shall include grease fittings.

- J. Flexible Duct Connectors: Fans shall be furnished with an outlet flexible duct connector to provide a flexible connection between the fan and the exhaust stack as indicated on the Contract Drawings. The flexible duct connector shall be constructed of 316 stainless steel frame and $\frac{3}{16}$ " thick EPDM rubber sleeve resistant to aging, ozone and UV rays, as manufactured by BAM Fan Accessories, Inc. or approved equal. All mounting hardware and incidentals shall be 316 stainless steel.
- K. Accessories: Fan accessories, which shall be furnished in accordance with the fan schedules as shown on the Contract Drawings, are intended to be standard equipment of the specified manufacturer or approved equal.
- L. Controls: Fan controls are to be furnished in accordance with the control schematics as shown on Contract Drawings, and as specified herein.

2.04 LOUVERS

- A. 4-inch Stationary Louvers
 - 1. Louvers and dampers shall be installed in combination at the locations shown on the Contract Drawings. Fixed weatherproof louvers with drainable blades shall be Ruskin Manufacturing Company Type ELF 375DXH or approved equal. Performance data shall be included with shop drawings.
 - 2. Louvers shall be stationary drainable type with drain gutters in each blade and downspouts in jambs and mullions. Louvers shall have a minimum of 54-percent free area based on a 48-inch by 48-inch size. Stationary drainable blades shall be contained within a 4-inch frame. Louver heads, jambs, sills, blades, & mullions shall be factory assembled by the louver manufacturer. Louver sizes too large for shipping shall be built up by the contractor from factory assembled louver sections to provide overall sizes required. Louver design shall limit span between visible mullions to 10 feet and shall incorporate structural supports required to withstand a wind load of 20 PSF.
 - 3. Louver frames shall be four inches deep and shall be constructed of 6063-T5 extruded aluminum with 0.125-inch nominal wall thickness. Include downspouts and caulking surfaces.
 - 4. Blades shall be constructed of 6063-T5 extruded aluminum with 0.125-inch nominal wall thickness, positioned at $37\frac{1}{2}$ degree angle and spaced approximately $5\frac{3}{32}$ inches on center.
 - 5. Bird screen of $\frac{3}{4}$ -inch x 0.051-inch expanded, flattened aluminum in removable frame shall be installed on all louvers.
 - 6. Louvers shall be furnished with a Kynar finish.

B. 6-inch Stationary Louvers

1. Louvers and dampers shall be installed in combination at the locations shown on the Contract Drawings. Fixed weatherproof louvers with drainable blades shall be Ruskin Manufacturing Company Type ELF6375DXH or approved equal. Performance data shall be included with shop drawings.
2. Louvers shall be stationary drainable type with drain gutters in each blade and downspouts in jambs and mullions. Louvers shall have a minimum of 57-percent free area based on a 48-inch by 48-inch size. Stationary drainable blades shall be contained within a 6-inch frame. Louver heads, jambs, sills, blades, & mullions shall be factory assembled by the louver manufacturer. Louver sizes too large for shipping shall be built up by the contractor from factory assembled louver sections to provide overall sizes required. Louver design shall limit span between visible mullions to 10 feet and shall incorporate structural supports required to withstand a wind load of 20 PSF.
3. Louver frames shall be six inches deep and shall be constructed of 6063-T5 extruded aluminum with 0.125-inch nominal wall thickness. Include downspouts and caulking surfaces.
4. Blades shall be constructed of 6063-T5 extruded aluminum with 0.125-inch nominal wall thickness, positioned at 37-½ degree angle and spaced approximately $5^{29/32}$ inches on center.
5. Bird screen of ¾-inch x 0.051-inch expanded, flattened aluminum in removable frame shall be installed on all louvers.
6. Louvers shall be furnished with a Kynar finish.

2.05 DAMPERS

A. Thin Line Control Dampers

1. Thin line control damper shall be Ruskin Manufacturing Company Type CD40 or approved equal. Performance data shall be included with shop drawings.
2. Damper frame shall be four inches deep and be constructed of 6063-T5 extruded aluminum with mounting flanges on both sides of frame.
3. Damper blades shall have air foil shape and be constructed of 6063-T5 extruded aluminum with integral structural reinforcing tube running full length of each blade. Blade edge seals shall be extruded vinyl double edge design with inflatable pocket which enables air pressure from either direction to assist in blade to blade seal off. Blade seals shall be mechanically locked in extruded blade slots. Adhesive or clip-on type seals are unacceptable.

Bearings shall be non-corrosive molded synthetic. Axles shall be hexagonal positively locked into the damper blades and linkage. Linkage shall be concealed in the frame, out of the airstream.

4. Electric actuators for dampers shall be properly sized to control the respective dampers without overloading. Position indicators shall be furnished and installed on each actuator. Actuators shall be totally enclosed, dustproof, and shall include mounting brackets suitable for mounting on the damper frame. Actuator shall be furnished at the specified voltage, phase and frequency and shall include a spring-return-to-damper position as shown on the Contract Drawings. Actuators shall be Invensys MA400 Series or approved equal.
5. Dampers shall be furnished with an anodized finish.

B. Low Leakage Control Dampers

1. Low leakage control damper shall be Ruskin Manufacturing Company Type CD60 or approved equal. Performance data shall be included with shop drawings.
2. Damper frame shall be five inches deep and be constructed of 16 gage galvanized steel hat channel reinforced with corner braces for structural strength.
3. Damper blades shall be galvanized steel air foil shaped, double skin construction of 14 gage equivalent thickness, with a nominal width of 6 inches. Blade edge seals shall be extruded vinyl for ultra-low leakage and shall be mechanically attached to blade edge. Bearings shall be self-lubricating stainless steel sleeve, turning in extruded hole in frame. Axles shall be a minimum ½-inch diameter plated steel with a hex-shaped, mechanically attached to blade. Linkage shall be concealed out of airstream, within the damper frame to reduce pressure drop and noise.
4. Electric actuators for dampers shall be properly sized to control the respective dampers without overloading. Position indicators shall be furnished and installed on each actuator. Actuators shall be totally enclosed, dustproof, and shall include mounting brackets suitable for mounting on the damper frame. Actuator shall be furnished at the specified voltage, phase and frequency and shall include a spring-return-to-damper position as shown on the Contract Drawings. Actuators shall be Invensys MA400 Series or approved equal.
5. Epoxy coating is required when used within a wetwell ventilation system.

2.06 HEATERS

A. Unit Heaters

1. Unit heaters shall be forced air with totally enclosed fan motor, power rating and service as shown on the Contract Drawings. Unit heaters shall be Q-Mark Type QWD or approved equal.
2. The unit heater case shall be constructed of heavy 16 gauge type 304 stainless steel for corrosion resistance and assembled with stainless steel hardware. The heating elements shall be corrosion resistant 300 stainless steel sheathed with 316 stainless steel fins for maximum heat dissipation. The elements are to be attached to junction box with leak resistant stainless steel fittings. A stainless steel combination wall and ceiling swivel type mounting bracket to be supplied with the unit heater.
3. The fan and motor assembly shall include a totally enclosed, permanently lubricated, ball bearing motor, epoxy coated for corrosion resistance. The fan shall be aluminum with corrosion resistant coating, directly connected to the motor, and be dynamically balanced. An epoxy sealed thermal fan delay shall be provided to allow the fan to continue to operate after heating thermostat has been satisfied to maximize transfer of generated heat to space being heated. The fan and motor shall be protected by an adjustable louvered outlet grille to direct flow up or down, painted with one coat zinc chromate primer and two coats of corrosion resistant paint.
4. The controls shall be factory prewired and tested and enclosed in a NEMA 4X molded fiberglass control enclosure mounted beneath the heater cabinet. The control center shall include contactors, automatic reset over-temperature protector, fan delay relay, motor contactor and fused transformer for 24V control circuit. Terminal blocks shall be included for remote thermostat connection.
5. Unit heaters shall have a mode switch accessible from outside the NEMA 4X enclosure to permit air flow with or without energizing the heating elements, a pilot light to indicate when heating elements are energized, internal fusing, manual reset switch, built in over temperature protection via an automatic reset thermal cutout, and ON/OFF disconnect switch.
6. Unit heaters shall have a heater manufacturer's integral thermostat with a temperature range of 40 to 90-degrees F.
7. All unit heaters shall be UL listed for corrosive areas and NEMA 4X wash down requirements and meet the requirements of the National Electrical Code. Electrical components for unit heaters shall be listed and labeled by UL.

2.07 CONTROLS

A. Thermostats

1. Thermostats for ventilation fans shall be wall-mounted on a 1-inch thick insulating board at the locations shown on the Contract Documents and installed at a height of five feet six inches above the finished floor.
2. Thermostats for ventilation fans shall be a line voltage thermostat, with single pole, single throw (SPST), hydraulic action close on rise temperature control, and a switch mechanism rating for 16 ampere full load at 120 volts. Thermostats shall have a coiled bulb to indicate temperature within the space, an operating range between 20 degrees F to 90 degrees F, and an adjustable differential range between 3 degrees F to 20 degrees F. Thermostats shall be White Rodgers Model 201-8 or approved equal.

B. Freezestats

1. Freezestat for ventilation fans shall be wall-mounted at location shown on the contract documents and shall be installed at a height of five feet six inches above the finished floor. Freezestat shall have adequate capillary length to mount bulb style temperature sensing element to the exterior of the pumping station. Temperature sensing element shall be protected from direct sunlight and outdoor elements, while still allowing accurate ambient air temperatures to be measured. The setting shall be visible without removing the cover. Freezestat shall be White Rodgers Model 1609 or approved equal.
2. Freezestat shall have a range of -30 degrees F to 90 degrees F, an adjustable differential from 3.5 to 40 degrees F, and a switch mechanism rating for 16 ampere full load at 120 volts. Switch action shall close on rise.

2.08 DUCT

A. Metal Duct

1. All drywell and operating room ventilation fan ducts shall be metal. Comply with SMACNA' "HVAC Duct Construction Standards—Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.
2. Metal ducts shall be aluminum sheet, ASTM B209, alloy 3003, temper H14; with standard, 1-side bright finish.
3. Tie rods shall be galvanized steel, 1/4-inch minimum diameter for lengths 36-inches or less; 3/8-inch minimum diameter for lengths longer than 36-inches.

B. Fiberglass Reinforced Plastic (FRP) Duct

1. All wetwell ventilation fan ducts shall be FRP. The resin used shall be a commercial grade thermoset that has either been evaluated in a laminate test in accordance with ASTM D3982, Practice C581, or that has been determined by previous documented service to be acceptable for the service conditions. The resin may contain fillers or pigments in accordance with C582.
2. A thixotropic agent may be added up to 5% by weight of resin.
3. Corrosion barrier shall consist of the conductive inner surface followed by the interior layer which has a minimum total calculated thickness of 0.096-inches.
4. Inner surface shall have a surfacing veil having 0.010- to 0.020-inches calculated thickness. Interior layer shall have a minimum of two plies of 1.5 ounce/square foot chopped-strand mat or chopped roving equivalent with a compatible sizing system with approximately 75% resin and 0.086-inch minimum calculated thickness. Fiber length shall be ½-inch minimum to 2-inch maximum.
5. Structural layer shall consist of chopped-strand mat plies of nominally 1.5 ounces/square foot and have a ½-inch minimum to 2-inch maximum fiber length or shall consist of a chopped roving equivalent in the spray-up method. When necessary, woven-roving plies shall be used and shall consist of 24 ounces/square yard with a five by four weave.
6. Duct construction and installation shall also include conductive layers, screens and grounding lugs as necessary, to safely control and remove static electricity.

2.09 TURNING VANES

- A. Manufactured Turning Vanes for Metal Ducts: Curved blades of aluminum sheet; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.
- B. Manufactured Turning Vanes for Nonmetal Ducts: Fabricate curved blades of resin-bonded fiberglass with acrylic polymer coating; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.
- C. Vane Construction: Single wall for ducts up to 48 inches wide and double wall for larger dimensions.

2.10 INTAKE/EXHAUST STACKS

- A. The stack shall be fiberglass reinforced vinyl ester and shall be constructed of the same material as the FRP duct.
- B. Stack shall be designed to be connected to the concrete top slab or exhaust fan, as shown, and shall be flange mounted to the concrete slab or stack support chair. Stainless steel bands and mounting brackets shall be provided and used to attach the stack to the adjacent building wall but shall not be considered for lateral or vertical support of the FRP stack. The stack shall be designed to withstand a 100 MPH wind load. The stack shall be supported independently of the exhaust fan so that the fan can be removed for routine maintenance. The fabricator shall provide stack design calculations, signed and sealed by a Professional Engineer registered in the State of Maryland. Calculations shall include the design of the Type 316 stainless steel stack support chair.
- C. The exhaust stack shall be furnished with an FRP stackhead, which shall be provided by the stack manufacturer.
- D. Stack construction and installation shall also include conductive layers, screens and grounding lugs as necessary, to safely control and remove static electricity.

2.11 GRILLES & REGISTERS

- A. General Purpose
 - 1. Construction of general purpose grilles and registers shall consist of extruded aluminum blades, and an extruded aluminum frame having 1¼-inch wide border and mitered corners. Each Grille and register shall have countersunk screw holes for surface mounting, an aluminum opposed blade volume damper, and stainless steel mounting screws. Grilles and registers shall have a clear or satin anodized finish.
 - 2. Supply grilles and registers in all areas except the wetwell shall have individually adjustable blades spaced ¾-inch on centers in the horizontal. Supply grilles and registers shall be Tuttle & Bailey Model A50, Krueger Model 580 or approved equal.
 - 3. Return grilles and registers in all areas except the wetwell shall have fixed blades spaced ¾-inch on centers in the vertical, with a blade deflection angle of 0-degree. Return grilles and registers shall be Tuttle & Bailey Model A80, Krueger Model S580 or approved equal.
- B. Corrosion Resistant
 - 1. Construction of corrosion resistant grilles and registers shall consist of 316 stainless steel blades, and a 316 stainless steel frame having 1¼-inch wide border and mitered corners. Each Grille and register shall have countersunk

screw holes for surface mounting, a heavy gauge stainless steel opposed blade volume damper, and stainless steel mounting screws. Grilles and registers shall have a satin polished finish.

2. Supply grilles and registers in the wetwell shall have individually adjustable blades spaced $\frac{3}{4}$ -inch on centers in the horizontal. Supply grilles and registers shall be Tuttle & Bailey Model T50SS, Krueger Model 980 or approved equal.
3. Return grilles and registers in the wetwell shall have fixed blades spaced $\frac{3}{4}$ -inch on centers in the vertical, with a blade deflection angle of 0-degree. Return grilles and registers shall be Tuttle & Bailey Model T80SS, Krueger Model 9S80 or approved equal.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install all items to be furnished under this section of the Specifications in accordance with the manufacturer's instructions and as required herein using stainless steel anchors and fasteners.
- B. All apparatus housings and other items shall be erected with all runs straight and true, smooth on the inside with neatly finished air-tight joints. All equipment shall be securely anchored to the building or other support means with reinforcing, as required to be completely free from vibration.
- C. The inside of all equipment in the ventilation system shall be cleaned of metal cuttings, paper, loose pieces of insulation and all other debris.
- D. Exterior joints around louvers shall be caulked in accordance with Section 07900.
- E. Fabricate, install and support metal ducts according to SMACNA's "HVAC Duct Construction Standards—Metal and Flexible".
- F. Fabricate, assemble, install and support FRP ducts according to SMACNA's "Thermoset FRP Duct Construction Manual."
- G. Support horizontal ducts within 24-inches of each elbow and within 48-inches of each branch intersection. Support vertical ducts at maximum intervals of 15-feet and at each floor or slab.
- H. Make duct connections to equipment with flexible connectors. Comply with SMACNA's "HVAC Duct Construction Standards—Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

- I. Fans controls that include a thermostat for automatic operation shall provide for ventilation at a fixed, non-adjustable setting. Thermostat shall be fully wired and adjusted to energize fan(s) when space temperature rises to 90-degrees F or higher. On a fall in temperature, fans shall de-energize at and below 85-degrees F. Provide all wiring and devices required for operation. Thermostat shall be mounted on a 1-inch thick insulating board.
- J. Fan controls that include thermostats and a VFD for automatic operation shall provide for ventilation at two adjustable set points. Thermostat #1 shall be fully wired and adjusted to energize fan(s) at an adjustable flow rate when space temperature rises to 90-degrees F or higher. Thermostat #2 shall be fully wired and adjusted to energize fan(s) at full flow rate when space temperature rises to 95-degrees F or higher. On a fall in temperature, thermostat #2 shall de-energize at and below 90-degrees F. On a fall in temperature, thermostat #1 shall de-energize at and below 85-degrees F. Provide all wiring and devices required for operation. Thermostats shall be mounted on a 1-inch thick insulating board.
- K. Fan controls that include a cycle timer shall be set to provide a minimum of four (4) complete air changes per hour. During periods when temperatures drop below 45°F, the cycle timer(s) shall be de-energized by means of a freeze-stat.
- L. Fan controls that include integration with the pump room switches shall operate the fans continuously any time a light is on.
- M. Wetwell exhaust fan(s) that are constant speed shall be energized by a wall switch and shall operate the fan at full speed anytime the switch is activated prior to entry into the wetwell. Fan shall also include a cycle timer that is set to provide a minimum of two (2) complete air changes per hour.
- N. Adjust supply grille blades to provide a uniform air distribution to the space being ventilated.

3.02 TESTING, ADJUSTING AND BALANCING

- A. Dampers shall be tested once from full open to closed position. Blades shall be checked for binding and motors checked for bracket movement.
- B. Fans shall be tested in manual and automatic positions. Check for excessive vibration, noisy operation, or motor overheating. Check motor current against rated amperes.
- C. Heaters shall be started up and operated to demonstrate capability and compliance with all requirements.
- D. All ductwork shall undergo leakage tests at 2-inches water gauge. Total leakage from each system shall not exceed 1-percent of the total system air handling capacity of the system. If the system is tested in sections, the total leakage will be the sum of the leakage from the individual sections. Repair all leaks which are

audible, regardless of leakage rate of the system as a whole, by remaking the entire defective joint or seam. Spot sealing of ducts in place is unacceptable.

- E. Review all system designs and equipment manufacturers' data and become completely familiar with the work before proceeding.
- F. Inspect all systems and determine that the work is complete and ready for testing and balancing before proceeding.
- G. System balancing shall be performed by an independent test and balance agency that specializes in, and whose business is limited to, the testing and balancing of mechanical systems. The agency must be fully certified by the Associated Air Balance Council and have an engineer certified by the National Examining Board. All final reports shall be signed and officially stamped by the certified testing and balancing engineer.
- H. Furnish complete and up-to-date contract documents, shop drawings, installation and coordination drawings, submittal data, and other information to the testing and balancing agency so that the work is performed using all required system and equipment data.
- I. Plan and schedule testing and balancing at required time during construction. Review all plans, schedules, operations, and procedures with the Engineer before proceeding. Make system layouts and diagrams where required.
- J. Prepare all systems for testing and balancing.
- K. Coordinate the testing and balancing work with the work of other trades.
- L. Perform all testing and balancing in complete accordance with AABC National Standards for Field Measurement and Instrumentation, Form No. 81266, Volume One.
- M. Furnish all test instruments and equipment. All instruments shall have been calibrated within six (6) months prior to use and shall be checked for accuracy prior to and during the work.
- N. Test and balance all ventilation systems. The work shall include but not be limited to the following:
 - 1. Leak-test all ductwork and air distribution systems.
 - 2. Balance and adjust all air distribution systems to within 5% of design air quantities.
 - 3. Adjust all fans to required speeds for design air flow.

4. Adjust all air terminal devices for proper throw, distribution, and quiet operation.
 5. Test capacity and performance of all equipment and adjust to design conditions.
 6. Operate and test all systems under all sequences of operation and adjust equipment and controls for efficient and stable operation.
- O. After testing capacity and performance of all equipment, make all necessary adjustments to design conditions.
 - P. Make all necessary adjustments and repairs to the work, correcting any malfunctions or deficiencies which are disclosed by testing and balancing.
 - Q. Report all malfunctions or deficiencies to the Contractor so that corrective action can be taken. Repeat tests where required until design conditions are achieved.
 - R. Retest or rebalance the systems as required during the warranty period.
 - S. Maintain complete and accurate records of all tests results showing initial and final conditions. Record all temperatures, pressures, flows, speeds, current, voltages, control settings, ambient conditions, time, date and other pertinent data.
 - T. Where systems or equipment cannot be balanced or adjusted to design conditions, determine cause and submit complete report to the Engineer.
 - U. Upon completion of the work and before final acceptance, submit three (3) copies of complete testing and balancing report to the Engineer showing all recorded data and results.
 - V. If, in the opinion of the Engineer, test results or portions thereof are incomplete or inconclusive, repeat necessary portions of the work to the satisfaction of the Engineer.

END OF SECTION

SECTION 15700

MINI-SPLIT HEAT PUMP AIR CONDITIONING SYSTEM

PART 1 - GENERAL

1.01 DESCRIPTION

- A. This section includes requirements for providing a split system series heat pump air conditioning system. The system shall consist of a compact, wall mounted indoor fan coil section with wireless remote controller and a horizontal discharge outdoor unit which shall be of an inverter driven heat pump design, and include all appurtenances as required for a complete and fully functional system.
- B. Refer to the respective schedules and callouts on the Contract Drawings for the specific types of equipment and quantity of each to be provided.

1.02 QUALITY ASSURANCE

- A. All equipment shall be the product of recognized and reputable manufacturers. Equipment shall be locally serviceable and replacement parts shall be readily available.
- B. The system components shall be tested by a Nationally Recognized Testing Laboratory (NRTL) and shall bear the ETL label.
- C. All wiring shall be in accordance with the National Electrical Code (N.E.C.) and local codes, as required.
- D. The units shall be rated in accordance with Air-conditioning Heating, Refrigeration Institute's (AHRI) Standard 240 and bear the AHRI Certification label.
- E. The units shall be manufactured in a facility registered to ISO 9001 and ISO 14001, which is a set of standards applying to product and manufacturing quality and environmental management and protection set by the International Standard Organization (ISO).
- F. A dry air holding charge shall be provided in the indoor unit.
- G. System efficiency shall meet or exceed 20.5 SEER.
- H. Indoor and outdoor units shall be stored and handled according to the manufacturer's recommendations.
- I. The controller shall be shipped separately and shall be able to withstand 105°F storage temperatures and 95% relative humidity without adverse effect.

1.03 SUBMITTALS

- A. Catalog data, specifications and selection charts for indoor and outdoor units, including controller.
- B. Wiring diagrams, control diagrams and electrical schematic for the operation, control and power supply of the ductless mini-split system.
- C. Layout drawings showing outdoor unit, indoor unit, supports, refrigeration piping, condensate piping, and other accessories necessary for a complete installation.
- D. Operation and Maintenance Manual.
- E. Manufacturer's installation instructions for all equipment.
- F. Bracket supporting hardware and anchorage system design and product literature.
- G. Manufacturer's curves or tables for plotting total capacity, exterior temperatures, sensible heat capacity and indoor dry bulb and wet bulb temperatures.

1.04 WARRANTY

- A. The Contractor shall submit to the Owner a written manufacturer's warranty covering parts and equipment defects for a period of five years from the date Contractor achieves Substantial Completion for the project. The compressor shall have an extended warranty of seven (7) years from date of installation.

PART 2 - MATERIALS

2.01 GENERAL

- A. The outdoor unit shall be compatible with the indoor unit. The connected indoor unit capacity shall be of the same capacity as the outdoor unit.
- B. The outdoor unit must have the ability to operate over the full capacity range with a maximum height difference of 50 feet, and have refrigerant tubing length of up to 100 feet (with a maximum number of 10 bends) between the indoor and outdoor units.
- C. Outdoor unit shall be pre-charged with R-410a refrigerant for a minimum of 33 feet of refrigerant tubing.
- D. All refrigerant lines between outdoor and indoor units shall be of annealed, refrigeration grade copper tubing, ACR Type, meeting ASTM B280 requirements, individually insulated in twin-tube, flexible, closed-cell, CFC-free (ozone depletion potential of zero), elastomeric material for the insulation of refrigerant pipes and tubes with thermal conductivity equal to or better than 0.27 BTU-inch/hour per Sq Ft

/ °F, a water vapor transmission equal to or better than 0.08 Perm-inch and superior fire ratings such that insulation will not contribute significantly to fire and up to 1" thick insulation shall have a Flame-Spread Index of less than 25 and a Smoke-development Index of less than 50 as tested by ASTM E84.

- E. All refrigerant connections between outdoor and indoor units shall be flare type.
- F. Condensate drain line shall be SCH 40 PVC and sized in accordance applicable codes. Size piping and provide cleanout, traps and vents, insulation, and condensate switches as required by applicable codes
- G. Performance:

Manufacturer	Mitsubishi
Outdoor Unit Model Number	MUZ-GL24NA
Indoor Unit Model Number	MSZ-GL24NA
Rated Cooling Capacity	22,400 Btu/h
Cooling Capacity Range	8,200 – 31,400 Btu/h
Sensible Heat Factor	0.75
SEER	20.5
Rated Heating Capacity @ 47°F	27,600 Btu/h
Total Power Watts (Heating) @ 47°F	2,340 W
Rated Heating Capacity @ 17°F	24,600 Btu/h

- H. Operating Range:

Operating Range		Indoor Intake Air Temperature	Outdoor Intake Air Temperature
Cooling	Maximum	D.B. 90°F/W.B. 73°F	D.B. 115°
	Minimum	D.B. 67°F/W.B. 57°F	D.B. 14°F
Heating	Maximum	D.B. 80°F	D.B. 75°F
	Minimum	D.B. 70°F	D.B. -4°F

2.02 OUTDOOR UNIT

- A. Unit Cabinet:

1. The unit cabinet casing shall be fabricated of galvanized steel, bonderized, finished with an electrostatically applied, thermally fused acrylic or polyester powder coating for corrosion protection. Assembly hardware shall be cadmium plated for weather resistance. Cabinet color shall be Munsell 3Y 7.8/1.1.
2. Mounting feet shall be provided and shall be welded to the base of the cabinet and be of sufficient size to afford reliable equipment mount and stability. Cabinet mounting and construction shall be sufficient to withstand

155 MPH wind speed conditions. Provide heavy duty stainless steel mounting support designed to support 500 lbs and for mounting to the exterior pump station wall. Mounting, support, and hardware shall be provided and installed by the Contractor to meet Hurricane Code Conditions.

3. Easy access shall be afforded to all serviceable parts by means of removable panel sections.

B. Fan:

1. The unit shall be furnished with a direct drive, high performance propeller type fan.
2. The fan motor shall be a direct current (DC) motor and shall have permanently lubricated bearings.
3. The fan motor shall be mounted with vibration isolation for quiet operation.
4. The fan shall be provided with a raised guard to prevent contact with moving parts.
5. The outdoor unit shall have horizontal discharge airflow.
6. Outdoor unit sound level shall not exceed 55 dB.

C. Coil:

1. The outdoor unit coil shall be of nonferrous construction with lanced or corrugated plate fins on copper tubing.
2. The coil shall be protected with an integral guard.
3. Refrigerant flow from the outdoor unit to the indoor unit shall be regulated by means of an electronically controlled, precision, linear expansion valve.

D. Compressor

1. The compressor shall be a high performance, hermetic, inverter driven, variable speed, dual rotary type.
2. The compressor motor shall be direct current (DC) type equipped with a factory supplied and installed inverter drive package.
3. The outdoor unit shall be equipped with a suction side refrigerant accumulator.
4. The compressor will be equipped with internal thermal overload protection.

5. The compressor shall be mounted to avoid the transmission of vibration.
- E. Electrical:
1. Power supply shall be furnished at the specified voltage, phase and frequency as shown on the Contract Drawings.
 2. A 12 to 24 volt DC data stream shall communicate between the units providing all necessary information for full function control.
 3. Power for the indoor unit shall be supplied from the outdoor unit using 3-wire, 14 gauge AWG conductors plus ground wire.
- F. The outdoor unit shall be equipped with Pulse Amplitude Modulation (PAM) compressor inverter drive control for maximum efficiency with minimum power consumption.
- G. The outdoor unit shall be completely factory assembled, piped, and wired. Each unit must be test run at the factory.
- H. Outdoor unit shall be Model MUZ-GL Series as manufactured by Mitsubishi Electric, or approved equal.

2.03 INDOOR UNIT

- A. The indoor unit shall be factory assembled, wired and tested. Contained within the unit shall be all factory wiring, piping, control circuit board, fan and fan motor. The unit shall have a self-diagnostic function, 3-minute time delay mechanism, and an auto restart function after power interruption. Indoor unit shall be purged with dry air before shipment from factory.
- B. Unit Cabinet:
1. The casing shall have a smooth front, white finish - Munsell 1.0Y 9.2/0.2.
 2. Multidirectional drain connection and refrigerant piping, offering three (3) direction pipe alignments for all refrigerant piping and two (2) direction pipe alignments for condensate draining.
 3. There shall be a separate, metal installation-plate that secures the indoor unit firmly to the wall. The installation-plate shall be securely attached to the wall using appropriate anchor method. Contractor shall determine the best method and be responsible for proper mounting of the installation plate to the wall.

C. Fan:

1. The indoor unit fan shall be an assembly with a line-flow fan direct driven by a single motor.
2. The fan shall be statically and dynamically balanced and be powered by a motor with permanently lubricated bearing.
3. Manual adjustable guide vanes shall be provided with the ability to change the airflow from side to side (left to right).
4. An integral, motorized, multi-position, horizontal air sweep flow louver shall provide for uniform air distribution, up and down. Five (5) positions plus Auto and Swing shall be provided, controlled from the remote controller.
5. The indoor fan shall operate at one of five (5) speeds: Super High, High, Medium, Low, and Quiet plus Auto Fan Mode. All speeds shall be selected from the remote controller.
6. The indoor fan shall be an assembly with a turbo fan direct driven by a single motor.

D. Filter:

1. Return air shall be filtered by means of (2) easily removable, washable Nano Platinum Filters and an Anti-Allergy Enzyme Filter shall be filtered by means of a long-life washable filter.

E. Coil:

1. The indoor coil shall be of nonferrous construction with smooth plate fins on copper tubing.
2. The tubing shall have inner grooves for high efficiency heat exchange.
3. All tube joints shall be brazed with silver alloy.
4. The coils shall be pressure tested at the factory.
5. A sloped, condensate pan and drain shall be provided under the coil.
6. A drain pan level switch (SS610E), designed to connect to the control board, shall be provided and installed on the condensate pan to prevent condensate from overflowing. The unit shall include a condensate lift mechanism that will be able to raise drain water 19" above the condensate pan.

7. Both refrigerant lines between the indoor unit and outdoor unit shall be fully insulated.
- F. Electrical:
1. The electrical power of the indoor unit shall be supplied by the outdoor unit allowing the indoor unit to be powered and controlled directly from the outdoor unit, providing both primary power and integrated, by-directional, digital control signal without additional connections.
 2. The indoor units shall not have any supplemental or "back-up" electrical heating elements.
 3. Indoor unit shall be Model MSZ-GL as manufactured by Mitsubishi Electric, or approved equal.
- G. Indoor unit sound level shall not exceed 53 dB(A) at the highest fan speed and 34 dB(A) at the lowest fan speed.

2.04 SYSTEM CONTROL

- A. General. The unit shall have a wireless handheld remote controller to perform input functions necessary to operate the system.
1. The wireless handheld controller shall have a Power On/Off switch, Mode Selector – Auto, Cool, Heat, Dry Modes - Temperature Setting, Timer Control with Clock, Fan Speed Select and Vane / Airflow Direction selector. Controller shall have a programmable Smart Set button for pre-selected Temperature, Fan Speed, and Vane position settings.
 2. The indoor unit shall perform Self-diagnostic Function and Check Mode switching.
 3. Temperature changes shall be by 1°F increments with a range of 61 - 88°F (16-31°C).
 4. The microprocessor located in the indoor unit shall have the capability of sensing return air temperature and indoor coil temperature, receiving and processing commands from the wireless or a wired controller, providing emergency operation and controlling the outdoor unit.
 5. The system shall be capable of automatically restarting and operating at the previously selected conditions when the power is restored after power interruption.
 6. Control system shall control the continued operation of the air sweep louvers, as well as provide On/Off, System/Mode function.

- B. Wired Remote Controller. The Wired Remote Controller (PAR-40MAAU) shall be provided to include a MAC-334IF-E MA Series Terminal Interface for communications, which will be connected to the indoor unit control board on connector CN105. A two (2) conductor, stranded, 22 AWG twisted pair, jacketed cable shall connect the MAC-334IF-E to the PAR-40MAAU wall controller. Connection shall not be polarity sensitive and controller wire shall not exceed 33 feet (10m) length.
1. The wired remote controller shall be approximately 5" x 5" in size and white in color with a light-green LCD display. There shall be a built-in weekly timer with up to 8 pattern settings per day. The controller shall consist of an On/Off button, Increase/Decrease Set Temperature buttons, a Cool/Auto/Fan/Dry mode selector, a Timer Menu button, a Timer On/Off button, Set Time buttons, a Fan Speed selector, a Ventilation button, a Test Run button, and a Check Mode button. The controller shall have a built-in temperature sensor. Temperature shall be displayed in either Fahrenheit (°F) or Celsius (°C), and temperature changes shall be by increments of 1°F (0.5°C). The PAR-40MAAU shall have the capability of controlling up to a maximum of 16 systems, as a group with the same mode and set-point for all, at a maximum developed control cable distance of 1,500 feet (500 meters). Contractor shall provide all wiring and conduit as required to the wired remote controller.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install all items to be furnished under this section of the Specifications in accordance with the manufacturer's instructions and as required herein using stainless steel anchors and fasteners.
- B. Install units level and plumb.
- C. Install outdoor unit using manufacturer's heavy duty wall mounting brackets securely fastened to building structure. Install wall mounting bracket in accordance with the manufacturer's recommendations.
- D. Install indoor unit to precast concrete building interior wall in accordance with manufacturer's installation instructions.
- E. Install refrigerant piping according to ASHRAE 15, with piping at right angles or parallel to building walls. Install piping as short and direct as possible, with a minimum number of joints, elbows, and fittings. Piping shall be installed free of sags and bends.
- F. Install condensate piping with adequate fall from the indoor unit to an exterior wall. Condensate piping shall be extended outdoors and down the exterior side of the

wall to 3 inches above finished grade. Install condensate drain in accordance with all applicable codes.

- G. Provide hangers and supports to secure the piping to the structure. Hangers and supports shall be compatible with the piping.

3.02 CONNECTIONS

- A. Piping installation requirements shall be in accordance with the manufacturer's requirements.
- B. Install piping adjacent to unit to allow service and maintenance.
- C. Ground equipment and make electrical connections in accordance with the Contract Documents.

3.03 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust field-assembled components and equipment installation, including connections, and to assist in field testing. Report results in writing.
- B. Perform the following field tests and inspections and prepare test reports:
 - 1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
 - 2. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
- C. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- D. Provide written certification that the installation is per the manufacturer's installation requirements and is acceptable for use.
- E. Remove and replace malfunctioning units and retest as specified above.

3.04 STARTUP SERVICE

- A. Complete installation and startup checks according to manufacturer's written instructions.

3.05 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain units.

END OF SECTION

SECTION 16010

ELECTRICAL GENERAL REQUIREMENTS

PART 1 - GENERAL

1.01 DESCRIPTION

A. Work Included:

1. All items of labor, materials and equipment, not specified in detail or shown on drawings but necessary for complete installation and proper operation of work described or implied, shall be furnished and installed.
2. Test all electrical conductors, after completion of installation of wiring and apparatus, to insure continuity, proper splicing, freedom from grounds, except "made grounds" and those required for protection and insulation resistance. Use testing instruments, i.e. megger. Activation of each circuit will be required as final test. Testing shall be done at no additional expense to the Owner.
3. Drawings are indicative of work to be installed but do not indicate all bends, fittings, boxes, etc. that will be required in this Contract. The structural and finished conditions of the project shall be investigated prior to construction.
4. Coordinate work to avoid interferences between piping, ducts, equipment, architectural or structural features.
5. Visit the site to determine actual conditions. No extra compensation will be allowed by failure to determine existing conditions.

B. Additional Circuits:

1. A sum of money shall be included in the Lump Sum Bid for the installation of two (2) additional circuits. Each additional circuit shall include the following:
 - a. 50' of 3/4" PVC conduit, and associated fasteners and connectors.
 - b. 150' of #12 THHN/THWN wire
 - c. (1) PVC outlet box/pull box/junction box
 - d. 6' of 3/4" flexible, liquid-tight conduit
 - e. Final connections to motor, receptacle, lighting control switch, instrument control or power wiring circuit, etc.

1.02 QUALITY ASSURANCE

A. Regulations, Standards and Publications:

ANSI	American National Standards Institute, Inc.
ASTM	American Society for Testing and Materials
BOCA	Building Officials and Code Administrators
IEEE	Institute of Electrical and Electronic Engineers
ISA	International Society of Automation
IPCEA	Insulated Power Cable Engineers Association
NEC	National Electrical Code of National Fire Protection Association
NEMA	National Electrical Manufacturers Association
NESC	National Electrical Safety Code
UL	Underwriters' Laboratories

1. The installation must comply with all Federal and State, municipal or other authority's laws, rules and/or regulations.
2. Electrical inspections shall be made by the Middle Department Inspection Agency, or equal. The cost of the inspections shall be paid by the Contractor.
3. All electrical equipment and its components and materials shall meet all applicable UL criteria and bear the appropriate label of the Underwriters' Laboratory.
4. All electrical equipment or apparatus of any one system shall be of the same quality as produced by one or more manufacturers, suitable for use in a unified system. The term "manufacturer" shall be understood as applying to a reputable firm who assumes full responsibility for its products.

1.03 SUBMITTALS

A. Shop Drawings:

1. All shop drawings shall be submitted to the Engineer for review. All shop drawing submittals shall clearly indicate, using arrows and/or highlighting on all copies, which item(s) are being submitted and that each item being submitted is in compliance with all requirements on the drawings and in these specifications. All pertinent specification and drawing requirements shall be indicated on the shop drawings. If incorrect, they shall be resubmitted in quantity according to Contract conditions until satisfactory. Work shown on shop drawings shall not be executed until such drawings are approved. Electrical items shall not be installed until final approval of the shop drawings has been given by the Engineer.

2. See specific sections for a breakdown of shop drawing items.
 3. Submit certification that all equipment is UL listed.
 4. Shop drawings shall indicate adequate clearance for operation, maintenance and replacement of operating equipment devices.
 5. This list does not necessarily include all items of shop drawings required. The Engineer reserves the right to request additional shop drawings.
- B. Installation, Operation and Maintenance Manuals:
1. Submit required number of installation, operation and maintenance manuals for all equipment being provided for the electrical system. These manuals shall be submitted in 3-ring loose-leaf binders and shall be complete, neat, orderly and indexed.
 2. The installation, operation and maintenance manuals shall include a copy of the approved shop drawings for all electrical items installed on the project.

1.04 PRODUCT DELIVERY, HANDLING AND STORAGE

- A. Product Handling:
1. Deliver all materials in good condition. Store in dry place, off ground, and keep dry at all times.
- B. Protection of Installation:
1. All unfinished installations, construction materials and equipment shall be protected during construction.

PART 2 - PRODUCTS

2.01 SEE SPECIFIC SECTIONS FOR PRODUCTS

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Protection of Installation:

1. All equipment shall be protected during construction. All damaged equipment caused by noncompliance with this requirement shall be repaired at no expense to the Owner.
- B. Position of Outlets and Equipment:
1. The Owner shall determine the position of all relocated outlets and equipment if the required location differs from that indicated on the drawings.
- C. Moving Outlets and Equipment:
1. The Owner reserves the right to move any outlet, or equipment enclosure, a distance of ten feet before roughing in, at no additional expense.
- D. Methods and Materials:
1. All work shall be installed in a first-class, neat and workmanlike manner by skilled mechanics. All materials shall be new. Firmly support all materials and equipment.
- E. Cutting, Repairing and Finishing:
1. All cutting, repairing and finishing required for the installation of work under this Contract shall be performed under this Contract.
 2. All disturbed surfaces shall be repaired and finished to match adjacent surfaces by skilled mechanics working in their respective fields.
- F. Excavation and Backfilling:
1. Excavation and backfilling will be in accordance with the requirements of Division 2 and as required to complete the work according to details on the Drawings.
- G. Concrete:
1. Concrete work shall be in provided in accordance with the requirements of Division 3 and as required to complete the work according to details on the Drawings. Concrete for electrical duct banks can be poured against the excavated earth.
- H. Cutting and Patching of Macadam and Concrete Areas:
1. Openings in concrete or macadam required for Electrical construction shall be made by taking extreme precautions to prevent excessive

damage to existing facilities. Prior to completion, all disturbed areas shall be closed, restored to normal and finished to match surrounding areas.

I. Access:

1. Install all conduit, wire, cable, wiring devices and equipment to preserve access to all equipment installed under this Contract.

J. Layout of Wiring:

1. The layout of wiring as shown on the drawings shall not be considered as absolute. It shall be subject to changes where necessary to overcome obstacles in construction. Where a major deviation from the plans is indicated by practical consideration, shop drawings shall be submitted showing all deviations in detail to clearly indicate the necessity or desirability for the change.

K. Miscellaneous Supports:

1. Furnish and install all necessary angles, beams, channels, hanger rods or other supports for equipment and piping furnished under this Contract requiring support or suspension from building structure.

L. Continuity of Service:

1. Uninterrupted electrical service shall be maintained during the entire time required for complete installation of the work proposed in the Drawings and in the specifications.
2. Temporary equipment, cable, emergency generators, and whatever else is necessary shall be provided as required to maintain electrical service to all facilities. Temporary service facilities, if required at any time, shall not be disconnected or removed until new services are placed in proper operation.
3. If any service or system must be interrupted, the Contractor shall request permission in writing stating the date and time the service will be interrupted, and the areas affected. This request shall be made in sufficient time for proper arrangements to be made. Written permission shall be obtained from the Owner before interrupting electrical service to any facility.

M. Clean Up:

1. Upon completion of all work under electrical specifications, furnish labor, materials and incidentals to accomplish the following: remove all dirt, foreign materials, stains, fingerprints, etc. from all electrical equipment

enclosures, panelboards, and system equipment, and leave the electrical work in such a condition that no cleaning will be required by the Owner. The complete system shall be subject to inspection and approval by the Owner.

3.02 ELECTRICAL COORDINATION AND ARC FLASH STUDY

A. General:

1. A short-circuit, component protection, flash hazard analysis, and selective coordination study shall be made for the entire electrical distribution system, beginning at utility connections and ending at the largest feeder from each motor control center or panel but in no case will study terminate before AIC values are below 10,000 amps.
2. The company performing the study shall attend one (1) meeting with the Owner and the Engineer to review the study requirements prior to performing the study. This meeting shall be held at the pump station.

B. References:

1. The coordination study shall be completed in accordance with the latest edition of IEEE Standard 242 – Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems.
2. The flash hazard analysis shall be completed in accordance with the latest editions of NFPA 70E – Standard for Electrical Safety Requirements for Employee Workplaces and IEEE Standard 1584 - Guide for Performing Arc-Flash Hazard Calculations.

C. The short circuit study shall consist of the following:

1. Momentary and interrupting values of short circuit shall be calculated for three-phase bolted faults at each bus having a protective device. Fault current calculations shall consider the contribution of all significant synchronous and/or induction motors. Motors less than 15 hp at one location shall be represented as a lump sum, and motors 15 hp and larger shall be represented individually. Motor horsepower's shall be obtained from the Contract Drawings, including applicable Addenda, by the firm performing the fault study.
2. Questions regarding the starting, running and construction characteristics of individual motors shall be coordinated directly with the associated equipment manufacturer by the firm performing the fault study.
3. Motor subtransient reactances shall be used for the calculation of momentary fault current values. A final tabulation of short circuit

calculations shall include X to R ratios, asymmetry factors, short circuit kVA and symmetrical fault current values for each bus. In addition to this tabulation, provide a tabulation showing protective device interrupting capacity versus available fault current.

4. Recommendations which may be required in order to insure safe fault current interruption shall also form a part of the final report.

D. The coordination study shall consist of the following:

1. All protective devices contained in the scope of work shall be set to provide the best possible coordination and protection. The coordination study shall include log-log plots of phase overcurrent and ground overcurrent protection devices on K & E time-current characteristic paper. Complete plots of these devices will be accurately plotted through their operating range. A sketch shall be included on each plot sheet showing device identification.
2. Attempts will be made to obtain complete coordination on every portion of the system. Appropriate maximum fault levels, transformer inrush currents, conductor insulation withstand curves and transformer withstand points shall be plotted on each coordination plot sheet to assure adequate component protection and maximum system reliability.
3. Each current transformer shall be checked for saturation to insure that they accurately translate all fault currents which may be available on the system. A complete and thorough discussion of each coordination curve sheet shall be prepared. This discussion will describe the areas where coordination is effective, as well as any instances where a lack of coordination exists. All protective relay settings, fuse sizes and low-voltage circuit breaker settings will be tabulated.
4. Recommendations for new equipment or conductor changes which may be necessary to improve protection and/or coordination will also be contained in a section of the completed coordination study.

E. Arc Flash Hazard Analysis:

1. The study shall include a flash hazard analysis for the electrical distribution equipment. The analysis shall determine the flash protection boundary, incident energy, and required level of personal protective equipment (PPE) for workers at the electrical distribution equipment. The flash protection boundary and incident energy shall be determined based upon a working distance of 18 inches. The electrical distribution equipment shall be field marked with this information in accordance with codes and standards.

2. The arc flash labels shall be furnished and installed by the Contractor.
- F. A complete set of coordination curves, starting with the main outdoor switchgear devices protecting the service down through and including all on-site service, feeder, sub-feeder, and secondary main and branch circuit devices, shall be provided.
 - G. The final selection and setting of overcurrent devices shall be based on this coordination study. Study Contractor to coordinate with settings for overcurrent devices in conjunction with the switchgear manufacturer.
 - H. The Study Contractor shall coordinate ground fault protection.
 - I. Submissions and approval of this study are required prior to final approval of shop drawings.
 - J. Motor starting voltage profiles for all large motors shall be provided.
 - K. The Contractor shall make all settings as recommended by the coordination study.
 - L. A factory representative for the switchgear shall be present when the Contractor adjusts, tests and calibrates devices as required in the field after the installation is complete. The number of days required to do this work shall be the manufacturer's responsibility and shall be included in the bid.
 - M. Points of non-coordination shall be brought to the attention of the Engineer, along with recommendations by Contractor and manufacturers involved.
 - N. This study shall be made by an independent electrical testing company. Acceptable testing companies are Square D, Eaton, or equal.
 - O. The final study, along with the SKM Power tools Project file (.PRJ), shall be submitted to the Owner on a CD.

END OF SECTION

SECTION 16050

BASIC MATERIALS AND METHODS

PART 1 - GENERAL

1.01 DESCRIPTION

A. Work Included:

1. All items of labor, materials and equipment, not specified in details on Drawings but necessary for complete installation and proper operation of work described or implied, shall be furnished and installed.

1.02 QUALITY ASSURANCE

A. Regulations, Standards and Publications:

ANSI	American National Standards Institute, Inc.
ASTM	American Society for Testing and Materials
BOCA	Building Officials and Code Administrators
IEEE	Institute of Electrical and Electronic Engineers
IPCEA	Insulated Power Cable Engineers Association
NEC	National Electrical Code of National Fire Protection Association
NEMA	National Electrical Manufacturers Association
NESC	National Electrical Safety Code
UL	Underwriters' Laboratories

B. Qualification of Manufacturers:

1. Various materials specified herein shall be as supplied by manufacturers listed under PRODUCTS.

C. Quality Control:

1. All equipment shall be new and limited to products regularly produced and recommended for service ratings in accordance with engineering data or other comprehensive literature made available and in effect at time of bidding. In all cases where device, or devices, or part of equipment is herein referred to in singular, reference shall apply to as many items as required to complete installation.

1.03 SUBMITTALS

A. Shop Drawings:

1. Shop drawings shall be complete in all respects and shall indicate all dimensions, installation methods, size, weight, capacity, ratings, integral controls and types of materials, elevations, and sections.
2. All shop drawing submittals shall clearly indicate, using arrows and/or highlighting on all copies, which item(s) are being submitted and that each item being submitted is in compliance with all requirements on the drawings and in these specifications. All pertinent specification and drawing requirements shall be indicated on the manufacturer's drawings.
3. Submit manufacturer's latest publications for the following items:
 - a. Conduit and Fittings
 - b. Wire
 - c. Instrumentation Cable
 - d. Outlet Boxes
 - e. Junction Boxes
 - f. Pull Boxes
 - g. Convenience Receptacles
 - h. Local Control Switches
 - i. Disconnect Switches
 - j. Emergency Stop Push Button Stations
 - k. Uni-Strut
 - l. Conduit Link Seals
 - m. Conduit Labels

PART 2 - PRODUCTS

2.01 MATERIALS

A. Conduit:

1. PVC conduit in duct banks shall be Schedule 40. Direct buried PVC conduit shall be Schedule 80. PVC conduit shall be suitable for installation underground.
2. Rigid steel conduit shall be mild steel piping, zinc coated, and of sufficient weight and toughness to withstand cracking and peeling during bending. Galvanizing to be a coating of zinc of uniform thickness applied by either electrolytic or hot metal dip process.

3. Rigid aluminum conduit shall be 6063-T1 aluminum alloy and shall comply with Federal Specification WW-C-540C.
4. Each piece of rigid conduit to be straight, free from blisters and defects, cut square and taper reamed, finished in 10' lengths and threaded at each end. Couplings shall be supplied at one end and a protective sleeve for the other end. All threads shall be clearly cut. Each length of conduit shall bear Underwriters' Label.
5. PVC coated galvanized rigid steel conduit shall have a permanent plastic coating factory applied to a minimum thickness of 40 mils and a urethane internal coating. PVC coated conduit shall be Plasti-Bond Red H2OT as manufactured by Robroy Industries, Ocal Blue as manufactured by the Occidental Coating Company or Perma-Cote Supreme as manufactured by Perma-Cote Industries.
6. Flexible metallic conduit shall conform to Articles 350 and 351 of the NEC and shall be UL listed. All flexible metallic conduit shall have nonmetallic screw-in type connectors and couplings. All flexible conduit shall be liquid-tight type. Flexible conduit in wet locations and chemical feed areas shall be non-metallic.
7. Minimum size of rigid conduit shall be 3/4". Minimum size of flexible conduit shall be 1/2".

B. Wire:

1. Wire inside the pump station shall be Type THHN/THWN. Underground wiring shall be Type XHHW. All wiring shall be stranded copper with 600 volt insulation. Aluminum wire will not be acceptable.
2. Wire shall be 90°C, suitable for wet or dry locations.

C. Instrumentation Cable:

1. Instrumentation cable for analog signal wiring shall be #18 AWG stranded, twisted shielded pairs with tinned copper conductors, 300 volt polyethylene insulation, a continuous foil shield with 100% coverage, a tinned copper drain wire, and PVC jacket.
2. The instrumentation cable shall be Beldon #8760, or approved equal.

D. Cast Fittings:

1. Cast fittings for steel conduit shall be made of rust resisting alloy of iron or steel. An iron fitting shall be cast malleable iron thoroughly coated with metallic zinc or cadmium inside and outside after all machine work is completed.
2. Cast fittings for aluminum conduit shall be made of aluminum.
3. Each cast fitting shall be provided with heavy threaded hubs to fit the conduit used. A cast fitting shall be used on all exposed conduit runs except at impractical locations where factory ells may be used.
4. All cast fittings used for PVC coated conduit shall be PVC coated and shall be Form 8 with encapsulated screws.
5. All fittings in wet locations shall be gasketed.

E. Outlet Boxes:

1. Each outlet box shall be sized in accordance with current editions of all Federal, State and local codes.
2. All outlet boxes shall have mounting lugs or ears for mounting wiring devices and covers. Each outlet box shall be equipped with an appropriate cover.
3. Outlet boxes shall be cast type of same construction as cast fittings described above.

F. Junction Boxes:

1. Junction boxes shall be cast type, and shall be of same construction as cast fittings, unless noted otherwise on the Drawings.
2. Junction boxes identified on the Drawings as NEMA 4X aluminum shall be constructed of Type 5052 H-32 aluminum, and shall have gasketed shoe box type covers with stainless steel screws.
3. Label all junction boxes with an engraved nameplate fastened to the junction box. Nameplate shall be black with 1/4" white lettering.

G. Pull Boxes:

1. Pull boxes identified on the Drawings as NEMA 4X aluminum shall be constructed of Type 5052 H-32 aluminum, and shall have gasketed shoe box type covers with stainless steel screws.

2. Pull boxes identified on the Drawings as fiberglass shall be Hoffman, or equal.
 3. Label all pull boxes with an engraved nameplate fastened to the pull box. Nameplate shall be black with 1/4" white lettering.
- H. 20 Ampere, 120 Volt, Single Receptacles, NEMA 5-20R:
1. Single receptacles shall be corrosion resistant, 20 ampere, 3 wire, U-ground to meet Federal Specification WC-596. Receptacle color shall be yellow.
 2. Single receptacles shall be Arrow Hart #5361-CR, Hubbell #53CM61, Leviton #5361-CR, or approved equal.
- I. 20 Ampere, 120 Volt, Duplex Receptacles, NEMA 5-20R:
1. Duplex receptacles shall be 3 wire, U-ground, to meet Federal Specification WC-596. Receptacle color shall be ivory.
 2. Receptacles shall be Arrow Hart #5362, Bryant #5362, Hubbell #5362, Leviton #5362, Pass & Seymour #5362, or approved equal.
- J. 20 Ampere, 120 Volt, Duplex Receptacles, NEMA 5-20R (G.F.I. Type):
1. All receptacles noted as G.F.I. receptacles shall be 20 Amp ground fault circuit interrupter receptacles. Receptacles shall be the "Standard" End-of-Line" type, which protects itself only. "Feed-Thru" installation will not be permitted. Devices shall be Class A, UL listed.
 2. Provide a weatherproof cover for G.F.I. receptacles where indicated on the Drawings. Cover shall be self-closing and UL listed.
- K. Switches:
1. Local control switches, other than those mounted on a panelboard, shall be 20 ampere, 120-277 volt, AC, meeting Federal Specification WS-896E. Switch color shall be ivory.
 2. Switches shall be single pole, double pole, three-way, four-way or type as noted. Switches shall be Arrow Hart #1221, Bryant #4901, Hubbell #1221, Leviton #1221, Pass & Seymour #20AC, or approved equal.

L. Wall Plates:

1. Local control switches, receptacles and similar wiring devices shall be provided with stainless steel wall plates with beveled edges. Plates shall be same manufacturer as wiring device used.
2. At locations where FS condulets are used for switches or receptacle outlets, an FS condulet plate shall be used. Plates shall have beveled or rounded edges and shall fit flush with all sides of the FS condulet.

M. Disconnect Switches:

1. Disconnect switches shall be non-fusible, size and NEMA enclosure as indicated on the Drawings, quick-make, quick-break, heavy-duty. Provide a ground lug in each disconnect switch.
2. NEMA 4X disconnect switches shall be 316 stainless steel, unless noted otherwise.
3. Label all disconnect switches with an engraved nameplate fastened to the disconnect switch.
4. Disconnect switches shall be Square D, Eaton, or approved equal.

N. Emergency Stop Push Button Stations:

1. Emergency stop push button stations shall consist of a 30.5 mm heavy-duty, non-illuminated, push-pull type with red mushroom head mounted in a corrosion resistant NEMA 4X stainless steel enclosure. Push buttons shall be maintained contact type with double-break silver contacts. Provide a red automotive sized legend plate for each push button with white marking.
2. The emergency stop push button stations shall be Allen-Bradley Bulletin 800H, NEMA Type 4X, or approved equal.

O. Uni-strut:

1. Uni-strut shall be used to support conduit and electrical equipment. All uni-strut shall be 316 stainless steel, unless noted otherwise on the Drawings.

P. Conduit Link Seals:

1. Conduit link seals shall be installed in all core-drilled holes for sealing around the conduit. All link seal bolts shall be stainless steel.

Q. Conduit Labels:

1. Conduit labels shall be PVC sleeves that wrap around conduit. Labels shall indicate the voltage of the wiring inside the conduit.

R. Fire Resistant Foam Sealant:

1. All penetrations through floors and walls shall be sealed with Nelson Firestop Products CLK, Cat. #AA492, silicon based sealant, or approved equal.
2. All wall or floor penetration openings shall be as small as possible.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Conduit:

1. All direct buried conduits shall be PVC coated galvanized rigid steel, unless noted otherwise on Drawings.
2. All conduits for power wiring embedded in concrete slabs shall be PVC. Where conduits turn up out of the slab, they shall be PVC coated galvanized rigid steel. All conduits embedded in slabs for instrumentation wiring and motor feeders from VFDs shall be PVC coated rigid steel.
3. All conduits for motor feeders from VFDs shall be PVC coated galvanized rigid steel.
4. All exterior exposed conduits shall be rigid aluminum, unless noted otherwise on the Drawings.
5. All exposed conduits in buildings shall be rigid aluminum, unless noted otherwise on the Drawings.
6. All wiring shall be run in conduit.
7. Install conduit so wires may be removed and replaced at a later date.
8. Short runs of flexible metallic conduit with separate ground wire shall be used for connection of motors and instrumentation. Flexible conduit in chemical areas shall be non-metallic. Approximately 18" runs of flexible metallic conduit shall be used for connection of all HVAC equipment. No rigid connection to HVAC equipment will be permitted.

9. Running threads will not be permitted. Use an approved threaded coupling or a suitable union where required. Setscrew couplings will not be permitted.
10. Space supports for conduit as per the NEC. Support conduit by one-hole malleable iron pipe straps or beam clamps. Where it is impractical to use beam clamps and where conduit is installed on building surfaces, use back straps and approved fastening devices with malleable iron pipe straps. All straps and clamps for PVC coated conduit shall be permanently PVC coated by same manufacturer as conduit.
11. Where it is necessary to cross building expansion joints, or expansion joints in piping, provide conduit runs with suitable expansion fittings.
12. All conduit penetrations into electrical equipment enclosures shall be made using conduit hubs. PVC coated rigid steel conduit systems shall use PVC coated conduit hubs.
13. Bend conduit only by use of an approved pipe bending machine or hickey so the conduit will always retain its cylindrical shape. PVC coated conduit shall be bent and threaded only with tools manufactured for that purpose.
14. If the PVC coating on conduit and fittings is damaged during installation, the damaged conduit or fitting shall be replaced in its entirety by the contractor. Repairing damaged conduit with touch-up paint will not be acceptable.
15. Install metallic electrical warning tape above all underground duct banks and conduit. Tape shall be 6" wide with red background and black letters. Letters shall read "CAUTION ELECTRICAL LINE BURIED BELOW". Install tape 6" below finished grade.
16. Label all exposed conduits at each end of the conduit run.

B. Outlet Boxes:

1. An outlet box shall be furnished and installed at each outlet, firmly in place, and set true and square.
2. All outlet boxes shall be supported from the building structure, independent of the entering conduit. All unused knockouts must remain closed.

C. Wiring:

1. The voltage drop at the end of any circuit shall not exceed 3% of the normal line voltage under full load. No wires smaller than #12 AWG shall be used for branch circuits; pilot and control circuits shall not be smaller than #14 AWG.
2. Care shall be exercised in pulling wire into conduit so as not to injure insulation. Use pulling compound as required.
3. Conductors shall be continuous from source to end point with no splices.
4. Balance circuits across the phase wires of the branch and distribution panels. Run separate neutral wires for all circuits.
5. Switches shall not be connected to the neutral conductor.
6. Power and control wiring shall be run in separate conduits. AC and DC circuits shall be run in separate conduits.
7. All wiring shall conform to the following color code:
 - 480 Volt, 3 Phase: Brown, Orange, Yellow - Phase Wires
Gray - Neutral Wire
 - 208 Volt, 3 Phase: Black, Red, Blue - Phase Wires
White - Neutral Wire
 - 208 Volt, 1 Phase: Black, Red - Phase Wires
 - 120 Volt, 1 Phase: Black - Phase Wire
White - Neutral Wire
 - Control Wires: 120V AC - Red
24V dc - Blue
 - Ground Wires: Green
8. AC control wires energized from a source external to the control panel power source shall be yellow.
9. All control wiring shall be identified at each end with a legible permanent coded wire-marking sleeve. Sleeves shall be heat-shrink white PVC tubing with machine printed black marking, as manufactured by Brady Markings shall be in accordance with the wire numbers and terminal numbers shown on the control panel wiring diagrams.

- D. Splices:
1. Make all splices using solderless connectors. Use wire nut connectors composed of expandable spring steel shell and PVC insulator for size #14 through #8. Temperature rating shall be 105°C.
 2. For size #6 and larger, use bolted-type tinned copper pressure connectors, either the straight coupling type or the split bolt type. All connectors #6 and larger shall be wrapped with UL approved liner-less rubber splicing tape rated to 69 KV and vinyl plastic electrical tape to the same thickness as the insulation of the wire. Electrical tape shall be Scotch 33+, or equal.
- E. Lugs:
1. All lugs used with copper wire and cable shall be tinned copper. Aluminum will not be accepted.
- F. Panels:
1. Furnish a typed list identifying all circuits and insert in frames provided inside of panel doors.
- G. Mounting Heights:
1. Mounting heights and exact locations of all equipment to be verified by the Engineer before roughing in.
 2. Unless otherwise instructed, outlets shall be located as follows:
 - a. Local Lighting Control Switches: Locate all outlets for single or gang switches 3'-4" above finished floor on strike side of door. If this location places the switch group partly in tile or other finishes, the outlet shall be lowered or raised to place the plate entirely on a flat surface.
 - b. Duplex Receptacles: 36" above finished floor.
 - c. Disconnect Switches: 5'-0" above finished floor to top of switch, unless noted otherwise on Drawings.

END OF SECTION

SECTION 16060
GROUNDING SYSTEM

PART 1 - GENERAL

1.01 DESCRIPTION

A. Work Included:

1. Furnish all labor and materials required to complete all work necessary for an electric service and branch distribution grounding system. System shall include but not be limited to all grounding electrodes, ring conductors, connectors, and miscellaneous accessories such as bonding lugs, bushings and jumpers in accordance with the current edition of the National Electrical Code and as specified herein.
2. In addition to grounding/bonding connections required to comply with NEC provisions, a grounding ring system shall be installed as indicated herein or on the Drawings. This system is intended to provide bonding between all process and structural components and the electrical distribution system grounding. The description "process piping" where included herein shall be understood to mean all metallic piping systems where they occur on the site. Other process and structural components shall be grounded as specifically described herein to provide a complete system with all metallic components at the site bonded together.

1.02 QUALITY ASSURANCE

A. Regulations, Standards and Publications:

ANSI American National Standards Institute, Inc.
ASTM American Society for Testing and Materials
IEEE Institute of Electrical and Electronic Engineers
NEC National Electrical Code of National Fire Protection Association
UL Underwriters' Laboratories

1.03 SUBMITTALS

A. Shop Drawings:

1. Submit in accordance with General Requirements. Shop drawings shall be complete in all respects and shall indicate all dimensions, installation methods, size, weight, capacity, ratings and types of materials.
2. All shop drawing submittals shall clearly indicate, using arrows and/or highlighting on all copies, which item(s) are being submitted and that each

item being submitted is in compliance with all requirements on the Drawings and in these Specifications. All pertinent Specification and Drawing requirements shall be indicated on the manufacturer's drawings. Submit shop drawings on the following:

- a. Grounding Electrodes
- b. Grounding Conductors
- c. Grounding Conductor Connectors
- d. Conduit Grounding Bushings
- e. Conduit Grounding Jumpers
- f. Exothermic Weld Process and Components
- g. Grounding System Resistance Test Equipment
- h. Grounding System Test Point Sleeves

B. Literature:

1. Submit manufacturer's latest publications for each item.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Grounding Electrodes:

1. Grounding electrodes shall be 10'-0" long, 3/4" diameter copper clad steel. Exterior shall be electrolytic copper metallically bonded to a round one-piece carbon steel rod. The electrodes shall be fabricated so as to prevent mushrooming of rod head during driving, or a steel-driving stud, manufactured for such a purpose, shall be used.
2. Electrodes shall conform to the requirements of UL Specification No. 467 (ANSI C-33.8-1972).
3. Electrodes shall be Blackburn, Carolina, or approved equal.

B. Ground Conductors:

1. Electric service ground conductor shall be sized in accordance with NEC Article 250-66 and shall be connected to the associated building/structure grounding ring as well as all other equipment and building components required by the NEC.
2. The grounding rings shall be annealed temper, stranded, bare, copper, uncoated type. Individual members of stranded conductor shall meet the requirements of ASTM B3, and the overall fabrication shall meet the requirements of ASTM B8 for stranded conductors.

3. Size of grounding ring conductors shall be #4/0 AWG.
 4. All connections between the grounding ring and the individual equipment or building/structure components called for to be grounded herein shall be made using #2/0 AWG copper cable of the same type as the grounding rings.
- C. Grounding Jumpers:
1. UL listed jumpers shall be provided on all metallic conduit expansion fittings whether or not the circuit is provided with a separate ground conductor. Jumpers shall be braided, tinned copper, factory connected as a single assembly to two galvanized steel U-bolts. OZ Gedney Type "BJ" (for steel conduit), or approved equal.
- D. Grounding Bus:
1. All power distribution equipment, motor control centers, panelboards, terminal boxes, transformers, etc. shall be furnished with a factory installed grounding bus or termination point.
- E. Electrical Conduit Grounding Bushings:
1. Conduit connectors shall be insulated bushing type for grounding and bonding. Fitting shall have ground lug terminal as well as a bonding setscrew in the circumference of the bushing. Appleton "G1B" series, OZ Gedney "BLG" series, Steel City "BG" series, or approved equal.
- F. Exothermic Weld Connections:
1. All underground grounding system connections shall be exothermically welded, including all cable connections to grounding electrodes (rods), concrete reinforcing and any other utilities required to be grounded but are not accessible from above grade.
 2. The welding process shall use a mixture of copper oxide and aluminum packaged according to connection type in plastic tubes. The packages shall be nonexplosive and shall not be subject to spontaneous ignition.
 3. All welding materials used shall be Cadweld as manufactured by Erico Products, Inc. or equal and shall meet or exceed the requirements of IEEE Standards 80 and 837 and as listed in MIL 419.
- G. Exposed Mechanical Type Grounding System Connectors:
1. The following equipment, structural and nonstructural components at the site shall be connected with a #2/0 AWG, soft-drawn, stranded, tinned copper, bare grounding conductor with the described materials or fitting to

the associated building or structure grounding ring. (These items are in addition to the electrical distribution grounding requirements described elsewhere herein.) In addition to the component and fitting manufacturers listed herein and on the Standard Details, fittings and components manufactured by Burndy, OZ Gedney, Dossert, Teledyne/Penn-Union, or approved equal:

- a. Electrical Switchgear and Substation
 - b. Motor Control Center
 - c. Emergency Generators
 - d. Process Piping:
 - 1) 1/2" to 1-1/2" - OZ Gedney Type "ABG"
 - 2) 1-1/4" to 12" - OZ Gedney Type "G" bronze heavy-duty ground clamps with Type "GWB" dead end terminal hub
 - 3) Larger than 12" - OZ Gedney Type "XL" single hole lug mounted to a single process pipe flange bolt.
 - e. Concrete slab reinforcing steel
 - f. Handrail
2. Components used for grounding conductor connections shall be as indicated herein or on the Drawings.

H. Grounding Conductor Connection Lugs:

1. Grounding conductor connection lugs shall be aluminum for all connections to aluminum materials. Grounding conductor connection lugs for connections to all other materials shall be copper. All aluminum-to-copper connections shall be made according to the lug manufacturer's recommendations using an appropriate cleaning and oxidation prevention compound, Penetrox A-13, or approved equal.

PART 3 - EXECUTION

3.01 INSTALLATION

A. General:

1. Grounding system shall comply with the current edition of the National Electrical Code, the current edition of the National Electrical Safety Code and as specified herein.

2. Flexible conduit to motors shall not be used as a ground conductor.
3. All ground conductors shall be copper and sized according to the requirements of the NEC, Table 250-66 and Table 250-122 as applicable.
4. All conduits shall be furnished with a separate ground conductor. Conduits shall not be used as a ground conductor.
5. All metallic electrical conduits shall be bonded to the equipment ground terminal, ground wire or ground bus using an insulated ground bushing and jumpers sized as required by the NEC. Bond shall be provided at all conduit terminations.
6. Flexible jumpers (bonding straps) shall be installed where conduit expansion fittings occur.
7. Ground conductors shall be green, insulated stranded type where installed in conduit.
8. Grounding ring and all associated conductors shall be soft drawn, stranded copper, size 4/0, bare type.
9. Unless otherwise indicated on the drawings or in the specifications, all copper-to-copper or copper-to-steel splices and terminations for ground ring and connections to the ground ring shall be made by controlled exothermic reaction welding process, using the appropriate fittings for the process employed. Steel shall be ground or filed, and copper conductors shall be cleaned, to ensure all surfaces are clean, dry and free from oxide before welding process is performed.
10. System ground ring and top of ground electrodes shall be direct buried to a minimum depth of 24" and a maximum depth of 30". Electrodes shall be driven straight down, perpendicular to the finished grade.
11. Ground electrodes in the ground ring shall be installed at no less than 10' intervals nor greater than 20' intervals.
12. The term "grounding ring" shall be understood to mean a copper conductor, as specified of this Section, buried and connected to grounding electrodes (driven rods) at + 15'-0" intervals, to completely encircle the associated building or structure. Splices in and connections to the copper conductor and grounding electrodes shall be made using an exothermic weld process, as described in this Section.
13. All metallic water piping systems shall be connected to the building's associated ground ring at two locations. Where flow meters, valves, flexible piping or any type of nonmetallic connection occur in a piping system, a bonding jumper shall be installed around the device to ensure ground

continuity. Jumpers installed under other portions of these specifications, such as reference grounds for process flow meters, etc., shall not be used to replace or be considered as grounding system jumpers.

14. Rebar in concrete structures shall be connected to the grounding ring at two locations for each structure.
15. The ground ring shall be furnished with a test point. The test point shall consist of a 6" diameter, Schedule 40 PVC conduit brought flush with finished grade and extending down to 4" below point on ground rod where ring conductor is attached. The PVC shall be notched as required to prevent stress on the ground ring conductor if the PVC conduit is pushed downward from grade for any reason. Provide threaded end cap on top of PVC conduit. The cap shall be labeled "GROUND TEST POINT".
16. Testing of actual ground resistance shall be made by the Contractor before any finish landscaping is accomplished. Testing shall not be performed until after all underground connections are made and buried and after all structural steel has been connected to the ground ring. Test shall be made at the ground ring using a megger type ground tester and the "fall of potential" test method. Maximum resistance at the test point shall be 5 ohms unless otherwise noted. Where measured values exceed the above figures, the Contractor shall install additional electrodes at no additional cost to the Owner until further tests indicate the ground resistance has been reduced to the specified limit.

END OF SECTION

SECTION 16210
ELECTRIC SERVICE

PART 1 - GENERAL

1.01 DESCRIPTION

A. Work Included:

1. Furnish all labor and materials to remove the primary electric service to the existing pump station transformer and install a new temporary primary electric service to the transformer prior to the construction of the new pump station.
2. Furnish all labor and materials to remove the electric service to the existing pump station and install a complete new electric service to the new pump station including transformer pad, conduit, wiring, termination, metering, and all equipment and labor required, as shown on Drawings, and specified herein.
3. Service characteristics for the new electric service are 277/480V, 3 phase, 4 wire, wye connected. Power company is Potomac Edison. Design Request (DR) Number for this project is 765131070.
4. All power company coordination is the responsibility of the Contractor.

1.02 QUALITY ASSURANCE

- A. Contact power company for specific instructions regarding service requirements before beginning work. Complete system must meet with power company approval, and shall meet all power company requirements
- B. Power company contact is Garrett Hixon. Phone number is 301-271-5907.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Transformer Pad:

1. Transformer pad shall be a pre-cast concrete pad, furnished and installed in accordance with the requirements of the power company.

- B. Primary Service Conduit for Temporary Service:
 - 1. Primary service conduit for the temporary service shall be PVC Schedule 40, direct buried.
- C. Primary Service Conduits for New Service:
 - 1. Primary service conduits for the new service shall be PVC Schedule 40, encased in a concrete duct bank for straight runs of conduit. At bends, the conduit shall be PVC coated galvanized rigid steel.
- D. Secondary Service Conduits:
 - 1. Secondary service conduits shall be PVC Schedule 40, encased in a concrete duct bank for straight runs of conduit. At bends, the conduit shall be PVC coated galvanized rigid steel.

PART 3 - EXECUTION

3.01 INSTALLATION OF TEMPORARY ELECTRIC SERVICE

- A. Temporary Service:
 - 1. Disconnect and remove the primary electric service to the existing pump station transformer and re-feed the transformer with a temporary electric service from a new service pole.
- B. Temporary Service Conduit:
 - 1. The temporary service conduit shall start at the new electric service pole and run underground to the existing pad mounted transformer. The temporary service conduit shall be furnished and installed by the Contractor.

3.02 REMOVAL OF EXISTING ELECTRIC SERVICE

- A. General:
 - 1. The Contractor shall remove the existing pad mounted power company transformer, transformer pad, and the secondary electric service to the existing pump station after the new pump station is on-line.
 - 2. Coordinate the removal of the existing pad mounted transformer with the power company.

3.03 INSTALLATION OF NEW ELECTRIC SERVICE

A. General:

1. The Contractor shall install a complete new electric service to new pump station, including a new pad mounted transformer, transformer pad, and underground primary and secondary electric service as shown on the Drawings and specified herein.
2. Coordinate all service installation requirements with the power company.

B. Transformer Pad:

1. Install a pre-cast transformer pad for the new power company transformer. The pad shall be installed in accordance with the power company requirements and as shown on the Drawings.

C. Primary Service Conduits:

1. Primary service conduits shall start at the electric service pole and run underground to the pad mounted transformer. Primary service conduits shall be furnished and installed by the Contractor in a concrete duct bank.

D. Secondary Service Conduits:

1. Secondary service conduits shall start at the pad mounted transformer and run underground to MCC-C located in the Pump Station. Secondary service conduits shall be furnished and installed by the Contractor in a concrete duct bank.

E. Primary Service Conductors:

1. Primary service conductors shall be furnished and installed by the power company in the primary service conduits.

F. Secondary Service Conductors:

1. Secondary service conductors shall be furnished and installed by the Contractor in the secondary service conduits.

G. Electric Metering:

1. The electric metering shall be furnished by the power company on the pad mounted transformer.

H. Costs:

1. All power company costs for the installation of the temporary electric service, the installation of the new electric service, and the removal of the existing electric service will be paid by the Owner. The Contractor shall be responsible for all other costs associated with the installation of the new electric service, and the removal of the existing electric service.

END OF SECTION

SECTION 16230

EMERGENCY GENERATOR SYSTEM

PART 1 - GENERAL

1.01 DESCRIPTION

A. Work Included:

1. Furnish a complete natural gas emergency generator system including generator, prime mover, muffler, exhaust system, cranking battery, battery charger, control panel, water jacket heater, generator mounted circuit breaker, Level 2 sound attenuated weatherproof enclosure, and all other necessary material required to complete the system.

B. Generator Requirements:

1. The emergency generator shall be rated for continuous standby service at 200 KW, 250 KVA, 60 Hz, 0.8 power factor, 277/480 volts, 3 phase, 4 wire.
2. The generator must meet the most current EPA emission requirements for this size generator at the time of manufacture.

1.02 QUALITY ASSURANCE

A. Standards: The engine generator set, and all accessories, shall meet the requirements of:

MIL-STD	705 B
NEC	National Electrical Code
NEMA	National Electrical Manufacturer's Association
NFPA	National Fire Protection Association (Pamphlets 30, 31, 37, 110)
UL	Underwriters' Laboratory

B. Quality Control:

1. All components of the emergency generator system shall be new and of the most current and proven design.
2. The complete system shall be of a type, which has been in satisfactory service for at least one year under automatic emergency system conditions.

3. This generator set system shall be assembled, tested and shipped by one supplier so that there is one source of supply and responsibility.
4. The Supplier shall be a factory trained and certified manufacturer's representative and shall maintain a complete service facility. The service facility shall be capable of making delivery to the generator set site all generator set parts within 48 hours of placing the order. The Supplier shall employ a manufacturer trained and certified technician on a full time basis at the service facility capable of making repairs and responding to service calls within 24 hours of notice. Certified proof of this requirement shall be available from the Supplier.

C. Testing:

1. Prototype tests performed on a generator set of the same size and type, required by these specifications, shall be submitted and approved with the shop drawings, required below. The test procedures and results shall be certified by an independent testing laboratory. The tests shall be performed in accordance with NFPA 110 and shall document the following:
 - a. Maximum power level
 - b. Maximum motor starting capacity
 - c. Voltage dip
 - d. Fuel consumption
 - e. Engine-generator cooling air flow
 - f. Governor response time
 - g. Alternator temperature rise per NEMA MG1-22.40
 - h. Harmonic analysis and voltage Wave Form Deviation per MIL-STD-705 B, method 601.4
 - i. Three (3) phase short circuit test for mechanical and electrical strength
2. Factory tests of the generator set to be supplied shall be conducted in accordance with procedures certified by an independent testing laboratory. The manufacturer shall successfully test the generator set to be supplied, document items 1 a-i above and submit the test results for approval before shipping the generator set to the job site. A two-hour load bank test shall be performed and the results submitted before shipping the generator set.

D. Acceptance Tests:

1. Acceptance testing of the installed generator set shall be conducted by a factory-trained representative of the generator set manufacturer. An authorized representative of the Owner shall witness the acceptance tests. The test results shall be submitted to and approved by the Owner

before the generator set is accepted. The Supplier shall furnish all testing equipment, materials, etc., including fuel needed to demonstrate the set is in compliance with the specification. Any deficiencies brought to the attention of the Supplier shall be corrected and, if warranted or requested by the Owner, the test shall be re-performed prior to acceptance. Final O&M Manuals shall be submitted before the acceptance tests commence.

2. The acceptance tests shall be performed during an eight-hour field test during which the manufacturer's representative shall demonstrate that the system performs in complete compliance with the specifications. As a minimum, a load bank test, performed in accordance with NFPA 110 section 5-13.2. The load tests shall use dry type load banks specifically utilized for this purpose. The load bank will be capable of definite and precise incremental loading and shall not be dependent on the generator control instrumentation to read voltage and amperage of each phase. The test instrumentation will serve as a check of the generator set meters. Load bank testing shall be performed for a period of four (4) hours at the full rated load of the generator. Salt-water brine tank load banks are not acceptable for this purpose and are disallowed and will not be utilized for this test.

E. Warranty:

1. The emergency generator shall be furnished with a 5-year warranty.

1.03 SUBMITTALS

A. Shop Drawings:

1. Shop drawings shall be complete in all respects and shall indicate all dimensions, installation methods, size, weight, capacity, ratings, integral controls and types of materials, elevations, and sections. Shop drawings shall include manufacturer's literature and complete information including the following:
 - a. Engine generator system plan, elevation and dimensional drawings clearly indicating all aspects of the system including points for each of the inter-connections required.
 - b. Engine generator/exciter control cubicle layout and component descriptions.
 - c. Gas piping schematic and fuel line connection information.
 - d. Fuel consumption rate curve at various loads, ventilation and combustion CFM requirements.

- e. Exhaust muffler and vibration isolator.
- f. Schematic ladder and control wiring diagrams for the generator system.
- g. Printed literature and brochures describing the system including all sizing requirements and components specified.
- h. The weight of the engine, generator and complete system.
- i. Points of measurement and maximum vibration readings (measured as velocity) for the installed system recommended by the manufacturer.
- j. Battery, battery rack and battery charger literature and description.
- k. Sound attenuated weatherproof housing.
- l. The specified standby KW of the generator shall be for continuous electrical service during interruption of the normal utility power source and this shall be certified to this effect by the manufacturer for the actual unit supplied.
- m. Factory prototype test results performed on a unit of this size and type documenting items (a) through (l) listed in 1.02 C above.

B. Operation and Maintenance Manuals:

- 1. Submit required number of copies of an operation and maintenance manual for the complete emergency generator system. The manual shall be submitted in 3-ring loose-leaf binders, and shall be complete, neat, orderly and indexed. The manual shall include, at the least, all data bearing on the specific generator system necessary for maintenance, operation, parts repair and replacement including all accessories and electrical controls, fire-code safety and operator safety measures, and lubrication schedule. A copy of the approved shop drawings shall be included in the manual. Manual shall be submitted and approved before system will be accepted.

C. Installation Certificate:

- 1. A factory technician shall inspect the installed generator system and certify in writing to the installer that it is installed in accordance with the manufacturer's recommendations before the system is initially started. The technician shall be present for the initial start-up and make recommendations to resolve any defects experienced. A copy of the

installation certificate must be submitted to the Owner before the generator set is conditionally accepted.

1.04 MANUFACTURER

- A. The manufacturer of the generator set shall be Cummins Onan, Caterpillar, Kohler, or approved equal.

PART 2 - PRODUCTS

2.01 GENERATOR EQUIPMENT

- A. Engine:

1. The engine shall be the water-cooled in-line or V-type, natural gas. It shall meet specifications when operating on natural gas. The engine shall be equipped with filters for fuel, lube oil, intake air, lube oil cooler, fuel transfer pump, fuel priming pump, one foot of flexible fuel line between engine and rigid supply, and gear-driven water pump.
2. The engine shall be controlled by an electronic governor. The governor shall maintain isochronous frequency regulation from no load to full load.
3. The engine shall be equipped with automatic safety controls, which will shut down the engine in the event of low oil pressure, high water temperature, overspeed and overcrank.
4. The engine shall be remote starting with a 2 wire, solenoid shift electric starter.

- B. Generator:

1. The generator shall be a three phase, single-bearing, synchronous-type built to NEMA standards, rated for continuous standby at service. Class F insulation shall be used on the stator and rotor, and both shall be further protected with 100% epoxy impregnation and an overcoat of resilient insulating material on end coils to reduce possible fungus and/or abrasion deterioration. The generator shall incorporate a resettable thermal protector for exciter/regulator protection against extended low power factor loads. The generator shall be capable of accepting full nameplate load in one step.
2. A generator-mounted, volts-per-hertz type exciter/regulator shall be provided to match the characteristics of the generator and engine. Voltage regulation shall be $\pm 1\%$ from no load to full rated load. Voltage level adjustment shall be a minimum of $\pm 5\%$. The solid-state regulator

module shall be shock-mounted and epoxy-encapsulated for protection against vibration and atmospheric deterioration. Voltage dip due to motor starting current shall not exceed 20% under the maximum load conditions.

3. A permanent magnet generator (PMG) shall provide excitation power to the automatic voltage regulator for immunity from voltage distortion caused by non-linear SCR controlled loads on the generator. The PMG shall sustain main field excitation power for optimum motor starting and to sustain short circuit current for selective operation and coordination of system over current devices.
4. The alternator shall be 105°C rise at standby rating.

C. Cooling System:

1. The engine shall be furnished with a cooling system having sufficient capacity for cooling the engine when the generator set is delivering full rated load at an ambient temperature of 125°F.
2. The engine cooling system shall be filled with a solution of 50% ethylene glycol. Cooling system shall be pretreated by supplier for inhibition of internal corrosion.
3. The engine shall be equipped with a radiator having a blower type fan. The radiator shall have a duct adapter flange, and shall be equipped with a fan guard and core guards.

D. Starting System:

1. The engine shall be equipped with a DC electric starting system of sufficient capacity to crank the engine at a speed, which will allow full natural gas starting of the engine. The motor voltage shall be as recommended by the engine manufacturer.
2. Fully automatic generator start/stop controls shall be provided in the generator control panel to start the generator automatically from a contact in the automatic transfer switch.
3. When the engine starts, the starting control shall automatically disconnect the cranking controls. The cranking disconnect means shall be electrically self-regulating to prevent re-cranking for a definite time after source voltage has reduced to a low value. If engine fails to start, or any safety device operates while engine is running, engine shall be stopped immediately and starting control locked out, requiring manual resetting.

4. Controls shall provide shutdown for low oil pressure, high water temperature, overspeed and overcrank. Controls shall include a 10-second cranking cycle limited to 3-5 attempts before lockout.
5. The automatic engine starting control shall incorporate industrial control type elements throughout, which must operate at 80% battery voltage. Relays shall be equipped with silver-gold contacts of the wiping type and shall have adequate pressure to insure reliable performance at battery voltage.
6. Batteries:
 - a. A lead/acid storage battery set of the heavy-duty starting type shall be provided. Battery voltage shall be compatible with the starting system. The battery set shall be rated for a minimum of 172 hours and shall be of sufficient capacity to provide for 1½ minutes total cranking time without recharging. It shall be sized for the cold cranking amps as recommended by the battery manufacturer. A wood bottom, fiberglass treated, battery rack and necessary cables and clamps shall be provided. The battery rack shall be isolated from the engine to protect it from excessive vibration, and shall be readily accessible for service and/or removal.
7. Battery Charger:
 - a. A 10-amp current limiting battery charger shall be furnished to automatically recharge the batteries. The charger shall include overload protection, silicon diode-full wave rectifiers, voltage surge suppressors, DC ammeter, and AC over current protection. AC input voltages shall be the same as the generator output voltage.
 - b. The battery charger shall be mounted inside the generator housing.
- E. Jacket Water Heater:
 1. Provide an engine mounted thermostatically controlled water heater to maintain the engine jacket water temperature at 100°F. Heater shall be sized as recommended by the manufacturer.
 2. The heater for the generator shall operate on 208 volts, 1 phase.
- F. Exhaust System:
 1. Provide a critical type exhaust silencer, including stainless steel flexible exhaust fitting, properly sized according to the manufacturer's

recommendation. Exhaust pipe size shall be sufficient to ensure that exhaust backpressure does not exceed the maximum limitations specified by the generator set manufacturer. The silencer shall be manufactured by Maxim, or equal.

2. Provide taps for drainage with petcock drain valves, drip cap, rain cap, wall thimble and accessories.
3. The exhaust silencer shall be installed inside the generator housing.
4. The exhaust piping and muffler shall be insulated with insulating blankets.

G. Engine Generator Set Mounting:

1. The engine generator shall be mounted in perfect alignment on an all welded preformed structural steel I-beam or C channel skid type sub-base which shall provide for attachment of all specified engine and generator accessories.
2. Provide spring-type vibration isolators for mounting between the engine generator set mounting rails and the concrete slab. The size and quantity of isolators shall be as recommended by the manufacturer.

H. Generator Control Panel:

1. Provide a generator-mounted NEMA 12 control panel. The control panel shall be mounted on the generator terminal box and shall be vibration isolated. The generator control panel shall contain, but not be limited to, the following equipment:
 - a. Digital AC Voltmeter
 - b. Digital AC Ammeter
 - c. Digital AC Frequency Meter
 - d. Ammeter - Voltmeter Phase Selector Switch
 - e. Automatic Starting Controls
 - f. Voltage Level Adjustment Potentiometer
 - g. Run-stop-remote switch and remote start-stop terminals
 - h. Alarm lights for low oil pressure, low engine temperature, high water temperature, overspeed, and overcrank
 - i. Engine Temperature and Pressure Gauges
 - j. DC Charging Volts and Ampere Gauges
 - k. Running Time Meter
 - l. Dry Contacts for run indication, not in auto, and common alarm wired to terminal strips
 - m. Panel illumination lights and switch

I. Generator Circuit Breaker:

1. A main line molded case 3-pole circuit breaker shall be installed as a load circuit interrupting and protection device. It shall operate both manually as an isolation switch and automatically during overload and short circuit conditions.
2. The trip unit for each pole shall have elements providing inverse time delay during overload conditions and instantaneous magnetic tripping for short circuit protection. The circuit breaker shall meet standards established by Underwriters' Laboratories, National Electrical Manufacturer's Association, and National Electrical Code.
3. The circuit breaker shall be mounted in a NEMA 12 type enclosure, adjacent to the generator control panel.

J. Sound Attenuated Enclosure:

1. Provide a weatherproof, sound attenuated 16 gauge aluminum enclosure for the generator. The enclosure shall be drip-proof to prevent water from entering enclosure and shall be provided with heavy-duty "lockable" latches to ensure tamper-proof security and safety. Sound shield shall be provided with lifting eyes for ease of installation.
2. The enclosure shall have solid access doors with door handles keyed alike. Doors shall have 3-point latches, stainless steel butt hinges, stainless steel door holders, and rain gutters above doors.
3. The enclosure shall have an advanced sound-attenuation design. The noise at 7 meters shall be 72 dBA or less, at full load.
4. Provide a 20 amp 120 volt, weatherproof, G.F.I. receptacle on the generator enclosure.

K. Painting:

1. The complete generator set shall be painted with the manufacturer's standard prime and finish paint system. Observed nicks, damage, rust, etc. to the paint system of the installed generator set shall be prepared, primed and finish coated in the field prior to conditional acceptance.

PART 3 - FIELD SERVICES

3.01 TECHNICAL SERVICES

- A. The manufacturer of the emergency generator shall furnish a qualified technician, whose qualifications are acceptable to the Owner, to provide the following services:
 - 1. Inspection of the installation of the emergency generator system
 - 2. Start-up
 - 3. Performance testing
 - 4. Operating adjustments
 - 5. Instruction of Owner's personnel
 - 6. Assistance at final inspection
- B. These services shall include not less than four (4) 8-hour workdays on-site comprising a minimum of four trips.

END OF SECTION

SECTION 16500
LIGHTING FIXTURES

PART 1 - GENERAL

1.01 DESCRIPTION

A. Work Included:

1. Furnish all labor and materials for a complete lighting fixture installation as indicated on the Drawings and specified herein.
2. Fixtures of size and type specified herein shall be supplied, installed and connected as indicated on the Drawings. Provide accessories for each fixture as required for a complete installation.
3. Furnish and install lamps in each fixture.

1.02 QUALITY ASSURANCE

A. Regulations, Standards and Publications:

1. Fixtures shall be U.L. listed.
2. All fixtures shall meet all Federal, State and local required criteria.
3. All light fixtures shall be mounted in accordance with manufacturer's recommendations.
4. The installation must comply with the amended National Electrical Code of the National Fire Protection Association.

B. Qualification:

1. Provide manufacturer specified for each light fixture type. Substitutes will not be accepted without approval prior to the bid.
2. When more than one name of manufacturer of fixture is listed in these specifications, the first manufacturer and number determine the style and quality.

1.03 SUBMITTALS

A. Shop Drawings:

1. Submit manufacturer's latest publication of each fixture; including LED information, construction details, light distribution details and/or coefficients.

PART 2 - PRODUCTS

2.01 MATERIALS

A. LED Drivers:

1. LED light driver shall be of high efficiency.
2. LED light driver shall allow continued operation of all other LEDs in the event of an LED failure.

B. Light Fixture Schedule:

1. CA: Ceiling mounted, 120 volt, high efficiency LED, nominal 8" x 4', totally enclosed gasketed fixture suitable for wet locations. Fixture shall be provided with an electronic driver. Fixture shall produce a minimum of 6,000 initial lumens and have a color temperature of less than or equal to 4000K. Housing shall be one-piece high impact plastic to provide durability and corrosion resistance. The lens shall be one-piece low profile, frosted acrylic, resistant to damage. Fixture shall have plastic latches to apply positive, uniform pressure on the gaskets to seal against dust and moisture. Provide gasketed conduit hubs. Fixture shall be Holophane #EMS-L48-6000LM-LPAFL-MD-MVOLT-40K-WLFEND, Lithonia #FEM-L48-6000LM-LPAFL-MD-MVOLT-40K-80CRI-WLFEND2, or approved equal.
2. SA: Same as Light Fixture Type CA, except pendant mounted.
3. WA: Wall mounted, 120 volt, high efficiency LED fixture. The fixture shall produce a minimum of 8000 initial lumens and have a color temperature of 4000K. The fixture housing shall be constructed of die-cast copper-free aluminum with a bronze powder coated finish. Fixture shall have a tempered glass lens. Fixture shall have a button style photoelectric cell. Fixture shall be Holophane #W4GLED-30C1000-40K-T3M-MVOLT-SPD-PE-BZSDP, or approved equal.
4. WB: Same as Light Fixture Type WA, except without photoelectric cell.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Installation:

1. Contractor shall furnish supports for light fixtures. Light fixtures shall be supported with formed channels, angles, rods, clamps, washers, etc. of sufficient size and strength to support weight of fixtures from the building overhead structural members, independently from the ceiling system.
2. The fixture manufacturer's catalog numbers describing the various types of fixtures shall be used as a guide only and do not include all the required accessories or hardware that may be required for a complete installation. The Contractor shall be responsible for furnishing, at no additional cost to the Owner, all required accessories and hardware for a complete installation.
3. All inoperable lamps shall be replaced with new lamps during the course of construction, up to and including the date of final acceptance by the Owner and Engineer.

END OF SECTION

SECTION 16530

BATTERY EMERGENCY LIGHTING FIXTURES

PART 1 - GENERAL

1.01 DESCRIPTION

A. Work Included:

1. Furnish, install and connect a complete system of conduits, conductors, unit type battery emergency lighting fixtures and all other materials and equipment necessary for the installation of an emergency lighting system.

1.02 QUALITY ASSURANCE

A. Regulations, Standards and Publications:

- FM Factory Mutual Engineering Corp.
- NEC National Electrical Code of National Fire Protection Association
- UL Underwriters' Laboratories

B. Qualification:

1. The complete system shall be of a type, which has been in satisfactory service for at least one year under automatic emergency lighting conditions.
2. Provide manufacturer specified for each fixture type. Substitutes will not be accepted without approval prior to the bid.
3. When more than one name of manufacturer of fixture is listed in these specifications, the first manufacturer and number determine the style and quality.

1.03 SUBMITTALS

A. Shop Drawings:

1. Submit manufacturer's latest publication of the following:
 - a. Battery Unit
 - b. Fixed Heads
 - c. Remote Heads
 - d. Combination Battery Emergency/Exit Fixtures
 - e. Battery Exit Fixtures

PART 2 - PRODUCTS

2.01 MATERIALS

A. Battery Units:

1. EA/EAR: Battery emergency light fixtures shall have a nonmetallic housing. Fixture shall be provided with a test switch, status indicator and a rechargeable Nickel Cadmium battery. The battery shall provide 90 minutes of emergency illumination. Fixture shall operate on 120 volts and shall be furnished with two 2-watt LED lighting heads. Fixture shall be Holophane #DM30-WL-LED, Crouse-Hinds #N2LPS12222, or approved equal. Battery emergency remote heads shall be Holophane ELA-QM-T-L0309 or Crouse-Hinds #N2RF1222, or approved equal.

B. Combination Battery Emergency/Exit Fixtures:

1. EB: Combination exit fixture/battery emergency light fixtures shall be back mounted, single faced with red (confirm color with local code) high intensity LED lamps and sealed nickel cadmium battery. The fixture housing shall be white polycarbonate. The exit fixtures shall operate on 120 VAC power. Fixture shall be Holophane Magellan #QM-LED-R-HO-SD, Sure-Lites #LPX7DHNCI, or approved equal.

C. Exit Fixtures:

1. EC: Exit fixtures shall be back mounted, single faced with red high intensity LED lamps and a sealed nickel cadmium battery. The fixture housing shall be white polycarbonate. The exit fixtures shall operate on 120 VAC power and shall be Holophane Magellan #QM-R-HORO, Sure-Lites #LPX7, or approved equal.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Battery Unit:

1. Battery units shall be firmly fastened to walls. Mounting height to be determined in field.

B. Wiring:

1. Wiring on low voltage side of unit shall be no smaller than #10.
2. Connect battery emergency lighting units and exit fixtures to lighting circuit for area being protected ahead of all local control switches.

END OF SECTION

SECTION 17010

PUMP CONTROL SYSTEM GENERAL REQUIREMENTS

PART 1 - GENERAL

1.01 DESCRIPTION

A. Work Included:

1. The Contractor shall obtain the services of a subcontractor who shall provide a complete integrated Pump Control System (PCS) consisting of a motor control center, variable frequency drives, control panels, instrumentation, and programmable controller system hardware and software, as shown on the Pump Control System Drawings and as specified in Division 17. This subcontractor will hereafter be referred to as the Pump Control System Supplier. The System Supplier shall have total responsibility for the design, programming, testing, start-up and commissioning of the Pump Control System.
2. The Pump Control System Supplier shall be one of the following System Integrators. No other suppliers will be accepted without approval prior to the bid:

Micro-Tech Designs, Inc.
4312 Black Rock Rd.
Suite 1
Hampstead, MD 21074
410-239-2885
Contact: Mark Duvall

S-L Controls, Inc.
2140 Renard Court
Annapolis, MD 21401
410-841-6810
Contact: Steve Vinceguerra

Optimum Controls Corp.
1301 Rosemount Blvd.
Reading, PA 19604
610-375-0990
Contact: Jim Brunell

Trijay Systems, Inc.
10 Maple Avenue
Line Lexington, PA 18932
215-997-5833
Contact: Jim Arevalo

Allied Control Services, Inc.
611 Garfield Ave.
West Point, PA 19486
(215) 699-2955
Contact: Paul Mamzic

1.02 QUALITY ASSURANCE

A. Regulations, Standards and Publications:

ANSI	American National Standards Institute
IEEE	Institute of Electrical and Electronic Engineers
ISA	International Society of Automation
NEC	National Electrical Code
NEMA	National Electrical Manufacturers Association
UL	Underwriters' Laboratories, Inc.

B. Quality Control:

1. All components of the Pump Control System shall be new and of the most current and proven design. All components shall be suitable for the intended application and shall be installed and wired in strict accordance with the manufacturer's requirements. The System Supplier shall provide all necessary transformers, power supplies, fusing, and grounding required to meet the manufacturer's requirements.
2. The complete system must comply with all Federal, State, Municipal, or other authority's laws, rules, or regulations.
3. All motor control centers, variable frequency drives, and control panels, and their components and materials, shall bear the label of the Underwriters' Laboratory. All control panels shall be UL listed as a complete assembly.

C. Equipment Manufacturers:

1. The Pump Control System Supplier shall base his bid on providing the manufacturers specified under Division 17 for all equipment furnished for the System. No substitutes will be allowed.

1.03 SUBMITTALS

A. Shop Drawings:

1. Submit required number of detailed shop drawings for all equipment being provided for the Pump Control System. Shop drawings shall be submitted within 90 days of the date of Notice to Proceed.
2. Shop drawings shall be submitted in 3-ring loose-leaf binders and shall be complete, neat, orderly, and indexed. Separate shop drawing submittals shall be made for each of the following:
 - a. Motor Control Center
 - b. Variable Frequency Drives

- c. Control Panels
 - d. Instrumentation
 - e. Programmable Controller System Hardware and Software
 - f. PLC Program
 - g. Factory Acceptance Test Plan
 - h. Loop Check-out Sheets
3. Refer to specification sections for specific shop drawing requirements.
4. The System Supplier shall submit a complete set of engineered drawings for the Motor Control Center, Variable Frequency Drives, Control Panels, and Programmable Controller system hardware. These engineered drawings shall be similar to the Contract PCS Drawings, and shall be done by the System Supplier using AUTOCAD. The drawing size shall be 11"x17". These drawings shall include, but not be limited to, the following:
- a. Motor Control Center elevation showing all unit locations, door mounted devices and dimensions.
 - b. A chart for the Motor Control Center indicating nameplate engraving, starter size and type, circuit breaker size and type, transformer size, special controls, motor horsepower, and overload heater size, for each Motor Control Center unit.
 - c. Three line wiring diagrams for each motor control center unit showing power and control wiring, unit devices, terminal numbers, and interconnecting wiring.
 - d. Variable Frequency Drive elevation showing all door mounted devices and dimensions.
 - e. Wiring diagrams for each variable frequency drive showing power and control wiring, unit devices, terminal numbers, and interconnecting wiring.
 - f. Control panel elevation, details, front and back panel layout, and wiring diagrams showing terminal numbers and interconnecting wiring. The control panel layout drawings shall include dimensions for the location of all panel-mounted devices.
 - g. Programmable controller system block diagram, power wiring diagrams and I/O wiring diagrams showing terminal numbers and

interconnecting wiring. The I/O wiring diagrams shall include the PLC address for each input and output.

B. Installation, Operation and Maintenance Manuals:

1. Submit required number of copies of installation, operation and maintenance manuals for all equipment being provided for the Pump Control System.
2. Installation, operation and maintenance manuals shall be submitted in 3-ring loose-leaf binders, and shall be complete, neat, orderly and indexed. Separate binders shall be submitted for each of the following:
 - a. Motor Control Center
 - b. Variable Frequency Drives
 - c. Control Panels
 - d. Instrumentation
 - e. Programmable Controller System Hardware and Software

PART 2 - PRODUCTS

2.01 SEE SPECIFIC SECTIONS FOR PRODUCTS

PART 3 - EXECUTION

3.01 COORDINATION

- A. The Pump Control System Supplier shall attend an initial coordination meeting with the Engineer, the Contractor, and the Owner to review the scope of the project and the project schedule.

3.02 FACTORY ACCEPTANCE TEST

- A. The System Supplier shall conduct a factory acceptance test for the Pump Control System prior to shipment of the equipment. The factory test shall be conducted at the supplier's facility and shall demonstrate the control system was designed and performs in accordance with the Specifications and Drawings.
- B. The System Supplier shall provide all necessary equipment and hardware required to conduct the factory test.
- C. The factory acceptance test shall demonstrate the proper operation of all system hardware and software, and all PLC and HMI control logic described in the Description of Operation. The factory test shall demonstrate the operation of all HMI graphic displays. The factory test shall be witnessed by the Engineer and the Owner.

- D. Submit an itemized test procedure and schedule for the factory acceptance test to the Engineer for his review prior to the actual test.

3.03 RECORD DRAWINGS

- A. Submit required number of as-built drawings for the Pump Control System prior to the delivery of any equipment to the site. Provide an as-built drawing in the control panel.
- B. Following start-up and commissioning of the system, the System Supplier shall make all necessary changes to the as-built drawings and re-submit required number of final as-built drawings. A final as-built drawing shall also be provided in the control panel.

3.04 SYSTEM INSTALLATION, START-UP AND COMMISSIONING

A. System Installation:

1. The System Supplier shall provide on-site supervision and advice to the installing contractor to insure the system is installed in accordance with the specifications and the manufacturer's requirements.
2. All field wiring to the equipment furnished by the System Supplier shall be performed under the electrical work unless noted otherwise on the Drawings.

B. Loop Check-out:

1. The System Supplier shall perform loop check-out for each loop to verify that the wiring, programming and documentation for the loop are correct. The loop check-out shall check each input from its origination point back to the PLC and each output from the PLC to its destination point. The loop shall be verified at the PLC and the operator interface terminal.
2. Loop check-out sheets shall be provided by the System Supplier which shall be used for the record sign-off for each loop. The loop check-out sheets shall be submitted to the Engineer at least 30 days prior to loop check-out.
3. The System Supplier shall provide a minimum of two people on site for the duration of the loop check-out.

C. System Start-Up:

1. Start-up the control system by energizing the system equipment and testing the operation of all hardware, software, pump control logic, and all customized software programs.

2. All start-up and testing shall be scheduled, performed in an orderly sequence, and conducted in the presence of and to the satisfaction of the Engineer and the Owner.

D. System Commissioning:

1. Calibrate all instrumentation, and place the complete pump control system into operation. The commissioning of the system shall include the overall calibration and tuning of all control loops and sequences to provide stable control of the pumps. The validity of all inputs and outputs for the system shall be checked and verified during the system commissioning.
2. The System Supplier shall provide a minimum of two people on-site for the length of time necessary for system start-up and commissioning.

3.05 FINAL ACCEPTANCE TEST

- A. Following the commissioning of the Pump Control System, and the issuance of the Certificate of Substantial Completion to the Contractor by the Engineer, a final acceptance test shall be conducted for a period of 30 consecutive days. This test shall be scheduled with the Owner and the Engineer and shall not begin until the System Supplier receives written approval to start. During that time period, the system shall operate satisfactorily and in compliance with the Specifications. The System Supplier shall promptly correct any problems that occur during the acceptance test.
- B. Following the successful completion of the final acceptance test, a certificate of final acceptance will be issued to the System Supplier.

3.06 EXPANSION OF SYSTEM I/O

- A. The System Supplier shall include in his cost for this Contract the addition of 10 I/O points to the system as directed by the Engineer. These additional I/O points will originate from the spare I/O. The Supplier's allowance shall include all costs to add these points to the system including wiring, drawing changes, PLC programming, field verification and testing.

3.07 ADDITIONAL SOFTWARE CONFIGURATION AND PROGRAMMING

- A. The System Supplier shall include in their cost for this Contract 80 additional manhours of on-site time for software configuration and programming. This time shall be utilized for changes and/or additions that may be required after the commissioning of the system. The Supplier's cost for these additional manhours shall include software documentation changes, and updates to the O&M Manuals. The additional programming and configuration shall be performed during start-up and during the one-year warranty period.

3.08 TRAINING

- A. During the Final Acceptance Test, the System Supplier shall arrange for the instruction and training of the Owner at the pump station site in the operational procedures of the system. At the end of this period, the Owner shall have, as determined by the Engineer, sufficient knowledge to operate the system. This training shall be for six people for eight (8) hours. Training shall be conducted on two separate days with four (4) hours of training being performed each day.
- B. This training shall be in addition to the training specified in the other Division 17 sections.

END OF SECTION

SECTION 17100

MOTOR CONTROL CENTER

PART 1 - GENERAL

1.01 DESCRIPTION

A. Work Included:

1. Furnish and install a motor control center in the pump station as shown on the Drawings.
2. The motor control center shall include required number of vertical sections, main breaker, automatic transfer switch, power monitor, surge protective device, circuit breakers, combination type motor starters, panelboard, panelboard transformer, variable frequency drives, control transformers, relays, selector switches, push buttons, pilot lights, and special controls as shown on the Drawings and specified herein.
3. See Section 17110 for the variable frequency drives.

B. Special Requirements:

1. The Motor Control Center shall be provided by the Pump Control System Supplier.

1.02 QUALITY ASSURANCE

A. Regulations, Standards and Publications:

ANSI	American National Standards Institute
NEC	National Electrical Code
NEMA	National Electrical Manufacturers Association
UL	Underwriters' Laboratories, Inc.

B. Quality Control:

1. The motor control centers shall be new and limited to products regularly produced and recommended for service ratings in accordance with engineering data or other comprehensive literature. In all cases where device, or devices, or part of equipment is herein referred to in singular, reference shall apply to as many items as required to complete installation.

2. All internal conductors are to be of sufficient cross-sectional area copper to carry the rated ampere load and not exceed the maximum heat rise above ambient temperature specified by UL and NEMA.

1.03 SUBMITTALS

A. Shop Drawings:

1. Submit in accordance with the General Requirements. Shop drawings shall be complete in all respects and shall indicate all dimensions, installation methods, size, weight, capacity, ratings, integral controls and types of materials, elevations, and sections. Shop drawings shall include manufacturer's literature and complete information on the following:
 - a. Freestanding Vertical Sections
 - b. Main Circuit Breaker
 - c. Automatic Transfer Switch
 - d. Power Monitor
 - e. Surge Protective Device
 - f. Thermal-Magnetic Type Circuit Breakers
 - g. Motor Circuit Protector Type Circuit Breakers
 - h. Magnetic Across-the-Line Motor Starters
 - i. Panelboard Transformer
 - j. Panelboard
 - k. Control Transformers
 - l. Relays
 - m. Selector Switches
 - n. Push Buttons
 - o. Pilot Lights
 - p. Elapsed Time Meters
 - q. Special Controls
 - r. Engineered Control Diagrams and Connection Diagrams
 - s. Nameplate Schedules

1.04 MANUFACTURER

- A. The motor control center shall be Allen-Bradley Centerline 2100, Square D Model 6, or approved equal.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Motor Control Center Structure and Configuration:

1. The Motor Control Centers shall be NEMA Type 1, gasketed. Wiring shall be NEMA Class 1, Type B. The motor control center shall have a main breaker to feed the horizontal bus. Provide lugs of adequate size to terminate incoming cables. The motor control center shall be furnished with a ground bus, and a neutral bus as indicated on the Drawings.
2. The motor control center shall be rated at 480 volts, 3 phase, 4 wire, 60 Hz and shall be braced to withstand a short circuit current of 65,000 rms symmetrical amperes.
3. Motor starter units shall be combination type with a molded case circuit breaker. Control voltage for units shall be 120 volts.
4. The motor control center shall consist of vertical sections bolted together to form a rigid, freestanding assembly.
5. Vertical sections shall be formed of 13 gauge hot rolled steel with uniform blemish-free surfaces. Top and bottom structural parts shall be 10 gauge. End closing plates shall be 12 gauge, and unit parts and doors shall be 14 gauge. Base channels shall be provided constructed of rugged steel to easily withstand the stress of transit and moving the control center into position. Bolt holes in the base channels shall be provided in all sections for the purpose of bolting the control center to the floor. Steel removable lifting angles shall be provided on the top of the sections for convenience in handling the control center.
6. Each section, to comply with standards of NEMA, shall be approximately 90" high excluding lifting angles and base channels. It shall be 20" deep by 20" to 35" wide, as indicated on the Drawings.
7. End sections shall have end-closing plates, which can be removed for the addition of future sections. The top plate shall be of a removable one-piece construction for added convenience in cutting conduit holes. Removable blank plates flanged on all 4 sides and having captive screws shall cover all unused unit spaces.

B. Main Circuit Breaker:

1. Main circuit breaker shall be solid state electronic trip, individually mounted and identified, and shall be 100% rated. Main circuit breaker shall have quick-make, quick-break mechanism and shall visually indicate whether the breaker is closed, open or tripped.
2. The main breaker shall have sufficient interrupting capacity to properly close against and interrupt instantaneously, without damage, the maximum short circuit current available at the breaker. Minimum interrupting capacity shall be 65,000 amperes symmetrical at 480 volts.

3. The main breaker shall have adjustable long time, short time, and instantaneous trip settings.

C. Automatic Transfer Switch:

1. Furnish a 600 amp, 480 volt, 3-pole, 4-wire automatic transfer switch in the MCC for utility and generator service. The transfer switch shall be suitable for continuous operation and shall consist of a double throw power transfer mechanism and a microprocessor controller. Provide lugs in the MCC for the transfer switch wiring.
2. The transfer switch shall be arranged to close a contact for remote starting of the emergency generator, after a time delay of 0-6 seconds, after power failure or drop in any phase voltage to 70 percent of line voltage. During the delay period, the load circuits shall not be disconnected from the normal service lines.
3. When the generator is delivering not less than 95 percent of rated voltage and frequency, the load circuits shall be transferred. Retransfer to normal service shall be automatic when full line voltage and phase are restored after a time delay of 0 to 5 minutes, set for 3 minutes. Provisions shall also be made for manual transfer to the generator. After transfer to normal source, the generator shall continue to run for 5 minutes (adjustable 0 to 25 minutes) unloaded, shall shut down and shall be ready to start upon the next failure of the normal source or for manual start-up. If the generator should fail while carrying the load, retransfer to the normal source after a short delay shall be made upon restoration of the normal power. The pick-up and drop-out settings of the phase voltage-sensing relays shall be completely adjustable in the field from 70 percent to 100 percent pick-up and drop-out.
4. The transfer switch shall be double-throw switch operated by a single coil mechanism momentarily and electrically. Operating current for transfer shall be obtained from the source to which the load is to be transferred. Failure of any coil or disarrangement of any parts shall not permit a neutral position. The switch shall be positively locked mechanically on either source without the use of hooks, latches, semi-permanent magnets, or contacts. All contacts and coils shall be readily accessible for replacement from the front of the panel without major disassembly of associated parts.
5. The transfer switch shall be equipped with a test button, and auxiliary contacts as required to show that the switch is in the normal or emergency position. Provide pilot lights on the MCC door to indicate the switch position.

6. Auxiliary contacts shall be provided for remote indication of the transfer switch position. These contacts shall be wired to a terminal block in the transfer switch for wiring to the PLC System.
7. The transfer switch shall have a load test switch to simulate normal power failure.
8. The transfer switch shall be furnished with an in-phase monitor.
9. Provide a 7-day solid-state exercise clock to set the day, time and duration of the generator exercise period. Furnish a selector switch to enable the generator to be exercised with or without load.
10. Minimum withstand and closing ratings shall be in accordance with UL 1008.
11. The automatic transfer switch shall be ASCO 7000 Series, or approved equal.
12. The automatic transfer switch shall be furnished with all software, programs and cables necessary for maintenance and adjustment of the transfer switch.

D. Power Monitor:

1. Provide a power monitor in MCC-C to provide complete electrical metering. The power monitor shall be microprocessor based and shall be furnished complete with current transformers. The power monitor shall be Allen-Bradley PM 5000, or approved equal.
2. The power monitor shall be furnished with an alarm contact for remote indication of a power failure. This contact shall be wired to terminals in the MCC cubicle for wiring to the plant PLC System.

E. Surge Protective Device:

1. A surge protective device shall be furnished in MCC-C. The surge suppressor shall be UL 1449 Second Edition Listed (1998). Unit shall protect all modes (L-L, L-N, L-G, N-G) applicable. Unit shall have 240kA of surge capacity per phase with a let-thru voltage of less than 1500V L-L and 700V L-G. A disconnecting means shall be provided ahead of the surge suppressor so the unit can be serviced without de-energizing the service.
2. Surge suppressor shall have AC tracking filter with EMI/RFI filtering. Each module shall be fused individually, thermally protected, and have LED indication.

3. The surge suppressor shall be furnished with a dry alarm contact to indicate a failure of any module. The alarm contact shall be wired to terminals in the MCC cubicle for wiring to the plant PLC System.
4. Surge protective device shall be provided and installed by MCC manufacturer. Surge suppressor shall be APT Transient Eliminator XGA Series, or approved equal.

F. Horizontal Wireways:

1. Adequate conduit entrance space and wire entry room shall be provided at both the top and bottom of each section. The bottom horizontal wireway shall be 12" and the top horizontal wireway shall be 6" and both shall extend through the length and depth of the control center section with openings between sections. Covers over these wireways shall be equipped with captive type screws to prevent loss of hardware during installation. These wireways shall be isolated from the bus bars.

G. Vertical Wireways:

1. A vertical wire trough located on the right-hand side of each standard section and having a cross-sectional area of not less than 28 sq.in. shall extend from the top horizontal wire trough to the bottom horizontal wire trough for the purpose of routing user's motor and control wires to the control units. The wire trough shall be isolated from the bus bars to guard against accidental contact. A separately hinged door having captive type screws shall cover the vertical wire trough for safe and easy access to wiring without disturbing control units.
2. Wire ties shall be furnished in the vertical wire trough to group and securely hold wires in place for a neat, orderly installation.
3. Where wire access ports between unit spaces and vertical wire trough are open, shutters shall be provided to prevent items, such as a fish tape, from accidentally entering the unit space. Snap-in wire grommets shall be provided in wire access ports for size 2 units and smaller for isolation and added protection of small wires. For larger units, snap-in wire guards shall be provided for added protection of larger wires.

H. Vertical Sections:

1. Each vertical section shall be divided into compartments, each containing a combination starter or other control assembly as indicated on the Drawings. Power shall be provided to these compartments from the main bus by bus bars extending the full height of the unit. Sections shall also be provided with horizontal spaces at the top and at the bottom, which shall

line up with adjacent section to form horizontal wiring raceways along the entire length of the control center.

I. Compartments:

1. Compartments shall be built in interchangeable combinations of modular heights. A full vertical section shall contain six equal NEMA size I modular compartments exclusive of top and bottom wiring spaces. Starter compartments shall not be less than 12" high. Only 1/2 and integral multiples of the basic module will be allowed. Compartments for NEMA size 4 and smaller starters shall be draw out type.
2. Guide rails shall be provided in the structure for supporting and aligning a unit during its removal or replacement. Draw out units shall have pressure type, line disconnecting stabs of high strength alloy and shall be held in place by means of quick acting, captive machine screw fasteners arranged so the units can be removed or remounted readily without access to the rear of the structure. Each compartment whether draw out or stationary, shall be enclosed and effectively baffled to isolate any fault which may occur and shall be covered by an individual door fixed to the structure with a continuous full length piano hinge or two (three for doors over 36" high) semi-concealed, heavy-duty, pin type hinges. Doors shall be secured with captive, quick acting machine screw fasteners and shall be arranged to completely cover all live parts whether the draw out unit is present or not.

J. Bus Bars:

1. Main horizontal bus bars rated as indicated on Drawings but not less than 600 amperes shall be provided at the top or center of the control center and extend its entire length, except when cut and supplied with splice bars to divide the control center for ease in handling or when section is indicated on Drawings to be furnished without bus.
2. Horizontal bus bars of copper shall be mounted edge-to-edge to provide greater mechanical strength.
3. Vertical copper bus bars shall be rated not less than 300 amperes for adequate current carrying capacity in a variety of plug-in applications.
4. Horizontal and vertical bus bars shall be electrolytically tin plated copper. Connections between horizontal and vertical busses shall be joined by bolts, conical spring washers for constant pressure joints and self-clinching nuts to allow joint maintenance from the front.
5. High strength glass reinforced alkyd insulators shall be used as bus supports and as unit plug-in insulators. Bus and plug-in insulators shall be red to indicate the proximity of energized bus parts.

6. The temperature rise, above ambient temperature outside the enclosure, of bus bars and connections shall not exceed 50°C and that of connections to insulated cable shall not exceed 45°C when operated continuously at rated current. Buswork, wiring and equipment shall be rated to withstand short circuits of 65,000 rms symmetrical amperes at 480 volts or as noted on the Drawings.
7. A copper ground lug shall be provided in each incoming line vertical section capable of accepting a #8 to 250 MCM cable. A horizontal and vertical copper ground bus shall be provided in each section of the motor control center. Horizontal ground bus shall run continuously throughout the control center except where splits are necessary for ease of shipment and handling; in which case, splice bars shall be provided. Ground bus shall be tin plated copper and have a cross-sectional area of equal to 28% of the main horizontal bus cross-sectional area. Horizontal ground bus shall be located at the bottom of the motor control center.

K. Bus Barriers:

1. Insulated horizontal and vertical bus barriers shall be furnished to reduce the hazard of accidental contact. These barriers shall have a red color to indicate proximity to energized busses. Vertical bus barriers shall have interlocking front and back pieces to give added protection on all sides and shall segregate the phases from each other. Small, separate openings in the vertical bus barriers shall permit unit plug-in contacts to pass through and engage the vertical bus bars.
2. Bottom bus covers shall be provided below the vertical bus to protect the ends of this bus from contact with fish tapes or other items entering the bottom of the enclosure. Unused plug-in openings shall have plastic snap-in closing plates.

L. Unit Plug-In:

1. Unit plug-in contacts shall be provided for size 1 through size 5 motor starters and for branch circuit breakers.
2. The plug-in connection shall be 2-point connection for each phase designed to tighten during heavy current surge. The plug-in fingers shall be tin plated to yield a low resistance connection and shall be backed by spring steel clips to provide high-pressure connection points. Contact fingers shall be mounted in their support so these fingers become floating and self-aligning to allow solid seating onto the vertical bus bars.

M. Unit Doors:

1. Each unit shall have a door securely mounted with hinges, which allow the door to swing open a minimum of 112 degrees. Unit doors shall be fastened to the stationary structure so they can be closed to cover the unit space when the units have been temporarily removed. Unit doors shall be held closed with captive type screws, which engage self-aligning cage nuts. These screws shall provide at least 2 threads of engagement to help hold unit doors closed under fault conditions. Removable door panels held captive type screws shall be provided on starter unit doors for mounting push buttons, selector switches or pilot lights. Blank door panels capable of accepting future push button devices shall be furnished when push button devices are not originally specified for starter units. Starter units shall have an external low profile overload reset button.
2. Pilot devices and instruments, including push buttons, reset buttons, and indicating lights, shall be flush mounted in the compartment doors. Equipment shall not be mounted on the rear of draw out units. All equipment within the unit shall be arranged to provide ample electrical clearances and easy access for maintenance. Draw out combination starter unit of a given type and size shall be made interchangeable. Only those items, which are common to all starters, shall be mounted in the unit.
3. Where a spare unit is indicated on the Drawings, it shall be a complete combination starter of the type and size shown.

N. Unit Support Pan:

1. Each plug-in unit shall be supported and guided by a tilt and lift-out removable pan so unit rearrangement is easily accomplished. For easy unit installation and rearrangement, transfer of this unit support pan from one location to another shall be accomplished without the use of tools after the unit and door have been removed.

O. Unit Saddles:

1. Each plug-in unit shall have a sheet steel saddle designed to physically isolate the unit from the bus compartment and adjacent units. Saddles shall be equipped with captive, self-aligning mounting screws, which hold the unit securely in place during shipment and maintain the unit and structure at the same potential. Handholds shall be provided on each plug-in unit to facilitate unit removal.

P. Disconnect Operator:

1. A flange mounted operator handle shall be supplied for each switch or breaker. To prevent false circuit indication, this mechanism shall be

engaged with the switch or breaker at all times regardless of unit door position. The operator handle shall have a conventional up-down motion with the down position as "OFF." It shall be possible to lock this handle in the "OFF" position with up to three 3/8" diameter shackle padlocks. The operator handle shall be color coded to display red in the "ON" position and black in the "OFF" position.

2. The operator handle shall be interlocked with the unit door so the disconnect cannot be switched to the "ON" position unless the unit door is closed. It shall be possible to defeat this interlock by a deliberate act of an electrician should he desire to observe the operation of the operator handle assembly. This interlock shall also prevent opening the unit door, unless the disconnect is in the "OFF" position. A defeater for this action shall also be provided in the event an electrician must gain access to the unit without interrupting the service.

Q. Starter Units:

1. Starter units shall be completely draw out Type B, sizes as indicated on the Drawings, so units may be withdrawn without disconnecting any wiring. Units over three space units high may be bolt-in type. A positive guidance system shall be provided to assure proper alignment of wedge-shaped power stabs in dead-front openings in vertical power bus. The screw racking mechanism shall serve as a mechanical advantage to the operator during unit insertion or removal. Stab-in power terminals shall be of a type that will increase contact pressure on short circuits.
2. All starter units shall be rated to withstand short circuits of 65,000 rms symmetrical amperes at 480 volts or as noted on the Drawings.

R. Thermal Magnetic Type Circuit Breakers:

1. Thermal magnetic circuit breakers shall have quick-make, quick-break mechanisms and shall visually indicate whether the breaker is closed, open or tripped.
2. All breakers shall have sufficient interrupting capacity to properly close against and interrupt instantaneously, without damage, the maximum short circuit current available at the breaker. Minimum interrupting capacity of breakers shall be 65,000 amps rms symmetrical at 480 volts.
3. Provide auxiliary contacts on the circuit breakers where indicated on the Drawings.

- S. Motor Circuit Protector Type Circuit Breakers:
1. Motor circuit protector type circuit breakers shall be used for all branch circuit breakers for motor circuits. Breakers shall be instantaneous trip, magnetic only type.
 2. Each breaker shall be furnished with a single magnetic trip adjustment, which simultaneously sets the magnetic trip level of all poles. Adjustment shall be continuous throughout the trip range. Minimum interrupting capacity of breakers shall be 65,000 amps rms symmetrical at 480 volts.
 3. Provide auxiliary contacts on the circuit breakers where indicated on the Drawings.
- T. AC Magnetic Starters - Line Voltage Type:
1. Motor starters shall be across-the-line magnetic type, rated in accordance with NEMA standards, sizes and horsepower ratings. Starter sizes shall be as indicated on the Drawings.
 2. Across-the-line magnetic starters shall be equipped with double-break, silver alloy contacts. All contacts shall be replaceable without removing power wiring or removing starter from panel.
 3. Coils shall be of molded construction and shall operate on 120 volts AC. All coils shall be replaceable from the front without removing the starter from the panel.
 4. Overload relays shall be solid state electronic type.
- U. Electrical Interlocks:
1. All starters shall be furnished with electrical interlocks as shown on the Drawings plus one spare normally open and one spare normally closed contact. Arrangements shall be convertible from normally open to normally closed.
- V. Panelboard Transformer:
1. Provide a lighting transformer in MCC-C as shown on the drawings. The rating shown on the drawings shall be the minimum acceptable rating.
 2. The insulation shall be 180°C insulation with 80°C rise.
 3. Provide a circuit breaker with thermal magnetic trip for primary protection.

4. Provide a secondary fuse protection for the transformer. The primary circuit breaker compartment and transformer compartment shall be interlocked together and factory wired together.

W. Panelboard:

1. Provide a panelboard in MCC-C as shown on the Drawings.
2. The panelboard shall be rated for 14kA interrupting capacity.
3. Provide bolt-on branch breakers for the panelboard.

X. Control Transformers:

1. Provide a control transformer for each motor starter control circuit as indicated on the Drawings. Control transformers shall be 480 volts to 120 volts and shall have primary and secondary fusing. The primary fuses shall be Class "CC".
2. The control transformers shall be sized as required for the load being powered, plus 50VA spare capacity.

Y. Relays:

1. Relays shall be heavy-duty general-purpose type with 10 amp contacts. Relays shall have pin type terminals, which plug-in to a socket, mounted to the inside of the MCC bucket. Contact configuration shall be 3PDT.
2. Relay coils shall operate on 120 volts AC, unless indicated otherwise on the Drawings. Relays shall have an indicator light to indicate the relay coil is energized.

Z. Selector Switches:

1. Selector switches shall be non-illuminated. Switches shall be 30mm, heavy-duty, oil tight. Switches shall have double-break silver contacts. All switches shall be maintained contact type unless otherwise indicated on Drawings.
2. Provide auxiliary contact blocks as indicated on the Drawings.

AA. Push Buttons:

1. Push buttons shall be non-illuminated. They shall be 30mm, heavy-duty, oil tight. Contacts rated for 10 amps minimum. Push buttons shall be momentary contact type unless noted otherwise on the Drawings.

BB. Pilot Lights:

1. Pilot lights shall be LED, push to test, transformer type. They shall be 30mm, heavy-duty, oil tight. Voltage rating shall be 120 volts. Color caps shall be green for "run", and red for "alarm".

CC. Elapsed Time Meters:

1. Elapsed time meters shall be time totalizer, non-resettable. They shall have a synchronous motor, which shall drive a set of digit readout wheels to indicate the total time the unit is energized. Readout shall be five-digit including 1/10 digit. Range shall be 0 to 9999.9 hours. Voltage rating shall be 120 volts.
2. Elapsed time meters shall be ENM Company Series T50, or approved equal.

DD. Legend Plates:

1. Provide an engraved legend plate for each pilot device. Engraving shall be as indicated on the Drawings.

EE. Identification:

1. A control center identification number nameplate describing section catalog numbers and characteristics shall be fastened on the vertical wire trough door of every section. Each control center unit shall have its own identification number nameplate giving unit catalog number fastened to the unit saddle near the upper left-hand corner. These nameplates shall also have suitable references to factory records for efficient communication with supplier.
2. Each control center unit shall also have an engraved Bakelite nameplate fastened to the outside of each unit door. Nameplates shall be black with white engraving.

FF. Wiring:

1. The motor control center shall be wired in accordance with NEMA class and type previously specified and shall be furnished to be interconnected with a programmable controller system.
2. All 120 VAC control wiring shall be red. All wiring in each MCC cubicle shall be labeled.

3. Quick separating, pull apart terminals shall be mounted on lift-out brackets in the units. All terminals shall be labeled.

GG. Finish:

1. All painted parts shall undergo a phosphatizing pre-painting treatment for rust resistance and good paint bond. All painting shall be with enamel, which shall be baked for a durable, hard finish. Unit saddles shall be painted white for easy interior visibility. Removable push button plates, flange mounted operator handles and trim plates, and top horizontal wire trough cover plates shall be painted a contrasting charcoal gray. Other painted parts shall be painted ANSI-49 medium light gray.
2. All unpainted parts shall be plated for resistance to corrosion.

2.02 SPARE PARTS

A. Provide the following spare parts for the motor control center:

1. One (1) Relay for each type utilized
2. Six (6) Fuses for each type and size utilized

B. Spare parts shall be packaged individually in boxes that are clearly labeled with part name and manufacturer's part/stock number.

PART 3 - EXECUTION

3.01 FIELD SERVICES

A. Main Breaker Adjustment and Testing:

1. Contractor shall adjust the settings for the main breaker in accordance with the coordination study.
2. Contractor shall have a factory-authorized representative present with required test equipment to test the ground fault protection device and explain operation in the presence of the Owner and also submit results of test in writing.

B. Start-up and Testing:

1. Test the operation of each motor starter and all MCC controls.
2. Test the operation of the power failure and SPD alarm contacts.

3. Test the operation of the automatic transfer switch with the emergency generator.
 4. All start-up and testing shall be performed in the presence of the Owner and the Engineer.
- C. Training:
1. Provide two (2) hours of training on the motor control center. Training shall include theory of operation, maintenance and troubleshooting procedures.

END OF SECTION

SECTION 17110

VARIABLE FREQUENCY DRIVES

PART 1 - GENERAL

1.01 DESCRIPTION

A. Work Included:

1. Furnish and install variable frequency AC drives as shown on the Drawings and specified herein.
2. The variable frequency drives shall be mounted in the motor control center as shown on the Drawings.

B. Special Requirements:

1. The variable frequency drives shall be furnished by the Pump Control System Supplier, who shall be responsible for coordinating the drive start/stop and speed controls.

1.02 QUALITY ASSURANCE

A. Regulations, Standards and Publications:

ANSI	American National Standards Institute
NEC	National Electrical Code
NEMA	National Electrical Manufacturers Association
UL	Underwriters Laboratories, Inc.

1. The drives shall be built to applicable NEMA standards and be suitable for use as a component to meet NEC requirements. Drives shall be listed by Underwriters Laboratories (UL).

B. Quality Control:

1. All variable frequency drives shall be new and limited to products regularly produced and recommended for service ratings in accordance with engineering data or other comprehensive literature. In all cases where device, or devices, or part of equipment is herein referred to in singular, reference shall apply to as many items as required to complete installation.
2. All incoming material shall be inspected and/or tested for conformance to quality assurance specifications. All chips (CMOS, TTL, LINEAR, etc.) shall be functionally tested.

3. All subassemblies shall be inspected and/or tested for conformance to vendor's engineering and quality assurance specifications.
4. All drives shall be burned-in at the factory, cycling load to simulate no load/full load and exercise drive power components.

1.03 SUBMITTALS

A. Shop Drawings:

1. Submit in accordance with the requirements of Section 17010. Shop drawings shall be complete in all respects and shall indicate all dimensions, installation methods, size, weight, capacity, ratings, integral controls, elevations, and sections. Shop drawings shall include manufacturer's literature and complete information on the following:
 - a. Variable Frequency Drives
 - b. Line Reactors
 - c. Wiring Diagrams
2. The panel layout drawings and VFD wiring diagrams shall be customized for this project. Standard drawings will not be accepted.

1.04 MANUFACTURER

- A. The Variable Frequency Drives shall be Allen-Bradley PowerFlex 753, Square D Altivar 61, or approved equal.

1.05 WARRANTY

- A. Each Variable Frequency Drive shall be furnished with a 2-year warranty, which shall commence on the date of start-up by a factory authorized VFD service representative.

PART 2 - PRODUCTS

2.01 VARIABLE FREQUENCY DRIVES

A. General:

1. The variable frequency drives shall convert a fixed frequency, three phase input power to an adjustable AC frequency and voltage source for controlling the speed of a standard, NEMA Design B, AC induction motor.
2. The drives shall be fully digital, microprocessor controlled and shall incorporate a diode bridge rectifier and a transistorized inverter section. IGBT type power transistor modules shall be utilized in the inverter section

to invert a fixed DC bus voltage to a symmetrical three-phase pulse-width modulated (PWM) output voltage.

3. The drives shall accept incoming 480 VAC, 60 Hz line power, and shall not be affected by voltage fluctuations of $\pm 10\%$ or frequency fluctuations of $\pm 2\%$. The drive shall include phase-to-phase and phase-to-ground protection, and transient voltage surge protection.
4. Each variable frequency drive shall be designed to operate a 460 volt, 3 phase AC induction motor in an ambient temperature of 32 to 104°F. The drive output amp rating shall exceed the motor nameplate FLA rating. Refer to drawings for motor horsepower and specs for motor RPMs.

B. Drive Enclosure:

1. The variable frequency drives shall be mounted in motor control centers as shown on the Drawings. Provide ventilation fans and louvers as required to dissipate the heat generated by the drive.

C. Drive Operating Characteristics:

1. The drive operation shall be fully digital with microprocessor control of frequency, voltage and current. All drive set-up operations and adjustment shall be digital and stored in a non-volatile memory (EEPROM).
2. To control the rate of change of output frequency for a step change in input reference, the drive shall have two independently adjustable acceleration and deceleration rates.
3. The drive shall have a foldback current limiting circuit. During acceleration, the circuit shall automatically reduce the acceleration rate to a slower rate should the load inertia cause excessive currents.
4. The drive shall have a selectable deceleration voltage limiting circuit. The circuit shall extend the set deceleration ramp should the bus voltage approach high limits due to regeneration.
5. The drive output frequency shall be adjustable from 0-60 Hz.
6. The drive shall have a fully programmable volts per hertz ratio.
7. The drive shall maintain set frequency to within 0.6 Hz during power line fluctuations.
8. The drive speed reference signal shall be a 4-20mA analog output from the PLC or a signal received from the VFD keypad module.

9. The drive shall be capable of maintaining 100% of rated output current continuously, and shall be capable of delivering 110% of rated output current for up to one minute.
10. The drive shall be capable of restoring motor operation after a 0.5 second line loss without shutting down on a fault.
11. The drive input circuitry shall not generate line notches or large voltage transients on the incoming line.
12. The drive shall present a displacement power factor of 0.95 or better to the AC line at any speed or load.
13. The drive efficiency at rated load and frequency shall be 96% or better.

D. Drive Controls:

1. Each variable frequency drive shall be furnished with start/stop controls and speed controls as indicated on the Drawings and in the Description of Operation.

E. VFD Keypad Module:

1. A keypad module shall be mounted on the MCC door for digital set-up of the drive, drive parameter review and drive fault annunciation. The module shall have an LCD display and a digital speed pot for local control of the drive speed.

F. Drive Protection and Diagnostics:

1. Each variable frequency drive shall incorporate internal diagnostic and fault sensing circuits as an integral part of the drive. The following drive protection functions shall be monitored:
 - a. Momentary Overload Protection - Adjustable from 20 to 115% of Drive Rating
 - b. Motor Overload Protection
 - c. Undervoltage Sensing
 - d. Overvoltage Sensing
 - e. Phase Protection
 - f. Drive Overtemperature
 - g. Ground Fault Detection
2. Each of the above fault conditions shall be annunciated on the digital display panel and shall shut down the drive.

2.02 DRIVE CONTROL COMPONENTS

A. Line Reactors:

1. Provide line reactors for each VFD to eliminate nuisance overvoltage tripping and to reduce harmonic distortion. The line reactors shall be iron core, Class H insulation, 115°C rise, copper wound, and shall have an impedance as indicated on the Drawings. The line reactors shall be sized for the motor horsepower and shall be manufactured by TCI, MTE, or approved equal.

B. Control Wiring:

1. All 120 VAC control wiring shall be red. All 24vdc wiring shall be blue. All wiring in the VFD shall be labeled.

C. Control Terminal Block:

1. Provide a control terminal block in the MCC cubicle to terminate all control wiring from the field. All terminals shall be labeled with machine printed labels.

2.03 SPARE PARTS

A. Provide the following spare parts for the variable frequency drives provided:

1. Six (6) Fuses for each size and type utilized
2. One (1) variable frequency drive
3. Two (2) ventilation fans for each size provided
4. Four (4) sets of fan filters for each size utilized

B. Spare parts shall be packaged individually in boxes that are clearly labeled with part name and manufacturer's part number.

PART 3 - EXECUTION

3.01 FIELD SERVICES

A. Start-up and Testing:

1. Provide the services of a manufacturer's representative to start-up, adjust and test each variable frequency drive. Demonstrate start/stop control, fault diagnostics and variation of motor speeds in response to both the manual and automatic variable speed controls.

2. All start-up and testing shall be performed in the presence of the Owner and the Engineer.

B. Training:

1. Provide four (4) hours of on-site training for the Owner on the variable frequency drives.
2. Training shall be specific for the VFDs provided and shall include theory of operation, VFD keypad programming, and maintenance and troubleshooting procedures. All training shall be performed by a qualified training specialist from the VFD manufacturer.

END OF SECTION

SECTION 17200

PUMP STATION CONTROL PANEL

PART 1 - GENERAL

1.01 DESCRIPTION

A. Work Included:

1. Furnish and install a Pump Station Control Panel for the Pump Control System as shown on the Drawings.
2. The control panel shall be provided by the Pump Control System Supplier and shall be complete and include all components and wiring as shown on the Drawings and specified herein.

1.02 QUALITY ASSURANCE

A. Regulations and Standards:

ANSI	American National Standards Institute
IEEE	Institute of Electrical and Electronic Engineers
NEC	National Electrical Code
NEMA	National Electrical Manufacturers Association
UL	Underwriters' Laboratories

- B. The control panel components shall be of the most current 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 control panel. The components provided by the System Supplier shall be compatible with the functions required and shall form a complete working system.
- C. The control panel shall be UL listed as a complete assembly in accordance with UL-508.

1.03 SUBMITTALS

A. Shop Drawings:

1. Submit shop drawings on the control panel in accordance with the requirements of Section 17010. Shop drawings shall be complete in all respects and shall include a complete bill of material, catalog information, descriptive literature of all components, wiring diagrams, and panel layout drawings showing dimensions to all devices.

PART 2 - PRODUCTS

2.01 CONTROL PANEL COMPONENTS

A. Control Panel Enclosure:

1. The control panel enclosure shall be designed and sized in accordance with the requirements of the Drawings and as specified herein. Control panel enclosures shall be manufactured by Hoffman, Saginaw, or approved equal.
2. Steel control panel enclosures shall be NEMA 12, constructed of 10 gauge steel with continuously welded seams. Panel shall have piano type hinged, overlapping doors with neoprene gasket. Enclosure doors shall be equipped with a heavy-duty 3-point latching mechanism operated by a padlocking handle. Following fabrication, the control panel shall be degreased, cleaned and treated with a phosphatizing process, then primed and painted inside and out with an industrial grade enamel. The inside of the control panel shall be painted white. The exterior color shall be gray.
3. The control panel components shall be properly identified with an engraved nameplate mounted on the inside of the panel. All components not mounted on the front of the panel shall be mounted to a subpanel. All wiring shall be installed in a neat, workmanlike manner and shall be grouped, bundled, supported and routed horizontally and vertically to provide a neat appearance. All wires leaving the panel shall be terminated at the terminal strips inside the enclosure. Terminals and wires shall be identified in accordance with the Supplier's panel wiring diagrams.
4. Provide a copper grounding plate inside the control panel for terminating all ground wires.
5. Provide a plastic data pocket in the control panel.

B. Enclosure Light Fixtures:

1. Provide a LED light fixture in the control panel to illuminate the enclosure. The light fixture shall have a low profile design with a non-yellowing lens cover and a door-activated switch. The light fixture shall be Hoffman, or approved equal.

C. Control Circuit Breakers:

1. Control circuit breakers shall be quick-make, quick-break thermal magnetic molded case type, individually mounted and identified. Circuit breakers shall be Allen-Bradley Bulletin 1492-CB, Eaton, or approved equal.

D. Surge Protection Device:

1. Provide a 120 volt, 1 phase transient voltage surge suppressor in the control panel to protect the panel components from damage which may occur from transient over voltages caused by lightning or surges on the incoming power line.
2. The surge protective device shall have a pluggable surge protection module, an indication light to indicate if the unit has failed, and a normally closed alarm contact, which shall be wired to the PLC System.
3. Surge suppressor shall be Phoenix Contact PLT-SEC-T3-120-FM, or approved equal.

E. Uninterruptible Power Supplies (UPS):

1. Provide a UPS in the control panel to power the equipment in the panel. The UPS shall provide lightning and surge protection, spike attenuation, galvanic isolation, noise isolation, and a regulated 120 volt, 1-phase power supply. The power output shall be continuous with no interruptions.
2. The UPS shall be sized by the System Supplier based on the maximum power requirements of the control panel and for a minimum run time of 10 minutes. The UPS shall be furnished with two (2) alarm contacts to indicate when the UPS is operating on battery power and when the UPS battery needs replaced.
3. The UPS shall be APC Smart-UPS, or approved equal.

F. 24 Volt DC Power Supplies:

1. 24 volt DC power supplies shall be mounted in the control panel to supply 24 volt DC power for the analog output modules, Ethernet switches, and for the 2-wire instrumentation.
2. The power supplies shall be wired in parallel with a redundancy module. The power supplies shall be sized as required for the load being powered.
3. Each power supply shall be furnished with a normally open contact that closes when the power supply is operating and the DC power is ok. This contact shall be wired to the PLC System.
4. The 24 volt DC power supplies shall be Phoenix Contact Quint4 with a Quint-Oring redundancy module, or approved equal.

G. Selector Switches:

1. Selector switches shall be 30.5mm, heavy-duty, non-illuminated. Switches shall have double-break silver contacts. Switches shall be maintained contact type unless otherwise indicated on the Drawings. Provide auxiliary contact blocks on switches where indicated on the Drawings or in the Description of Operation.
2. Provide a black legend plate for each switch with white engraving as indicated on the Drawings.
3. Selector switches shall be Allen-Bradley Bulletin 800H, NEMA Type 4X, or equal by Square D, or approved equal.

H. Push Buttons:

1. Push buttons shall be 30.5mm, heavy-duty, non-illuminated. Push buttons shall have double-break silver contacts. Push buttons shall be momentary contact type and shall be color-coded as indicated on the Drawings. Stop push buttons shall have extended heads. All other push buttons shall have flush heads.
2. Provide a black legend plate for each push button with white engraving as indicated on the Drawings.
3. Push buttons shall be Allen-Bradley Bulletin 800H, NEMA Type 4X, bootless type, or equal by Square D, or approved equal.

I. Pilot Lights:

1. Pilot lights shall be 30.5mm, heavy-duty, push to test, transformer type with LED lamps. Voltage rating shall be 120 volts. Lens color shall be as indicated on the Drawings.
2. Provide a black legend plate for each pilot light with white engraving as indicated on the Drawings.
3. Pilot lights shall be Allen-Bradley Bulletin 800H, NEMA Type 4X, or equal by Square D, or approved equal.

J. Relays:

1. Relays shall be heavy-duty general-purpose type with 10 amp contacts. Relays shall have terminals, which plug-in to a socket, mounted to the inside of the panel enclosure. Terminals for relays shall be pin type. Contact configuration shall be 3PDT.

2. Relay coils shall operate on 120 volts AC, or 24vdc as indicated on the Drawings. Relays shall have an indicator light to indicate the relay coil is energized. Relays shall be Eaton #D7PF2AA (120VAC) and #D7PF2AT1 (24vdc). Provide relays with additional poles where required to provide the number of contacts indicated on the Drawings.
- K. TVSS Devices for Analog Signal Wiring:
1. Provide a transient voltage surge suppressor (TVSS) on all analog signal wiring that originates from outside of the pump station to protect the analog signal wiring from surges and transient voltages. The TVSS device shall have of a pluggable surge protection module, and shall be furnished with a status indicator for visual indication that the unit is functioning.
 2. The TVSS devices shall be Phoenix Contact PLUGTRAB PT for analog signal wiring, or approved equal.
- L. Intrinsically Safe Barriers:
1. Provide intrinsically safe barriers for analog signal wiring originating from a Class 1, Division 1, Group D area. The intrinsically safe barriers shall be furnished with surge protection.
 2. The intrinsically safe barriers shall be Pepperl+Fuchs, or approved equal.
- M. Fuses:
1. All fuses shall be sized as required for the circuit they are protecting. Fuses shall be Bussmann, touch-safe type, or approved equal.
- N. Terminal Blocks:
1. Terminal blocks shall be provided in the control panel for terminating field wiring. All terminal blocks shall be single level type, rated for 600 volts AC.
 2. Terminal blocks shall be identified with a permanent machine printed marking in accordance with the terminal numbers shown on the panel wiring diagrams.
 3. Terminal blocks for 24vdc inputs shall be blue.
 4. Provide 20% spare terminal blocks in each control panel.
 5. Terminal blocks shall be Phoenix Contact, or approved equal.

O. Wiring:

1. All wiring shall be stranded copper. Control wiring shall be 16 gauge, 600 volt, Type MTW. Power wiring shall be 600 volt, Type MTW, sized as required.
2. All analog signal wiring shall be 18 gauge twisted shielded pairs with foil shield and drain wire, with 300 volt, 90°C insulation. Drain wires shall be grounded at one end only.
3. All wiring and terminal strips shall be isolated by voltage levels to the greatest extent possible.
4. All wiring shall conform to the following color code:
 - a) 120 volt, 1 phase: Black, White
 - b) 24 vdc: Blue
 - c) 120 VAC Control Wires: Red
 - d) Intrinsically Safe Wiring: Purple
 - e) Ground Wires: Green
5. 120 VAC control wires energized from a source external to the control panel power source shall be yellow.
6. All control wiring shall be tagged at each end with a legible permanent coded wire-marking sleeve. Sleeves shall be white PVC tubing with machine printed black marking. Markings shall be in accordance with the wire numbers shown on the control wiring diagrams, and shall match terminal strip numbers.

P. Nameplates:

1. Provide laminated phenolic nameplates on the front of each control panel. Nameplates shall be black with white engraved letters. Engraving shall be as indicated on the Drawings. Minimum size of engraving shall be 1/4".

2.02 SPARE PARTS

A. Provide the following spare parts for the control panels:

1. One (1) 24 volt DC power supply for each size utilized
2. Two (2) general purpose relays for each type utilized
3. One (1) surge protection device
4. One (1) TVSS device for analog signal wiring

5. Six (6) fuses for each type and size utilized
- B. Spare parts shall be packaged individually in boxes that are clearly labeled with part name and manufacturer's part/stock number.

PART 3 - EXECUTION

3.01 FIELD SERVICES

- A. Start-up and Testing:
1. Test the operation of each control panel and all controls.
 2. Start-up each control panel and place the control panel into operation.
 3. All start-up and testing shall be performed in the presence of the Owner and the Engineer.

END OF SECTION

SECTION 17300
INSTRUMENTATION

PART 1 - GENERAL

1.01 DESCRIPTION

A. Work Included:

1. Furnish and install instrumentation and provide services as specified herein or as indicated on the Drawings. Instrumentation shall be provided by the Pump Control System Supplier.

1.02 QUALITY ASSURANCE

A. Regulations and Standards:

ANSI	American National Standards Institute
IEEE	Institute of Electrical and Electronic Engineers
ISA	International Society of Automation
NEC	National Electrical Code
NEMA	National Electrical Manufacturers Association
UL	Underwriters' Laboratories

- B.** All instrumentation equipment supplied shall be of the most current 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 equipment. The equipment provided by the System Supplier shall be compatible with the functions required for the Process Control System.
- C.** All necessary fuses and cables required for instrumentation equipment shall be provided with the equipment.

1.03 SUBMITTALS

A. Shop Drawings:

1. Submit shop drawings on all instrumentation in accordance with the requirements of Section 17010. Shop drawings shall be complete in all respects and shall indicate all dimensions, installation methods, size, weight, capacity, ratings, integral controls and types of materials, elevations, and sections. Submittals shall include a complete bill of material, catalog information, descriptive literature of all components and wiring diagrams.

PART 2 - PRODUCTS

2.01 INSTRUMENTATION

A. Submersible Level Transducer:

1. The wet well submersible level transducer shall be an industrial submersible pressure transducer, submerged in the wet well to sense the sewage level in the wet well. The transducer shall be furnished with an integral signal cable with a molded cable seal.
2. The transducer shall have a weatherproof housing constructed of 316 stainless steel. The transducer shall have a 2.75" sensing area and an integral diaphragm protector.
3. The transducer shall be designed for installation in a Class 1, Division 1, Groups C and D hazardous location.
4. The transducer cable shall be a polyethylene jacketed shielded cable. Length of cable shall be as required for transducer installation. Provide a stainless steel cable hanger to support the cable.
5. The pressure transducer shall be a 2-wire device with dc power being provided from the Pump Station Control Panel. The transducer shall output a 4-20mA dc signal, which is proportional to the wet well level.
6. The level transducer shall be factory calibrated for the range indicated on the schedule below. Provide an aneroid bellows for the transducer.
7. The transducer shall operate in a temperature range of -20°C to +60°C.
8. The accuracy shall be $\pm 0.25\%$ of the full-scale range.
9. The transducer shall be furnished with lightning protection at the transducer and in the Pump Station Control Panel.
10. The wet well level transducer shall be KPSI Series 750, or approved equal.

SCHEDULE OF SUBMERSIBLE LEVEL TRANSDUCERS

<u>Range</u>	<u>Location</u>	<u>Service</u>
0-12 Feet	Wet Well	Wet Well Level

B. Magnetic Flow Meter:

1. Magnetic flow meter shall be of the low frequency and short form characterized coil design. The characterized field principle of electro-magnetic induction shall produce a positive DC pulsed signal directly and linearly proportional to the flow rate.
2. The metering tube shall be constructed of Type 304 stainless steel. The meter body shall be carbon steel. The flow meter shall have a flanged body to fit between ANSI Class 150 pipe flanges. The flow meter shall have a polyurethane liner and Type 316 stainless steel electrodes. Liners and electrodes shall be suitable for potable water. Provide all required mounting hardware, stainless steel grounding rings and grounding straps for the installation of the magnetic flow meter.
3. The coils, which generate the field, shall be inside the pipe wall and shall be encapsulated in epoxy resin and encased behind the meter lining material. The ratio of flow velocity to reference voltage signals generated shall be compatible with the readout instrument without the necessity of circuit modifications. The meter shall have an average power consumption of 60 watts. Accuracy of the meter shall be $\pm 0.5\%$ of rate.
4. The meter housing shall be splash-proof and weather resistant design. The meter shall be capable of accidental submergence in up to 30 feet of water for up to 48 hours without damage to the electronics.
5. Complete zero stability shall be inherent characteristic of the meter system. This shall eliminate the requirement for valving downstream of the meter for creating a full pipe zero flow condition for calibration purposes. Meter systems requiring field zero adjustment will not be acceptable.
6. The magnetic flow meters shall be factory calibrated on an approved test stand with certified accuracy traceable to NIST, compliant with the ISO 17025 standard, and third party accreditation by a national verification agency such as A2LA. Calibration curves shall be submitted for each flow meter for 3 points within the specified flow range.
7. The flow meter shall have a remote mounted microprocessor based, NEMA 4X flow transmitter. The flow transmitter shall have an LCD display to indicate the flow rate. The transmitter shall convert the meter's DC pulsed signal to a linear 4-20mA dc signal which is proportional to the flow rate.
8. The flow transmitter shall operate on a 120 volt AC, 60 Hz power source and shall have RFI protection. Provide signal cable to connect the flow transmitter to the flow meter. Length of cable shall be as required for the installation (See Electrical Drawings).

9. The Magnetic Flow Meter shall be Endress & Hauser Proline Promag W400, or approved equal.

SCHEDULE OF MAGNETIC FLOW METERS

<u>Size</u>	<u>Flow Range</u>	<u>Location</u>	<u>Service</u>
14"	0 – 4,000 GPM	Flow Meter Vault	Pump Station Discharge Flow

C. Float Switches:

1. Each float switch shall consist of a single pole, weighted, mercury switch in a smooth chemical resistant polypropylene casing with integral 2-wire cable. The float switch shall be permanently molded to the signal cable at the factory.
2. Float switch cable shall be 2/C #18 AWG. Length of cable shall be as indicated on schedule below.
3. The wet well float switches shall be normally open, and the flooding float switches shall be normally closed. The float switches shall actuate 1" above and below horizontal.
4. Float switch contacts for the wet well float switches shall operate with an intrinsically safe relay. Float switch contacts for the flooding float switches shall operate on 24vdc power.
5. Provide a 316 stainless steel mounting bracket with rubber grommet for each float switch.
6. The float switches shall be Anchor Scientific Roto-Float, Conery, or approved equal.

SCHEDULE OF FLOAT SWITCHES

<u>Qty.</u>	<u>Type</u>	<u>Cable Length</u>	<u>Mounting Bracket</u>	<u>Service</u>
1	S	30 feet	WMS	Wet Well High Level
1	S	30 feet	WMS	Wet Well Lead Pump Start
1	S	30 feet	WMS	Wet Well Lag Pump Start

1	S	30 feet	WMS	Wet Well Pump Off
1	S	30 feet	WMS	Wet Well Low Level
1	S	20 feet	WMS	Pump Room Flooding
1	S	20 feet	WMS	Pump Station Flow Meter Vault Flooding

D. Magnetic Door Switches:

1. Door switches shall consist of an industrial wide gap surface mounted SPDT magnetic contact switch. The contact shall be a hermetically sealed reed switch in ABS plastic case with matching actuating magnet.
2. The door switch contact shall be closed when the door is closed and shall open when the door is opened.
3. See Electrical Drawings for locations of the door switches.
4. The door switches shall operate on 24 volts DC, and shall be Sentrol Model No. 1045, or approved equal.

E. Automatic Telephone Dialer:

1. The automatic telephone dialer shall be a 16-channel, solid state electronic, field programmable type with 6 hour 12vdc battery back-up.
2. Unit shall be programmable to dial up to nine 10-digit telephone numbers and shall be capable of dialing either local or long-distance calls.
3. Unit shall operate properly throughout a temperature range of 20°F to 130°F with a relative humidity of 0% to 95%.
4. Power requirements shall be 120 volt, 1 phase.
5. Unit shall operate over a standard private telephone line furnished by the telephone company.
6. Capacity for monitoring up to 16 different alarm conditions shall be furnished. Alarms shall be transmitted separately using code numbers in conjunction with the station identification. When any of the eight alarm conditions exist at the station, the dialer shall automatically call the programmed telephone numbers continuously until one of the numbers

answers. At that time, the dialer, through computer type synthesized voice, shall deliver a message indicating location of alarm and which alarm code number exists. After the answering party has received the dialer's message, they shall be required to dial specific code numbers on the receiving telephone to acknowledge the alarm condition. After acknowledgment, the dialer shall automatically go into a delay mode (field programmable from 1 to 99 hours) to allow time for the alarm condition to be corrected. If the alarm condition has not been corrected (or disabled using the selector switch provided on the alarm panel), the automatic dialer shall start the dialing sequence again. If a different alarm condition occurs during the delay mode, the dialer shall ignore the delay set point and automatically dial the programmed numbers and communicate the new alarm condition. After acknowledgment, the same sequence may be repeated for up to a total of eight different alarm conditions.

7. Dialer shall be capable of being interrogated at any time by calling the dialer from any location. When interrogated, the unit shall inform the caller of any and all existing alarm conditions or give a "normal" or "station clear" announcement.
8. Alarm messages shall be repeated six times when dialer's call is answered and repeated three times when dialer is interrogated.
9. Unit shall be field or factory programmed with voice vocabulary to announce the location of and description of the alarm condition.
10. All alarms interfaced with automatic dialer shall be able to be manually disabled, with the exception of "power failure". A "power failure" alarm will start the automatic dialing sequence every time it occurs and must be acknowledged each time.
11. Unit shall be furnished with a delayed fault recognition feature to eliminate false alarms due to slow response times of valves, etc. Time delay shall be adjustable from 0-60 seconds.
12. Unit shall be furnished with a fault "lock-in" feature that continues the calling sequence until the fault is acknowledged, even if fault clears itself before call sequence is answered.
13. The dialer shall be furnished with a surge suppressor for the AC power and telephone lines.
14. The automatic telephone dialer shall be RACO Verbatim, Cattron, or approved equal.

2.02 INSTRUMENT NAMEPLATES

- A. Provide a laminated phenolic nameplate for each instrument. The nameplates shall be black with white engraved letters, and they shall be mounted on the front of each instrument or instrument enclosure, or where applicable attached to the instrument with a plastic wire tie. An instrument nameplate schedule shall be submitted to the Engineer for approval prior to performing any engraving.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install the instrumentation in accordance with the manufacturer's instructions.
- B. Issue an installation certificate to the Owner and the Engineer for each instrument certifying that the instrument has been installed in accordance with the manufacturer's recommendations.

3.02 CALIBRATION

- A. Calibrate all instrumentation provided. All calibration shall be performed in the presence of the Owner and the Engineer. The calibration of each instrument shall be performed after the instrument installation certificate has been issued.
- B. Provide a calibration certificate to the Owner and the Engineer for each instrument certifying that the instrument has been calibrated and is ready to be placed into service. The calibration certificate shall indicate the calibrated range or setpoint for each instrument.

3.03 TRAINING

- A. Provide four (4) hours of training for the Owner on the instrumentation provided. Training shall include theory of operation, maintenance requirements, calibration methods and function of instrument in the Pump Control System.

END OF SECTION

SECTION 17400

PROGRAMMABLE CONTROLLER SYSTEM

PART 1 - GENERAL

1.01 DESCRIPTION

A. Work Included:

1. Furnish all labor and materials required for a complete programmable controller system consisting of a programmable controller, I/O modules, operator interface terminal, industrial Ethernet switch, power supplies, power and communication cables, software packages, and all other associated equipment as specified herein and as indicated on the Drawings.

B. System Configuration:

1. The system shall be configured as shown on the Pump Control System Drawings and as described in the Description of Operation.

1.02 QUALITY ASSURANCE

A. Regulations, Standards and Publications:

ANSI	American National Standards Institute
IEEE	Institute of Electrical and Electronic Engineers
NEC	National Electrical Code
NEMA	National Electrical Manufacturers Association

B. Quality Control:

1. All equipment and software supplied shall be of the most current and proven design. The Specifications and Drawings call attention to certain features but do not purport to cover all details entering into the design of the programmable controller system. The completed system and the equipment provided shall be compatible with the functions required and shall be a complete working system.

C. Manufacturer:

1. For continuity with the existing PLC system, the programmable controller system shall be manufactured by Allen-Bradley. All model numbers shown on the Drawings are Allen-Bradley numbers.

1.03 SUBMITTALS

A. Shop Drawings:

1. Submit shop drawings on each of the items listed below in accordance with the requirements of Section 17010. Shop drawings shall be complete in all respects, and shall include a complete bill of material, catalog information, descriptive literature of all components, and applicable wiring diagrams.
 - a. Programmable Controller
 - b. Input and Output Modules
 - c. Operator Interface Terminals
 - d. Ethernet Switches
 - e. Power and Communication Cables
 - f. Programming Software

1.04 MEETINGS

A. Initial Coordination Meeting:

1. The System Supplier shall attend and participate in an initial meeting with the Engineer and the Owner to discuss the PLC control logic, and the layout, color conventions, and control strategies for the operator interface screens.

B. Operator Interface Review Meetings:

1. The System Supplier shall attend and participate in one (1) review meeting with the Owner and the Engineer to review the operator interface graphic screens.

PART 2 - PRODUCTS

2.01 SYSTEM HARDWARE

A. Programmable Controller:

1. Provide an Allen-Bradley CompactLogix 5069-L330ER programmable controller in the Control Panel as indicated on the Drawings. The programmable controller shall be mounted with input and output (I/O) modules as indicated on the Drawings.
2. The programmable controller shall be furnished with an Allen-Bradley flash memory card. The PLC program shall be stored on the flash memory card.

B. Operator Interface Terminal:

1. An operator interface terminal shall be flush mounted in the Pump Station Control Panel to display process values, alarm messages and graphic displays, and to provide an interface for the operator to change process setpoints.
2. The operator interface shall have a TFT color touch screen with a NEMA 4X rating. Size shall be as indicated on the Drawings.
3. The operator interface shall be networked to the programmable controller via Ethernet. The operator interface shall be furnished with enough memory to meet the requirements of the Description of Operation plus 20 percent spare memory.
4. The operator interface shall operate on 24 vdc power.
5. The operator interface terminals shall be Allen-Bradley PanelView Plus 7 Performance Model.
6. The operator interface terminal shall be furnished with Factory Talk View Studio for Machine Edition and RSLinx software.

C. Ethernet Switch:

1. Provide a managed industrial Ethernet switch in the Pump Station Control Panel to network the PLC and operator interface terminal.
2. The Ethernet switch shall be furnished with the number of copper ports required for the system. Provide a minimum of two (2) spare copper ports on the switch.
3. The Ethernet switch shall be a stand-alone unit operating on 24vdc power.
4. The Ethernet switch shall be Stratix, N-tron, Moxa, or approved equal.

2.02 COMMUNICATIONS CABLES

A. Ethernet Cable:

1. Provide Cat 6 Ethernet cable to network the PLC and the operator interface terminal as shown on the Drawings. The System Supplier shall furnish all cables required for the Ethernet network. The Ethernet cables shall be blue.

2.03 PROGRAMMING SOFTWARE

- A. Programmable Controller Programming and Documentation Software:
 - 1. Provide a windows-based programming and documentation software package for programming the Allen-Bradley programmable controllers using a personal computer as a programming terminal. This software package shall be used to program the programmable controllers.
 - 2. The programming and documentation software shall be latest version of Rockwell Software RSLogix 5000, Professional Edition.
 - 3. The programming software, and all licenses, shall be turned over to the Owner at the completion of the project.

- B. Operator Interface Terminal Programming Software:
 - 1. Provide a Windows based programming and development software package to program the operator interface terminals using a personal computer. This software package shall be used to program the operator interface terminal.
 - 2. The programming and development software shall be the latest version of RSView Studio for Machine Edition.
 - 3. The programming software, and all licenses, shall be turned over to the Owner at the completion of the project.

2.04 SPARE PARTS

- A. Provide the following spare parts for the programmable controller system:
 - 1. One (1) CompactLogix Programmable Controller
 - 2. One (1) 24vdc Input Modules
 - 3. One (1) 24vdc Output Modules
 - 4. One (1) Analog Input Module
 - 5. One (1) Analog Output Module
 - 6. Six (6) fuses for each type and size utilized

- B. Spare parts shall be packaged individually in boxes that are clearly labeled with part name and manufacturer's part/stock number.

PART 3 - EXECUTION

3.01 SOFTWARE PROGRAMMING

A. PLC Programming:

1. Program the PLC to meet the requirements of the Description of Operation.
2. All programming shall be annotated and documented with rung numbers, descriptive comments and I/O identification comments. The beginning of each major sub-system shall be identified in the PLC program.
3. A copy of the PLC program shall be furnished to the Owner on CD, and on a hard copy print-out.

B. Operator Interface Programming:

1. General:

- a. Program the operator interface terminal to meet the requirements of the Description of Operation. All programming and graphic screen development shall be performed as required for a complete and operational system.

2. Graphic Displays:

- a. Dynamic graphic displays shall be programmed in the operator interface for the process equipment and its associated control strategies. The graphic displays shall be interactive with live data from the programmable controller.
- b. The graphic displays shall include all digital and analog points being monitored by the PLC system.
- c. The graphic displays shall indicate the auto/manual status, run status and alarms for all system equipment.
- d. The graphic displays shall allow the operator to set and adjust all process setpoints, and timer settings for control of the system equipment.
- e. The configuration of each graphic screen shall be reviewed with and approved by the Owner and the Engineer.

3. Alarms:
 - a. All alarms for the system shall be displayed on the alarm display screen on the operator interface.
4. Monitoring of Process Variables:
 - a. All process variables being monitored by the system shall be displayed by the operator interface.

3.02 TESTING

A. Field Testing:

1. Test the operation of each PLC I/O point after the PLC System is installed.
2. Analog points shall be tested using a signal generator. Each point shall be tested at 0, 25, 50, 75 and 100% of its full scale range.
3. Test the operation of each graphic screen programmed in the operator interface terminals to verify the digital and analog points display correctly on the screen.
4. Test all control strategies to verify that they function correctly.
5. Test all alarms in the system to verify that they display correctly.
6. All testing shall be conducted in the presence of, and to the satisfaction of, the Owner and the Engineer.

3.03 TRAINING

A. On-Site Training:

1. Provide four (4) hours of training for the Owner on the operation of the PLC System and the operator interface terminal.

END OF SECTION

SECTION 17500

DESCRIPTION OF OPERATION

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SECTION 17500

DESCRIPTION OF OPERATION

A. PUMP CONTROL SYSTEM CONFIGURATION

1. General Description

- a. A new Pump Control System consisting of a motor control center, variable frequency drives, control panels, instrumentation and a programmable controller system will be provided for the new Creamery Road Pump Station.

2. Motor Control Center

- a. A motor control center will be provided for the pump station to house the pump station main breaker, an automatic transfer switch, circuit breakers and motor starters for the pump station equipment. This motor control center will be designated as MCC-C.

3. Variable Frequency Drives

- a. Variable frequency drives (VFDs) will be provided in MCC-C for the three (3) Sewage Pumps.

4. Pump Station Control Panel

- a. A Pump Station Control Panel will be provided in the Pump Station Electrical Room to house a programmable controller, an operator interface and other associated controls for the pump station equipment.
- b. An Allen-Bradley ControlLogix PLC will be provided in the Pump Station Control Panel for automatic control and monitoring of the sewage pump and other pump station equipment. The programmable controller will be designated as PLC-C:

5. Operator Interface Terminals

- a. A 12" Allen-Bradley PanelView Plus 7 color touch screen operator interface terminal will be provided on the Pump Station Control Panel. The operator interface will be networked to the PLC via Ethernet.
- b. The operator interface terminals shall be programmed to perform the following functions:
 - (1) Display Graphic Screens of the Pump Station
 - (2) Display Setpoint Screens
 - (3) Display Process Variables

- (4) Display Alarm Messages
 - (5) Trend Wet Well Levels
 - (6) Trend Pump Station Flows
- c. Rockwell Software Factory Talk View Studio for Machine Edition software will be installed on each operator interface.

6. Programmable Controller Software

- a. Programmable controller programming and documentation software will be provided to enable a personal computer to be utilized to view, edit, program, document and print the logic program contained in the memory of the programmable controller.

B. INFLUENT GRINDER

1. General Description

- a. An influent grinder will be provided in the pump station wet well influent channel to grind up material in the influent sewage. The influent grinder will consist of a screen assembly, hydraulic unit with motor and a grinder with hydraulic torque motor.
- b. The hydraulic unit will be located on the wet well slab. A disconnect switch will be backboard mounted adjacent to the hydraulic unit to disconnect power to the hydraulic unit motor.

2. Influent Grinder Control Panel

- a. An influent grinder control panel will be provided for the influent grinder. The control panel will be wall mounted in the Electrical Room of the pump station. The control panel will power and control the influent grinder and will house the following:
 - (1) Main Disconnect Switch
 - (2) Motor Starter
 - (3) Control Transformer
 - (4) Off/On Selector Switch
 - (5) Run Indication Light
 - (6) Overload Alarm Light
 - (7) Solid State Controls
- b. The influent grinder off/on switch will have an auxiliary normally open contact that will close when the switch is placed in the "on" position. This contact will be wired to PLC-C.
- c. The influent grinder motor starter will have two auxiliary contacts that will close when the motor starter is energized. One contact will be wired to the run indication light on the grinder control panel, and the other contact will be wired to PLC-C for run status monitoring by the programmable controller.

3. Programmable Controller PLC-C Inputs

- a. Digital Inputs (24 vdc):

<u>Description</u>	<u>Origination Point</u>
(1) Influent Grinder Off/On Switch "On" Position	Off/On Switch on Influent Grinder Control Panel

- | | |
|------------------------------------|--|
| (2) Influent Grinder
Run Status | Motor Starter in
Influent Grinder
Control Panel |
| (3) Influent Grinder
Overload | Overload Contact in
Influent Grinder
Control Panel |

4. Description of Operation

- a. The influent grinder will be manually controlled by the off/on selector switch located on the grinder control panel. The influent grinder will normally run continuously.
- b. PLC-C will provide failure monitoring for the influent grinder as follows:
 - (1) When the influent grinder off/on switch is placed in the "on" position, a failure timer in the programmable controller will be started. If this timer times out and the influent grinder motor starter is not energized, an "Influent Grinder Failure" alarm message shall be displayed on the operator interface located on the Pump Station Control Panel.
- c. The influent grinder control panel will be furnished with solid-state controls to sense an overload condition. If an overload condition caused by a jam occurs, the grinder cutters will reverse their rotation in an attempt to free the jam. If the jam cannot be freed after several reverses, the influent grinder will shut down and an overload alarm circuit will be activated. When this occurs, an overload alarm light on the influent grinder control panel will be lit and an overload alarm contact in the panel will close. This contact will be wired to PLC-C. If an overload occurs, an "Influent Grinder Overload" alarm message shall be displayed on the operator interface.

5. Influent Grinder Alarms

- a. The following alarms for the Influent Grinder shall be displayed on the operator interface located on the Pump Station Control Panel:
 - (1) Influent Grinder Failure
 - (2) Influent Grinder Overload
- b. The influent grinder alarms shall be paralleled in PLC-C to a common alarm output. Whenever an influent grinder alarm occurs, PLC-C will energize an "Influent Grinder Alarm" relay in the Pump Station Control Panel. A normally open contact on this relay will be wired to the automatic telephone dialer for notification of an Influent Grinder alarm.

C. SEWAGE PUMPS

1. General Description

- a. Three dry-pit centrifugal sewage pumps will be installed in the pump station to pump the sewage from the wet well to the Town of Emmitsburg WWTP. The three pumps operate in the lead/first lag/second lag mode.
- b. An AC variable frequency drive (VFD) will be provided for each sewage pump to vary the pump discharge rate. The VFDs will be located in MCC-C.
- c. A submersible level transducer will be installed in the wet well to sense the sewage level in the wet well and provide for automatic control of the pumps. The level transducer will output a 4-20mA analog signal proportional to the wet well level to PLC-C for level monitoring by the programmable controller.
- d. Five float switches will be mounted in the wet well for back-up control of the sewage pumps should the transducer fail, or a PLC failure occurs, and for alarm indication. Each float switch will be wired to an intrinsically safe relay located in the Pump Station Control Panel. The float switches will be designated as follows:
 - (1) Wet Well Low Level
 - (2) Pump Off
 - (3) Lead Pump Start
 - (4) Lag Pump Start
 - (5) Wet Well High Level

2. Sewage Pump Motor Controls

- a. A variable frequency drive will be provided for each of the three sewage pumps. Each drive enclosure will house the following:
 - (1) Main Disconnect Switch
 - (2) Line Reactors
 - (3) Variable Frequency Drive
 - (4) Control Transformer
 - (5) H/O/A Selector Switch
 - (6) VFD Run Relay and Indication Light
 - (7) VFD Fault Relay and Alarm Light
 - (8) VFD Fault Reset Push Button
 - (9) Motor High Temp Relay and Alarm Light
 - (10) Elapsed Time Meter
- b. Each variable frequency drive (VFD) will incorporate the following:
 - (1) Diode Rectifier to Convert the AC input Voltage to a Fixed DC Voltage.

- (2) Transistorized Inverter to Invert the Fixed DC Voltage into a Sine Coded Pulse Width Modulated Output to the Pump Motor.
 - (3) Control Logic Boards to Control and Monitor Electronic Functions within the VFD.
 - (4) VFD Keypad Module Mounted on VFD Enclosure.
- c. Each pump H/O/A switch will have two auxiliary normally open contacts that will close when the switch is placed in the "auto" position. One contact will be wired to PLC-C and the other contact will be wired to the drive for selecting automatic speed control.
 - d. Each variable frequency drive will have a run contact that will close when the drive is energized and outputting a frequency to the pump motor. This contact will be wired to a run indication light and a run relay located in the VFD enclosure. The run relay will have three normally open contacts that will close when the relay is energized. One contact will be wired to the elapsed time meter located on the VFD, one will be wired to the VFD ventilation fan, and the other contact will be wired to PLC-C for run status monitoring by the programmable controller.
 - e. Each variable frequency drive will have a VFD fault contact that closes when a drive fault occurs. This contact is wired to a VFD fault relay in the VFD enclosure and to a VFD fault alarm light on the enclosure. The VFD fault relay will have a normally open contact that will close when the relay is energized. This contact will be wired to PLC-C for VFD fault alarm monitoring by the programmable controller.
 - f. Each variable frequency drive will output a 4-20mA analog speed signal proportional to the drive speed to PLC-C. The speed of each sewage pump shall be displayed on the operator interface located on the Pump Station Control Panel.
 - g. An emergency stop push button will be mounted adjacent to each pump to disconnect power to the pump control circuit. The emergency stop buttons will be wired in series with the VFD pump control circuit so that when the emergency stop button is pushed in, power to the VFD control circuit will be removed.

3. Programmable Controller PLC-C Inputs and Outputs

- a. The programmable controller inputs and outputs for the Sewage Pumps will be wired to and from PLC-C located in the Pump Station Control Panel.

b. Digital Inputs (24vdc):

	<u>Description</u>	<u>Origination Point</u>
(1)	Sewage Pump No. 1 H/O/A Switch "Auto" Position	H/O/A Switch on Pump VFD
(2)	Sewage Pump No. 1 Running	VFD Run Relay in Pump VFD
(3)	Sewage Pump No. 1 VFD Fault	VFD Fault Relay in Pump VFD
(4)	Sewage Pump No. 1 Motor High Temp	Motor High Temp Relay in Pump VFD
(5)	Sewage Pump No. 1 Casing High Temp	Thermal Switch on Pump Casing
(6)	Sewage Pump No. 2 H/O/A Switch "Auto" Position	H/O/A Switch on Pump VFD
(7)	Sewage Pump No. 2 Running	VFD Run Relay in Pump VFD
(8)	Sewage Pump No. 2 VFD Fault	VFD Fault Relay in Pump VFD
(9)	Sewage Pump No. 2 Motor High Temp	Motor High Temp Relay in Pump VFD
(10)	Sewage Pump No. 2 Casing High Temp	Thermal Switch on Pump Casing
(11)	Sewage Pump No. 3 H/O/A Switch "Auto" Position	H/O/A Switch on Pump VFD
(12)	Sewage Pump No. 3 Running	VFD Run Relay in Pump VFD
(13)	Sewage Pump No. 3 VFD Fault	VFD Fault Relay in Pump VFD

- | | |
|--|--|
| (14) Sewage Pump No. 3
Motor High Temp | Motor High Temp Relay
in Pump VFD |
| (15) Sewage Pump No. 3
Casing High Temp | Thermal Switch on
Pump Casing |
| (16) Wet Well Low Level
Float | Intrinsically Safe Relay
in Pump Station
Control Panel |
| (17) Sewage Pumps Off
Float | Intrinsically Safe Relay
in Pump Station
Control Panel |
| (18) Lead Sewage Pump Start
Float | Intrinsically Safe Relay
in Pump Station
Control Panel |
| (19) Lag Sewage Pump Start
Float | Intrinsically Safe Relay
in Pump Station
Control Panel |
| (20) Wet Well High Level
Float | Intrinsically Safe Relay
in Pump Station
Control Panel |

c. Digital Outputs (24vdc Relay):

<u>Description</u>	<u>Destination Point</u>
(1) Sewage Pump No. 1 Start/Stop	Pump Auto Start/Stop Relay in Pump Station Control Panel
(2) Sewage Pump No. 2 Start/Stop	Pump Auto Start/Stop Relay in Pump Station Control Panel
(3) Sewage Pump No. 3 Start/Stop	Pump Auto Start/Stop Relay in Pump Station Control Panel

d. Analog Inputs (4-20mA):

	<u>Description</u>	<u>Origination Point</u>
(1)	Wet Well Level	Submersible Level Transducer in Wet Well
(2)	Sewage Pump No. 1 Speed	Pump VFD
(3)	Sewage Pump No. 2 Speed	Pump VFD
(4)	Sewage Pump No. 3 Speed	Pump VFD

e. Analog Outputs (4-20mA):

	<u>Description</u>	<u>Destination Point</u>
(1)	Sewage Pump No. 1 Speed Reference	Pump VFD
(2)	Sewage Pump No. 2 Speed Reference	Pump VFD
(3)	Sewage Pump No. 3 Speed Reference	Pump VFD

4. Description of Operation

a. The three sewage pumps will be controlled by the individual H/O/A selector switches located on MCC-C. The "hand" and "off" positions of the H/O/A selector switches provide for manual start/stop control of the pumps. When a pump H/O/A switch is in the "hand" position, the pump speed may be manually controlled by the speed increment and decrement keys located on the VFD keypad. When the pump H/O/A switches are in the "auto" position, the sewage pumps will be automatically controlled by PLC-C in response to the pump station wet well level as follows:

- (1) Level setpoints will be programmed in PLC-C for the following wet well levels:
 - (a) Wet Well Low Level
 - (b) Lead Pump Stop
 - (c) First Lag Pump Stop

- (d) Second Lag Pump Stop
 - (e) Wet Well Level Setpoint
 - (f) Lead Pump Start
 - (g) First Lag Pump Start
 - (h) Second Lag Pump Start
 - (i) Wet Well High Level
- (2) The level setpoints shall be adjustable via the operator interface located on the Pump Station Control Panel.
- (3) A PID level controller will be configured in the programmable controller to control the sewage level in the wet well. The level controller will vary the speed of the sewage pumps as required to match the pump discharge flow rate to the pump station influent flow rate. The desired level to be maintained in the wet well will be programmed in PLC-C as the setpoint for the level controller. The level controller will compare the actual wet well level measured by the wet well level transducer to the setpoint level, and will output a speed reference signal to the pump VFDs to increase or decrease the speed of the pumps as required to maintain the setpoint level.
- (4) When the water level in the wet well rises to the elevation of the "lead pump start" level setpoint, PLC-C will start the lead sewage pump. When the lead pump is started, it will run with its speed being varied by the programmable controller to maintain the setpoint level in the wet well. As long as the pump station influent flow rate into the wet well is sufficient to maintain the water level in the wet well above the lead pump stop level, the lead pump will run continuously with its speed varied to match the pump discharge rate to the wet well influent flow rate as the influent flow rate varies from the minimum pumping rate to the maximum capacity of the lead pump. When the water level in the wet well is drawn down to the "lead pump stop" level setpoint, PLC-C will shut down the lead pump.
- (5) If the lead sewage pump cannot keep up with the pump station influent flow, the water level in the wet well will rise to the "first lag pump start" level setpoint. When this level is reached, a start delay timer in the programmable controller will be started. When this timer times out, PLC-C will start the first lag pump and will output equivalent speed reference signals to both the lead and first lag pumps so that both pumps match speeds. As long as the water level is above the first lag pump stop level, both pumps will run continuously with the speed of the lead and first lag pumps being varied by PLC-C as required to match the combined pump discharge rates to the pump station influent flow rate. When the water level in the wet well is pumped down to the "first lag pump stop" level setpoint, PLC-C will shut down the first lag pump.

- (6) If the lead and first lag sewage pumps cannot keep up with the pump station influent flow, the water level in the wet well will rise to the "second lag pump start" level setpoint. When this level is reached, a start delay timer in the programmable controller will be started. When this timer times out, PLC-C will start the second lag pump and will output equivalent speed reference signals to the lead, first lag, and second lag pumps so that all three pumps match speeds. As long as the water level is above the second lag pump stop level, all three pumps will run continuously with the speed of the lead, first lag, and second lag pumps being varied by PLC-C as required to match the combined pump discharge rates to the pump station influent flow rate. When the water level in the wet well is pumped down to the "second lag pump stop" level setpoint, PLC-C will shut down the second lag pump.
 - (7) The lead, first lag, and second lag sewage pumps will be assigned via the operator interface located on the Pump Station Control Panel. When "alternate" is selected, the programmable controller will alternate the lead/first lag/second lag status of the sewage pumps after an accumulated run time. The accumulated run time shall be an adjustable value that is entered by the operator via the operator interface.
- b. If the water level in the wet well is drawn down to the "wet well low level" setpoint, a timer in the programmable controller will be started. If this timer times out and the low level condition still exists, PLC-C will shut down the sewage pumps. When this occurs, a "Wet Well Low Level" alarm message shall be displayed on the operator interface.
 - c. If the sewage level in the wet well rises to the elevation of the "wet well high level" setpoint, a timer in the programmable controller will be started. If this timer times out and the high level condition still exists, a "Wet Well High Level" alarm message shall be displayed on the operator interface.
 - d. If an error is detected with the submersible level transducer signal, a "Level Transducer Failure, Pumps on Float Switch Control" alarm message shall be displayed on the operator interface. When this occurs, the PLC will automatically switch the wet well level control to the float switches. The float switches will remain in control until the alarm condition for the level transducer is corrected. The float switches and PLC-C will provide automatic start/stop control of the pumps as follows:
 - (1) The "pump off", "lead pump start", and "lag pump start" float switches will be wired to individual intrinsically safe relays located in the Pump Station Control Panel. These relays will each have a normally open contact that will be wired to the back-up relay logic in the control panel and a normally open contact that will be wired to PLC-C for pump control.
 - (2) When the sewage level in the wet well rises to the level of the "lead pump start" float switch, PLC-C will start the lead pump. When the lead pump is

started, it will continue to run until the sewage level in the wet well is drawn down to the level of the "pump off" float switch. When this occurs, PLC-C will shut down the lead pump.

- (3) If the sewage level in the wet well rises to the level of the "lag pump start" float switch, PLC-C will start the lag pump. When the lag pump is started, it will continue to run until the sewage level in the wet well is drawn down to the level of the "pump off" float switch. When this occurs, PLC-C will shut down the lag pump.
 - (4) When the pumps are operating under float switch control, PLC-C will output an adjustable speed reference signal to the pump VFD. This speed reference signal will be entered by the operator via the operator interface.
- e. The "wet well low level" float switch will be wired to an intrinsically safe relay located in the Pump Station Control Panel. This relay will have a normally open contact that will be wired to the back-up relay logic in the control panel and a normally open contact that will be wired to PLC-C for wet well low level monitoring. If the water level in the wet well is drawn down to the elevation of the low level float switch, the low level relay will be energized, and PLC-C will shut down the sewage pumps. When this occurs, a "Wet Well Low Level, Detected by Low Level Float" alarm message shall be displayed on the operator interface.
 - f. The "wet well high level" float switch will be wired to an intrinsically safe relay located in the Pump Station Control Panel. This relay will have one normally closed contact and one normally open contact. The normally closed contact will be wired to the automatic telephone dialer, and the normally open contact will be wired to PLC-C for wet well high level monitoring. If the water level in the wet well rises to the elevation of the high level float switch, the high level relay will be energized, and a "Wet Well High Level, Detected by High Level Float" alarm message shall be displayed on the operator interface.
 - g. Relays and timers will be provided in the Pump Station Control Panel to enable the sewage pumps to be controlled by the float switches if the programmable controller fails. This relay logic will serve as a back-up to the control logic programmed in the PLC and will be initiated as follows:
 - (1) A control relay will be wired to an output from the PLC so that it is always energized whenever the programmable controller is operating. A normally closed contact on this relay will be wired in series with the wet well float switch relay logic control of the sewage pumps. If the programmable controller system fails, the relay will be deenergized and the relay contact will close. When this occurs, the wet well float switches will provide automatic start/stop control of the pumps.

- h. PLC-C will provide failure monitoring for each sewage pump as follows:
 - (1) When a pump H/O/A switch is in the "auto" position and the pump gets a signal to start, a failure timer in the programmable controller will be started. If this timer times out and the pump VFD is not running, a "Sewage Pump Failure" alarm message shall be displayed on the operator interface.
 - i. A normally open drive fault contact is provided in each pump VFD. The VFD fault contact is wired to a VFD fault alarm light and a VFD fault relay in MCC-C. A normally open contact on the VFD fault relay will be wired to PLC-C. If a drive fault occurs, this contact will close and the pump VFD will shut down. When this occurs, a "Sewage Pump VFD Fault" alarm message shall be displayed on the operator interface.
 - j. Each sewage pump motor will be furnished with a normally closed thermal switch in the motor windings to detect a high motor temperature. The thermal switch will be wired to a motor high temp relay in the pump VFD. This relay has a normally open contact that is wired in series with the pump VFD. This relay will also have two normally closed contacts, one will be wired to a motor high temp alarm light on the VFD, and the other will be wired to PLC-C for motor high temp alarm monitoring by the PLC. When a high motor temperature occurs, the motor high temp relay will be de-energized, and the pump will shut down. When this occurs, a "Sewage Pump Motor High temp" alarm message will be displayed on the operator interface.
 - k. A high temperature switch will be provided on the casing for each sewage pump. If a high temperature occurs, a timer in PLC-C will be started. If this timer times out and the high temperature condition still exists, PLC-C will shut down the pump and a "Sewage Pump Casing High Temperature alarm message will be displayed on the operator interface.
 - l. If a sewage pump is taken out of "auto", or experiences a failure, VFD fault, motor high temperature, or casing high temperature, PLC-C will index the lead/first lag/second lag assignments of the three pumps so that this pump now becomes the second lag pump. The remaining two pumps will become the lead and first lag pumps. The pump that has become the second lag pump will be locked out of the pump sequence until it is placed back in "auto" or its alarm has been cleared.

5. Sewage Pump Alarms

- a. The following alarms for the Sewage Pumps shall be displayed on the Pump Station Control Panel operator interface:
 - (1) Sewage Pump No. 1 Failure
 - (2) Sewage Pump No. 1 VFD Fault
 - (3) Sewage Pump No. 1 Motor High Temperature
 - (4) Sewage Pump No. 1 Casing High Temperature

- (5) Sewage Pump No. 2 Failure
- (6) Sewage Pump No. 2 VFD Fault
- (7) Sewage Pump No. 2 Motor High Temperature
- (8) Sewage Pump No. 1 Casing High Temperature
- (9) Sewage Pump No. 3 Failure
- (10) Sewage Pump No. 3 VFD Fault
- (11) Sewage Pump No. 3 Motor High Temp
- (12) Sewage Pump No. 3 Casing High Temperature
- (13) Wet Well Low Level
- (14) Wet Well Low Level, Detected by Low Level Float
- (15) Wet Well High Level
- (16) Wet Well High Level, Detected by High Level Float
- (17) Level Transducer Failure, Pumps on Float Switch Control

- b. The Wet Well High Level, Detected by High Level Float alarm shall be output from PLC-C to the automatic telephone dialer for notification of a Wet Well High Level alarm.
- c. All other sewage pump alarms shall be paralleled in PLC-C to a common alarm output. Whenever a sewage pump alarm occurs, PLC-C will energize a "Sewage Pumps Common Alarm" relay in the Pump Station Control Panel. A normally open contact on this relay will be wired to the automatic telephone dialer for notification of a Sewage Pump alarm.

D. PUMP STATION FLOW METERING

1. General Description

- a. The sewage pumps will discharge to a common header, which is piped to the pump station force main.
- b. A 14" magnetic flow meter will be installed in the force main to meter the pump station discharge flow. The flow meter will be located outside the pump station in the Pump Station Discharge Flow Meter Vault.
- c. The magnetic flow meter will output a voltage signal proportional to the flow rate to a flow meter transmitter located in the Pump Station Electrical Room. The flow meter transmitter will convert the voltage signal to a 4-20mA analog signal proportional to the flow rate and will output this signal to PLC-C.
- d. The pump station flow shall be displayed on the operator interface located on the Pump Station Control Panel.
- e. The operator interface shall be programmed to trend, log and totalize the pump station flow.

2. Programmable Controller PLC-C Inputs

- a. Analog Inputs (4-20mA):

	<u>Description</u>	<u>Origination Point</u>
(1)	Pump Station Discharge Flow	Pump Station Discharge Flow Meter Transmitter

E. FLOODING SENSORS

1. General Description

- a. A flooding sensor consisting of a mercury float switch will be installed at each of the following locations to sense a flooding condition:

- (1) Pump Station Pump Room
- (2) Pump Station Discharge Flow Meter Vault

2. Programmable Controller PLC-C Inputs

- a. The flooding sensors will be wired to PLC-C located in the Pump Station Control Panel.
- b. Digital Inputs (24vdc):

	<u>Description</u>	<u>Origination Point</u>
(1)	Pump Room Flooding	Flooding Float Switch in Pump Room
(2)	Pump Station Discharge Flow Meter Vault Flooding	Flooding Float Switch in Meter Vault

3. Description of Operation

- a. If flooding occurs in the Pump Station Pump Room and water builds up on the floor to the elevation of the flooding float switch, a "Pump Station Pump Room Flooding" alarm message shall be displayed on the operator interface located on the Pump Station Control Panel.
- b. If flooding occurs in the Pump Station Discharge Flow Meter Vault and water builds up on the floor to the elevation of the flooding float switch, a "Pump Station Discharge Flow Meter Vault Flooding" alarm message shall be displayed on the operator interface.

4. Flooding Sensor Alarms

- a. The following alarms for the Flooding Sensors shall be displayed on the operator interface located on the Pump Station Control Panel:
- (1) Pump Station Pump Room Flooding
 - (2) Pump Station Discharge Flow Meter Vault Flooding

- b. Whenever a pump room flooding alarm occurs, PLC-C will energize a "Pump Station Pump Room Flooding Alarm" relay in the Pump Station Control Panel. A normally open contact on this relay will be wired to the automatic telephone dialer for notification of a Pump Room Flooding alarm.
- c. Whenever a meter vault flooding alarm occurs, PLC-C will energize a "Pump Station Discharge Flow Meter Vault Flooding Alarm" relay in the Pump Station Control Panel. A normally open contact on this relay will be wired to the automatic telephone dialer for notification of a Meter Vault Flooding alarm.

F. PUMP ROOM VENTILATION FANS

1. General Description

- a. A supply fan and an exhaust fan will be provided in the Pump Room of the pump station to provide ventilation for the room. The supply fan will be designated as Supply Fan SF-1, and the exhaust fan will be designated as Exhaust Fan EF-2.
- b. The supply fan will be installed in the duct work in the Pump Room to supply fresh air to the room. This fan will operate with Exhaust Fan EF-2, which will be wall mounted in the pump room. Supply Fan SF-1 and Exhaust Fan EF-2 will ventilate the pump station Pump Room.
- c. Supply Fan SF-1 will have an integral motor operated damper. The damper will be designated as M.O.D.-D1
- d. Exhaust Fan EF-2 will have an integral motor operated damper. The damper will be designated as M.O.D.-D2.

2. Supply Fan SF-1 Motor Controls

- a. Motor Control Center-C will house the following for Supply Fan SF-1:
 - (1) Motor Circuit Breaker
 - (2) Motor Starter
 - (3) Control Transformer
 - (4) H/O/A Selector Switch
 - (5) Start Relay
 - (6) M.O.D.-D1 Open Relay
 - (7) Run Indication Light
 - (8) Elapsed Time Meter
- b. The supply fan H/O/A selector switch will have an auxiliary normally open contact that will close when the switch is placed in the "auto" position. This contact will be wired to PLC-C for switch position monitoring by the PLC.
- c. The supply fan motor starter will have three auxiliary normally open contacts that will close when the motor starter is energized. One contact will be wired to the run indication light and elapsed time meter on MCC-C, one contact will be wired to the auto control circuit for Exhaust Fan EF-2, and the third contact will be wired to PLC-C for run status monitoring by the PLC.
- d. A disconnect switch will be mounted adjacent to the supply fan to disconnect power to the fan motor.

3. Exhaust Fan EF-2 Motor Controls

- a. Motor Control Center-C will house the following for Exhaust Fan EF-2:
 - (1) Motor Circuit Breaker
 - (2) Motor Starter
 - (3) Control Transformer
 - (4) H/O/A Selector Switch
 - (5) Start Relay
 - (6) M.O.D.-D2 Open Relay
 - (7) Run Indication Light
 - (8) Elapsed Time Meter
- b. The exhaust fan motor starter will have an auxiliary normally open contact that will close when the motor starter is energized. This contact will be wired to the run indication light and elapsed time meter on MCC-C.
- c. A disconnect switch will be mounted adjacent to the exhaust fan to disconnect power to the fan motor.

4. Programmable Controller PLC-C Inputs and Outputs

- a. The programmable controller inputs and outputs for the Pump Room Ventilation Fans will be wired to and from PLC-C located in the Pump Station Control Panel.
- b. Digital Inputs (24vdc):

	<u>Description</u>	<u>Origination Point</u>
(1)	Pump Room Supply Fan SF-1 H/O/A Switch "Auto" Position	H/O/A Switch on MCC-C
(2)	Pump Room Supply Fan SF-1 Running	Fan Motor Starter in MCC-C

- c. Digital Outputs (24vdc Relay):

	<u>Description</u>	<u>Destination Point</u>
(1)	Pump Room Supply Fan SF-1 Start/Stop	Fan Start/Stop Relay in Pump Station Control Panel

5. Description of Operation

- a. Supply Fan SF-1 will be controlled by the H/O/A selector switch located on MCC-C. The "hand" and "off" positions of the H/O/A switch provide for manual start/stop control of the fan. When the fan H/O/A switch is in the "auto" position, the fan will be controlled by a thermostat, manually controlled by the switch located at the top of the stairs to the pump room, or automatically controlled by PLC-C as follows:
 - (1) A graphic display shall be programmed in the operator interface located on the Pump Station Control Panel, and in the HMI software, for the Pump Room Ventilation Fans. The graphic display shall allow the operator to select either continuous or intermittent operation for Supply Fan SF-1.
 - (2) If continuous operation is selected, the ventilation fans will be controlled as follows:
 - (a) PLC-C will send a signal to start Supply Fan SF-1. When this occurs, the start relay will be energized. A normally open contact on the start relay will close, and M.O.D.-D1 will open. When the M.O.D. is fully open, an end of travel limit switch on the M.O.D. will close, and the M.O.D. open relay will be energized. When both the supply fan start relay and the M.O.D. open relay are energized, a normally open contact on each relay will close, and the supply fan will start.
 - (b) When the supply fan is started, Exhaust Fan EF-2 will receive a signal to start, the exhaust fan start relay will be energized. A normally open contact on the start relay will close, and M.O.D.-D2 will open. When the M.O.D. is fully open, an end of travel limit switch on the M.O.D. will close, and the M.O.D. open relay will be energized. When both the exhaust fan start relay and the M.O.D. open relay are energized, a normally open contact on each relay will close, and the exhaust fan will start. Both fans will run continuously in this mode of operation.
 - (3) If intermittent operation is selected, the ventilation fans will be controlled as follows:
 - (a) A repeat cycle timer will be programmed in the programmable controller to periodically start the ventilation fans at preset time intervals for intermittent operation of the fans. When a start time occurs, PLC-C will start the supply fan, and a run duration timer in the programmable controller will be started. When the supply fan is started, Exhaust Fan EF-2 will start. The exhaust fan will continue to run as long as the supply fan is running. When the run duration timer times out, the programmable controller will shut down the supply fan.

(b) The supply fan start time intervals and run duration time shall be adjustable via the operator interface on the Pump Station Control Panel.

b. PLC-C will provide failure monitoring for Supply Fan SF-1 as follows:

- (1) When the supply fan H/O/A switch is in the "auto" position and the fan gets a signal to start, a failure timer in the PLC will be started. If this timer times out and the fan is not running, a "Pump Room Supply Fan Failure" alarm message shall be displayed by the operator interface located on the Pump Station Control Panel.

6. Pump Room Ventilation Fans Alarms

a. The following alarms for the Pump Room Ventilation Fans shall be displayed on the operator interface located on the Pump Station Control Panel:

- (1) Pump Room Supply Fan SF-1 Failure

G. INTRUSION ALARM MONITORING

1. General Description

- a. A magnetic door switch will be installed on each of the pump station exterior doors to detect when someone enters the station. The door switches will be normally closed and will open when the door is opened.

2. Programmable Controller PLC-C Inputs

- a. The door switches will be wired in series to PLC-C located in the Pump Station Control Panel.
- b. Digital Inputs (24vdc):

<u>Description</u>	<u>Origination Point</u>
(1) Pump Station Intrusion	Pump Station Door Switches

3. Description of Operation

- a. Whenever a pump station door is opened, a timer in PLC-C will be started. When this timer times out, the PLC will energize a "Pump Station Intrusion Alarm" relay in the Pump Station Control Panel. A normally open contact on this relay will be wired to the automatic telephone dialer for notification of a Pump Station Intrusion alarm.
- b. The intrusion alarm shall be capable of being disabled from the operator interface terminal when the pump station operator enters the station.

H. EMERGENCY GENERATOR

1. General Description

- a. A 200 KW natural gas emergency generator will be pad mounted outside the pump station in a weatherproof housing to provide standby power for the pump station loads.
- b. An automatic transfer switch will be provided in MCC-C to sense a failure of the normal utility power and transfer the pump station loads to the emergency generator.

2. Programmable Controller PLC-C Inputs

- a. The programmable controller inputs for the Emergency Generator will be wired to PLC-C located in the Pump Station Control Panel.
- b. Digital Inputs (24vdc):

	<u>Description</u>	<u>Origination Point</u>
(1)	Automatic Transfer Switch Emergency Position	Automatic Transfer Switch in MCC-C
(2)	Emergency Generator Running	Run Relay in Generator Control Panel
(3)	Emergency Generator Common Alarm	Alarm Relay in Generator Control Panel

3. Description of Operation

- a. The automatic transfer switch will continuously monitor the incoming power source. When a failure of the utility power source occurs, control logic in the transfer switch will start the emergency generator. When the generator is putting out the required voltage and frequency, the transfer switch will transfer the loads to the generator. When the transfer switch transfers to the emergency position, a normally open contact on the switch will close. This contact will be wired to PLC-C for monitoring of the transfer switch position by the programmable controller.
- b. A generator run relay will be provided in the generator control panel. A normally open contact on this relay will be wired to PLC-C for generator run status monitoring by the programmable controller. If the generator is running, an "Emergency Generator Running" alarm shall be displayed on the operator interface located on the Pump Station Control Panel.

- c. A common alarm relay will be provided in the generator control panel to indicate a generator alarm. A normally open contact on this relay will be wired to PLC-C. If a generator alarm occurs, an "Emergency Generator Alarm" shall be displayed on the operator interface.

4. Emergency Generator Alarms

- a. The following alarms for the Emergency Generator shall be displayed on the operator interface located on the Pump Station Control Panel:
 - (1) Emergency Generator Running
 - (2) Emergency Generator Alarm
- b. Whenever a generator running alarm occurs, PLC-C will energize an "Emergency Generator Running" relay in the Pump Station Control Panel. A normally open contact on this relay will be wired to the automatic telephone dialer for notification that the generator is running.
- c. Whenever a generator alarm occurs, PLC-C will energize an "Emergency Generator Common Alarm" relay in the Pump Station Control Panel. A normally open contact on this relay will be wired to the automatic telephone dialer for notification of a generator alarm.

I. MCC-C POWER MONITORING

1. General Description

- a. A microprocessor based digital power monitor will be provided in MCC-C to provide for complete electrical metering and to monitor the incoming power to the MCC.
- b. A surge protective device (SPD) will be provided in the MCC to protect the MCC from transient voltages that may occur due to lightning or surges on the incoming power line.

2. Programmable Controller PLC-C Inputs

- a. The programmable controller inputs for the MCC Power Monitoring will be wired to PLC-C located in the Pump Station Control Panel.
- b. Digital Inputs (24vdc):

	<u>Description</u>	<u>Origination Point</u>
(1)	MCC-C Power Failure	Alarm Contact in MCC Power Monitor
(2)	MCC-C SPD Alarm	Alarm Contact in Surge Protective Device

3. Description of Operation

- a. The MCC power monitor will provide monitoring for a phase loss, phase unbalance, phase reversal, overvoltage, or undervoltage condition. The power monitor will be furnished with a normally open alarm contact, which will close when power is present, and there are no alarm conditions. This contact will be wired to PLC-C. If a power failure occurs, this contact will open, and an "MCC-C Power Failure" alarm message shall be displayed on the operator interface located on the Pump Station Control Panel.
- b. The surge protective device located in the MCC will be furnished with a normally open alarm contact. This contact will be wired to PLC-C. If a surge alarm occurs, this contact will close, and an "MCC-C Surge Alarm" message shall be displayed on the operator interface.

4. MCC-C Power Monitor Alarms

- a. The following alarms for the MCC-C Power Monitoring shall be displayed on the operator interface located on the Pump Station Control Panel, and shall be displayed and logged by the HMI software:

- (1) MCC-C Power Failure
 - (2) MCC-C Surge Alarm
- b. The MCC alarms shall be paralleled in PLC-C to a common alarm output. Whenever an MCC alarm occurs, PLC-C will energize an "MCC-C Common Alarm" relay in the Pump Station Control Panel. A normally open contact on this relay will be wired to the automatic telephone dialer for notification of an MCC alarm.

J. CONTROL PANEL POWER MONITORING

1. General Description

- a. A power failure relay and a surge protective device (SPD) will be provided in the Pump Station Control Panel to monitor the incoming power to the panel and to protect the PLC from transient voltages that may occur due to lightning or surges on the incoming power line.

2. Programmable Controller PLC-C Inputs

- a. The programmable controller inputs for Power Monitoring in the Pump Station Control Panel will be wired to PLC-C located in that panel.
- b. Digital Inputs (24vdc):

	<u>Description</u>	<u>Origination Point</u>
(1)	Pump Station Control Panel Power Failure	Power Failure Relay in PLC Panel
(2)	Pump Station Control Panel SPD Failure	Alarm Contact in SPD

3. Description of Operation

- a. A power failure relay will be provided in the control panel. The relay will be energized continuously by the main incoming power to the panel. The programmable controller will provide power failure monitoring for the control panel as follows:
 - (1) A normally closed contact on the power failure relay will be wired to PLC-C. Under normal circumstances, the relay will be energized and this contact will be open. If the main incoming power supply fails, the relay contact will close, and a "Control Panel Power Failure" alarm message shall be displayed on the operator interface located on the Pump Station Control Panel.
- b. The surge protective device located in the control panel will be furnished with a normally open alarm contact. This contact will be wired to PLC-C. If an SPD alarm occurs, this contact will close, and a "Control Panel SPD Failure" alarm message shall be displayed on the operator interface located on the control panel.

4. Control Panel Power Monitoring Alarms

- a. The following Power Monitoring alarms shall be displayed on the operator interface located on the Pump Station Control Panel:
 - (1) Pump Station Control Panel Power Failure
 - (2) Pump Station Control Panel SPD Failure

K. 24VDC POWER SUPPLIES

1. General Description

- a. Two 24vdc power supplies will be provided in the Pump Station Control Panel. The 24vdc power supplies will provide power for the Ethernet switch, 24vdc programmable controller inputs, and the 2-wire instruments. The power supplies will be wired in parallel through a redundancy module so that if one power supply fails, the other power supply will continue providing 24vdc power.

2. Programmable Controller PLC-C Inputs

- a. The programmable controller inputs for the 24vdc Power Supplies for the Pump Station Control Panel will be wired to PLC-C located in that panel.
- b. Digital Inputs (24vdc):

	<u>Description</u>	<u>Origination Point</u>
(1)	Pump Station Control Panel 24vdc Power Supply No. 1 Failure	Alarm Contact in Power Supply
(2)	Pump Station Control Panel 24vdc Power Supply No. 2 Failure	Alarm Contact in Power Supply

3. Description of Operation

- a. PLC-C will provide failure monitoring for the 24vdc power supplies in the control panel as follows:
 - (1) A normally closed contact on each power supply will be wired to the PLC in the panel. When the power supply is operating, this contact will be open. If a power supply fails, this contact will close, a "24vdc Power Supply Failure" alarm message shall be displayed on the operator interface located on the Pump Station Control Panel.

4. 24vdc Power Supply Alarms

- a. The following alarms for the 24vdc Power Supplies shall be displayed on the operator interface located on the Pump Station Control Panel:
 - (1) Pump Station Control Panel 24vdc Power Supply No. 1 Failure
 - (2) Pump Station Control Panel 24vdc Power Supply No. 2 Failure

L. UNINTERRUPTIBLE POWER SUPPLY

1. General Description

- a. An uninterruptible power supply (UPS) will be provided in the Pump Station Control Panel to provide continuous power for the equipment in the control panel.

2. Programmable Controller PLC-C Inputs

- a. The programmable controller inputs for the UPS in the Pump Station Control Panel will be wired to PLC-C located in that panel.

- b. Digital Inputs (24vdc):

	<u>Description</u>	<u>Origination Point</u>
(1)	UPS on Battery Power	UPS in Pump Station Control Panel
(2)	UPS Replace Battery	UPS in Pump Station Control Panel
(3)	UPS Failure	UPS Failure Relay in Pump Station Control Panel

3. Description of Operation

- a. The UPS will be furnished with a normally open contact that will close when the UPS is operating on battery power. This contact will be wired to PLC-C. When normal power fails and the UPS is operating on battery power, a timer in the programmable controller will be started. If this timer times out and the UPS is still on battery power, a "UPS on Battery Power" alarm message shall be displayed on the operator interface located on the Pump Station Control Panel.
- b. The UPS will be furnished with a normally open contact that will close when the UPS battery needs replaced. This contact will be wired to PLC-C. If the battery needs replaced, a timer in the programmable controller will be started. If this timer times out and the UPS battery still needs replaced, a "UPS Replace Battery" alarm message shall be displayed on the operator interface located on the control panel.
- c. A UPS failure relay will be provided for the UPS in the control panel. This relay will be energized continuously by the UPS. The programmable controller will provide failure monitoring for the UPS as follows:

- (1) A normally closed contact on the UPS failure relay will be wired to PLC-C. When the UPS in the control panel is operating, the relay will be energized, and this contact will be open. If the UPS fails, the relay contact will close, a "UPS Failure" alarm message shall be displayed on the operator interface located on the control panel.
- d. The UPS failure relay will have two normally open contacts and two normally closed contacts in addition to the normally closed contact being utilized for failure monitoring of the UPS. The UPS will be wired through two normally open relay contacts, and the 120 VAC power will be wired through two normally closed relay contacts. If the UPS fails, the UPS failure relay will be de-energized and the 120 VAC power will power the control panel.

4. Uninterruptible Power Supply Alarms

- a. The following alarms for the Uninterruptible Power Supplies shall be displayed on the operator interface located on the Pump Station Control Panel:
 - (1) Pump Station Control Panel UPS on Battery Power
 - (2) Pump Station Control Panel UPS Replace Battery
 - (3) Pump Station Control Panel UPS Failure

M. PLC FAILURE MONITORING

1. General Description

- a. The HMI software shall monitor the status of PLC-C, located in the Pump Station Control Panel.

2. Description of Operation

- a. The HMI software will monitor the status of an internal failure bit for PLC-C. If the PLC fails, the status of the failure bit will change, and a PLC failure alarm shall be displayed by the HMI software.

3. PLC Failure Monitoring Alarms

- a. The following alarms for the PLC Failure Monitoring shall be displayed and logged by the HMI software:
 - (1) PLC-C Failure
- b. Whenever a PLC failure alarm occurs, PLC-C will energize a "PLC Failure" relay in the Pump Station Control Panel. A normally open contact on this relay will be wired to the automatic telephone dialer for notification of a PLC Failure alarm.

N. OPERATOR INTERFACE TERMINAL

1. General Description

- a. An operator interface terminal will be provided on the Pump Station Control Panel to display graphic displays and alarm messages for the system.

2. Description of Operation

- a. Whenever an alarm occurs, a corresponding alarm message will be displayed on the operator interface as previously described in the Description of Operation.
- b. An alarm message will remain in the system until its corresponding alarm is cleared. The operator shall be able to acknowledge and clear the alarms from the operator interface.

O. AUTOMATIC TELEPHONE DIALER

1. General Description

- a. A 16-channel automatic telephone dialer will be wall mounted in the Pump Station Electrical Room to provide continuous monitoring of the pump station alarms. When an alarm occurs, the dialer will call a series of pre-programmed telephone numbers until one of the numbers answers. When the dialer is answered, it will deliver a message by means of a computer type synthesized voice indicating the alarm that exists.

2. Programmable Controller PLC-C Outputs

- a. The programmable controller outputs for the Automatic Telephone Dialer will be output from PLC-C located in the Pump Station Control Panel.
- b. Digital Outputs (24vdc Relay):

	<u>Description</u>	<u>Destination Point</u>
(1)	PLC Failure Channel No. 2	Failure Relay in Pump Station Control Panel
(2)	Influent Grinder Alarm Channel No. 3	Alarm Relay in Pump Station Control Panel
(3)	Sewage Pumps Common Alarm Channel No. 4	Alarm Relay in Pump Station Control Panel
(4)	Pump Room Flooding Alarm Channel No. 5	Alarm Relay in Pump Station Control Panel
(5)	Discharge Flow Meter Vault Flooding Alarm Channel No. 6	Alarm Relay in Pump Station Control Panel
(6)	Emergency Generator Running Channel No. 7	Run Relay in Pump Station Control Panel

(7)	Emergency Generator Common Alarm Channel No. 8	Alarm Relay in Pump Station Control Panel
(8)	Pump Station Intrusion Channel No. 9	Alarm Relay in Pump Station Control Panel

3. Description of Operation

- a. The wet well high level, detected by float alarm will be wired to Channel No. 1 of the automatic dialer.
- b. The pump station alarms shall be programmed to 7 common alarm outputs in PLC-C. The alarm outputs will be wired to Channel Nos. 2-9 of the automatic dialer for remote indication of a pump station alarm.
- c. A one minute time delay shall be programmed in PLC-C for each common alarm output to allow the pump station operator time to acknowledge the alarm before the dialer initiates its calling sequence.

END OF SECTION

APPENDIX A

SOIL BORING LOGS AND
LABORATORY TEST RESULTS

TEST BORING LOG

Boring No. B-1
Page 1 of 1



PROJECT: Creamery Road Pump Station

SITE: Frederick County, Maryland

DRILLING CO.: FSD **RIG/HAMMER:** CME 55 Track/Auto-Hammer

COMMISSION NO.: 19082.000

NORTH: 740704

EAST: 1222390

ELEVATION: 387.6 - ft

START DATE: 6/6/2019

END DATE: 6/6/2019

DRILLER: J. Scribellito

LOGGED BY: KPR

GROUNDWATER DATA (ft)					EQUIPMENT	CASING	SAMPLER	CORE
Date	Time	Water	Casing	Cave-In	TYPE			
6/6/2019	9:06:00 AM	Dry	--	16	SIZE, ID (in)	HSA	S	
					HAMMER WT. (lb)	3.25	1.375	
					HAMMER FALL (in)		140	-
							30	-

SAMPLE NUMBER	SAMPLE TYPE	SAMPLE RECOVERY (in)	BLOWS/6" (% ROD)	LABORATORY TEST RESULTS			DEPTH	ELEV. DEPTH	GRAPHIC	DESCRIPTION AND CLASSIFICATION (moisture, density, color, proportions, etc.)	NOTES:
				NM/C Frac. Freq.	LIQUID LIMIT	PLASTICITY INDEX					
S-1	X	15	4 4 4					EL 387.4 0.3	3-Inches TOPSOIL	Moist, Medium Stiff, Brown with Gray, CLAY, Little Coarse to Fine Sand, Trace Fine Gravel, Residual (CL) [A-4 (6)]	
S-2	X	6	1 1 2	22%			5		Sample S-2: Soft, Red/Brown		
S-3	X	18	3 5 9				9		Sample S-3: Stiff, Gray/Red/Orange Mottled		Bulk Sample Obtained from Auger Cuttings from 5 to 10-ft
S-4	X	18	4 7 10	16.9%	28	9	10		Sample S-4: Very Stiff, Red		
S-5	X	2	50/4"	4.7%			11.0	EL 376.6	Completely Weathered ROCK Sampled As: Moist, Red, SILT, Little Coarse to Fine Sand, Trace Rock Fragments	Difficult Drilling	
S-6	X	0	50/3"				15		Sample S-6: No Recovery		
S-7	X	0	50/3.5"				20		Sample S-7: No Recovery		
S-8	X	1	50/1"				25	EL 364.0 23.6	Bottom of Boring @ 23.6 ft		Spoon Refusal at 23.6-ft Boring Backfilled with Auger Cuttings upon Completion.

RKK NORTH/EAST (DEFAULT) 19082 CREAMERY ROAD PUMP STATION.GPJ_RKK_CURRENT.GDT 7/16/19

SAMPLE IDENTIFICATION	DRILLING METHOD	BLOWS/FT	DENSITY	BLOWS/FT	CONSISTENCY	SAMPLE PROPORTIONS (PERCENT)	
- S - SPLIT SPOON	HSA - HOLLOW STEM AUGERS	0-4	VERY LOOSE	0-2	VERY SOFT	TRACE	1 TO 10
- T - THIN WALL TUBE	SSA - SOLID STEM AUGERS	5-10	LOOSE	3-4	SOFT	LITTLE	11 TO 20
- SS - 3" SPLIT SPOON	DC - DRIVING CASING	11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	SOME	21 TO 35
- D - DENISON	MD - MUD DRILLING	31-50	DENSE	9-15	STIFF	AND	36 TO 50
- RC - ROCK CORE	HA - HAND AUGER	OVER 50	VERY DENSE	16-30	VERY STIFF		
				OVER 30	HARD		

Boring No. B-1

TEST BORING LOG

Boring No. B-2
Page 1 of 2

	PROJECT: Creamery Road Pump Station				COMMISSION NO.: 19082.000						
	SITE: Frederick County, Maryland				NORTH: 740696						
	DRILLING CO.: FSD				EAST: 1222453						
GROUNDWATER DATA (ft)				EQUIPMENT		CASING		SAMPLER		CORE	
Date	Time	Water	Casing	Cave-In	TYPE	HSA	S	NQ2		START DATE: 6/6/2019	
6/6/2019	12:30:00 PM	8	--	24	SIZE, ID (in)	3.25	1.375	2.03		END DATE: 6/6/2019	
					HAMMER WT. (lb)			140		DRILLER: J. Scribellito	
					HAMMER FALL (in)			30		LOGGED BY: KPR	

SAMPLE NUMBER	SAMPLE TYPE	SAMPLE RECOVERY (in)	BLOWS/6" (% ROD)	LABORATORY TEST RESULTS			DEPTH	ELEV. DEPTH	GRAPHIC	DESCRIPTION AND CLASSIFICATION (moisture, density, color, proportions, etc.)	NOTES:
				NM/C Frac. Freq.	LIQUID LIMIT	PLASTICITY INDEX					
S-1	X	14	3 4 5				EL 385.9 0.7		5.5-Inches Bituminous Concrete 3-Inches Graded Aggregate Base		
S-2	X	5	5 7 5				EL 383.1 3.5		FILL Sampled As: Moist, Red/Brown/Black, Coarse to Fine SAND, Some Coarse to Fine Rock Fragments, Little Silt		
S-3	X	12	1 4 8	23.7% 17.7%	45 33	25 14	EL 380.6 6.0		Moist, Stiff, Gray/Orange Mottled, CLAY, Trace Coarse to Fine Sand, Residual (CL) [A-7-6 (26)]	Bulk Sample Obtained from Auger Cuttings from 5 to 10-ft MDD = 128-pcf OMC = 11.4% CBR = 3.5	
S-4	X	7	3 6 9				EL 375.6 11.0		Sample S-4: Dark Red/Brown, Trace Coarse to Fine Gravel		
S-5	X	4	50/4"				EL 373.1 13.5		Completely Weathered ROCK Sampled As: Wet, Dark Red/Brown, CLAY, Trace Coarse to Fine Sand	Wet Spoon at 11-ft	
S-6	X	5	50/5"	20.5%	35	17	EL 368.1 18.5		Completely Weathered ROCK Sampled As: Moist, Red, Coarse to Fine SAND, Some Silt, Trace Coarse to Fine Rock Fragments	Very Difficult Drilling	
S-7	X	4	50/4"				EL 357.6 29.0		Sample S-9: No Recovery		
S-8	X	3	50/3"	3.7%					Red/Gray SHALE, Fine-Grained, Extremely to Slightly Fractured, Close Bedding, Moderately to Completely Weathered, Medium Strong	Auger and Spoon Refusal Laboratory UCC=3,860-psi at 29.8-ft	
S-9	X	0	50/0"								
R-1	█	31	48%								

RKK NORTH/EAST (DEFAULT) 19082 CREAMERY ROAD PUMP STATION.GPJ_RKK_CURRENT.GDT 7/16/19

SAMPLE IDENTIFICATION		DRILLING METHOD		BLOWS/FT	DENSITY	BLOWS/FT	CONSISTENCY	SAMPLE PROPORTIONS (PERCENT)	
X	- S - SPLIT SPOON	HSA - HOLLOW STEM AUGERS		0-4	VERY LOOSE	0-2	VERY SOFT	TRACE	1 TO 10
	- T - THIN WALL TUBE	SSA - SOLID STEM AUGERS		5-10	LOOSE	3-4	SOFT	LITTLE	11 TO 20
	- SS - 3" SPLIT SPOON	DC - DRIVING CASING		11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	SOME	21 TO 35
/	- D - DENISON	MD - MUD DRILLING		31-50	DENSE	9-15	STIFF	AND	36 TO 50
█	- RC - ROCK CORE	HA - HAND AUGER		OVER 50	VERY DENSE	16-30	VERY STIFF		
						OVER 30	HARD		

TEST BORING LOG



PROJECT: Creamery Road Pump Station

SITE: Frederick County, Maryland

DRILLING CO.: FSD **RIG/HAMMER:** CME 55 Track/Auto-Hammer

SAMPLE NUMBER	SAMPLE TYPE	SAMPLE RECOVERY (in)	BLOWS/6" (% RQD)	LABORATORY TEST RESULTS			DEPTH	ELEV. DEPTH	GRAPHIC	DESCRIPTION AND CLASSIFICATION (moisture, density, color, proportions, etc.)	NOTES:
				NMC/ Frac. Freq.	LIQUID LIMIT	PLASTICITY INDEX					
R-2		60	75%							Red/Gray SHALE, Fine-Grained, Extremely to Slightly Fractured, Close Bedding, Moderately to Completely Weathered, Medium Strong	Laboratory UCC=2,480-psi at 36.6-ft
R-3		36	93%								
							40	EL 346.6 40.0		Bottom of Boring @ 40.0 ft	Boring Backfilled with Auger Cuttings and Plugged with Bentonite Chips upon Completion. Cold Patched with Asphalt.
							45				
							50				
							55				
							60				
							65				
							70				

RKK NORTH/EAST (DEFAULT) 19082 CREAMERY ROAD PUMP STATION.GPJ_RKK_CURRENT.GDT 7/16/19

FIELD CLASSIFICATION SYSTEM FOR SOIL EXPLORATION

COHESIONLESS SOILS (Silt, Sand, Gravel, and Combinations)

<u>Density</u>		<u>Particle Size Identification</u>	
Very Loose	4 blows/ft or less	Boulders	12 inches diameter or more
Loose	5 to 10 blows/ft		
Medium Dense	11 to 30 blows/ft	Cobbles	3 to 12 inch diameter
Dense	31 to 50 blows/ft		
Very Dense	51 blows/ft or more	Gravel	Coarse: 3/4 to 3 inch diameter Fine: 1/4 to 3/4 inch diameter
		Sand	Coarse: 2 mm to 1/4 inch (diameter of pencil lead)
			Medium: 0.425 to 2 mm (diameter of broom straw)
			Fine: 0.075 to 0.425 mm (diameter of human hair)
		Silt	0.005 to 0.075 mm (Cannot see particles)

<u>Relative Proportions</u>	
<u>Descriptive Term</u>	<u>Percent</u>
Trace	1 to 10
Little	11 to 20
Some	21 to 35
And	36 to 50

COHESIVE SOILS (Clay, Silt, and Combinations)

<u>Consistency</u>		<u>Plasticity</u>	
		<u>Degree of Plasticity</u>	<u>Plasticity Index</u>
Very Soft	2 blows/ft or less	No to Slight	0 - 4
Soft	3 to 4 blows/ft	Slight	5 - 7
Medium Stiff	5 to 8 blows/ft	Medium	8 - 22
Stiff	9 to 15 blows/ft	High to Very High	over 22
Very Stiff	16 to 30 blows/ft		
Hard	31 blows/ft or more		

Soil Classifications on Test Boring Logs are made by visual-manual inspection of samples. Soil classification symbols using lower case letters are based on a visual-manual classification. Soil classification symbols using upper case letters are based on laboratory testing.

Standard Penetration Test

Driving a 2.0-inch OD, 1 3/8-inch ID sampler a distance of 1.0-foot into undisturbed soil with a 140-lb hammer free falling a distance of 30.0-inches. It is required to drive the spoon 6.0-inches to seat into undisturbed soil, then perform the test. The number of hammer blows for seating and making the test are recorded each 6.0-inches of penetration on the Test boring Log (Example 6-8-9, 8+9=17 blows/ft). (ASTM D-1586)

Strata Changes

In the column "Soil Descriptions" on the Test Boring Logs, the horizontal lines represent strata changes. A solid line represents an actually observed change, a dashed line represents an estimated change.

Ground Water

Observations were made at the time indicated. Porosity of soil strata, weather conditions, site topography, etc. may cause changes in the water levels indicated on the Test Boring Log.



700 East Pratt Street, Suite 500
Baltimore, Maryland 21202
(410) 728-2900

Title:

FIELD CLASSIFICATION SYSTEM FOR SOIL EXPLORATION

Figure No:

B-1

Drawn:

KPR

Approved:

JLT

Date:

July 2019

Comm No:

General

SOIL CLASSIFICATION CHART

MAJOR DIVISIONS			SYMBOLS		TYPICAL DESCRIPTIONS	
			GRAPH	LETTER		
COARSE GRAINED SOILS MORE THAN 50% OF MATERIAL IS LARGER THAN NO. 200 SIEVE SIZE	GRAVEL AND GRAVELLY SOILS MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	CLEAN GRAVELS (LITTLE OR NO FINES)		GW	WELL-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES	
		GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)		GP	POORLY-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES	
		GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)		GM	SILTY GRAVELS, GRAVEL - SAND - SILT MIXTURES	
		GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)		GC	CLAYEY GRAVELS, GRAVEL - SAND - CLAY MIXTURES	
	SAND AND SANDY SOILS MORE THAN 50% OF COARSE FRACTION PASSING ON NO. 4 SIEVE	CLEAN SANDS (LITTLE OR NO FINES)		SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES	
		SANDS WITH FINES (LITTLE OR NO FINES)		SP	POORLY-GRADED SANDS, GRAVELLY SAND, LITTLE OR NO FINES	
		SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)		SM	SILTY SANDS, SAND - SILT MIXTURES	
		SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)		SC	CLAYEY SANDS, SAND - CLAY MIXTURES	
		SILTS AND CLAYS LIQUID LIMIT LESS THAN 50	SILTS AND CLAYS LIQUID LIMIT LESS THAN 50		ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
			SILTS AND CLAYS LIQUID LIMIT LESS THAN 50		CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
SILTS AND CLAYS LIQUID LIMIT LESS THAN 50			OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY		
SILTS AND CLAYS LIQUID LIMIT GREATER THAN 50	SILTS AND CLAYS LIQUID LIMIT GREATER THAN 50		MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SAND OR SILTY SOILS		
	SILTS AND CLAYS LIQUID LIMIT GREATER THAN 50		CH	INORGANIC CLAYS OF HIGH PLASTICITY		
	SILTS AND CLAYS LIQUID LIMIT GREATER THAN 50		OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS		
HIGHLY ORGANIC SOILS				PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS	

NOTE: DUAL SYMBOLS ARE USED TO INDICATE BORDERLINE SOIL CLASSIFICATIONS



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Title:

UNIFIED SOIL CLASSIFICATION SYSTEM

Figure No:

B-2a

Drawn:

KPR

Approved:

JLT

Date:

July 2019

Comm No:

General

AASHTO SOIL CLASSIFICATION CHART

GENERAL CLASSIFICATION	SOIL TYPE	SYMBOLS		GRADING REQUIREMENTS	PHYSICAL CHARACTERISTICS
		GRAPH	LETTER		
GRANULAR MATERIALS (35 percent or less of total sample passing No. 200)	GRAVEL & SAND		A-1-a	Sieve analysis % passing No. 10 = 50 max No. 40 = 30 max No. 200 = 15 max	P.I. = 6 max
			A-1-b	Sieve analysis % passing No. 40 = 50 max No. 200 = 25 max	P.I. = 6 max
	FINE SAND		A-3	Sieve analysis % passing No. 40 = 51 max No. 200 = 10 max	Non-plastic
SILT-CLAY MATERIALS (More than 35 percent of total sample passing No. 200)	SILTY OR CLAYEY GRAVEL & SAND		A-2-4	Sieve analysis % passing No. 200 = 35 max	L.L. = 40 max P.I. = 10 max
			A-2-5	Sieve analysis % passing No. 200 = 35 max	L.L. = 41 min P.I. = 10 max
			A-2-6	Sieve analysis % passing No. 200 = 35 max	L.L. = 40 max P.I. = 11 min
			A-2-7	Sieve analysis % passing No. 200 = 35 max	L.L. = 41 min P.I. = 11 min
	SILTY SOILS		A-4	Sieve analysis % passing No. 200 = 36 min	L.L. = 40 max P.I. = 10 max
			A-5	Sieve analysis % passing No. 200 = 36 min	L.L. = 41 min P.I. = 10 max
			A-6	Sieve analysis % passing No. 200 = 36 min	L.L. = 40 max P.I. = 11 min
	CLAYEY SOILS		A-7-5	Sieve analysis % passing No. 200 = 36 min	L.L. = 41 min P.I. = 11 min
			A-7-6	Sieve analysis % passing No. 200 = 36 min	L.L. = 41 min P.I. = 11 min
	PEAT OR MUCK		A-8	Based on Visual Classification	

NOTE: DUAL SYMBOLS ARE USED TO INDICATE BORDERLINE SOIL CLASSIFICATIONS



Title:

AASHTO SOIL CLASSIFICATION SYSTEM

Figure No:

B-2b

Drawn:

KPR

Approved:

JLT

Date:

July 2019

Comm No:

General

FIELD CLASSIFICATION SYSTEM FOR ROCK EXPLORATION

Rock Penetrated by Split Spoon A transitional material between soil and rock retains the relic structure of the parent rock and exhibits penetration resistance between 60 blows/ft and 100 blows/ 2-inches of penetration

Sampler:

RQD:

Rock Quality Designation: Ratio of the core lengths greater than 4-inches to the total length of the run. Applies only to sound, fresh, unweathered rock.

Recovery	Description	RQD	Description of Rock Quality	Approximate General Tunneler's Description
< 40%	Incompetent	0 - 25	Very Poor	Crushed
40-70	Competent	25 - 50	Poor	Shattered, very blocky and seamy
70-90	Fairly Continuous	50 - 75	Fair	Blocky and seamy
90-100	Continuous	75 - 90	Good	Massive, moderately jointed
		90 - 100	Excellent	Intact Rock

FIELD HARDNESS

(A measure of resistance to scratching or abrasion.)

Very Hard

Cannot be scratched with knife or geologist's pick. Breaking of hand specimens requires hard blows of geologist's pick. Typical UCC > 28- ksi

Hard

Can be scratched with knife or geologist's pick only with difficulty. Hard blow of a hammer required to detach hand specimen. Typical UCC: 14 to 28- ksi

Medium Hard

Can be scratched with knife or geologist's pick. Gouges or grooves of 1/4-inch deep can be excavated by hard blow of point of a geologist's pick. Hand specimens can be detached by moderate blow. Typical UCC: 10.5 to 14- ksi

Medium

Can be grooved or gouged 1/16-inch deep by firm pressure on knife or geologist's pick point. Can be excavated in small chips to pieces about 1-inch maximum size by hard blows of the point of a geologist's pick. Typical UCC: 7 to 10.5- ksi

Soft

Can be gouged or grooved readily with knife or pick point. Can be excavated in chips and pieces several inches in size by moderate blows of a geologist's pick point. Small thin pieces can be broken by finger pressure. Typical UCC: 3.5 to 7- ksi

Very Soft

Can be carved with knife. Can be excavated with point of pick. Pieces 1-inch or more in thickness can be broken with finger pressure. Can be scratched readily by fingernail. Typical UCC: 140 to 3,500- psi

ROCK FRACTURE FREQUENCY

Description	Spacing Between Fractures
Extremely Fractured	< 1-in
Moderately Fractured	1 to 4-in
Slightly Fractured	4 to 8-in
Sound	> 8-in

NOTE: Fracture frequency terms are generalized to describe the average condition of the rock obtained from the core run. Portions of the rock within the run described may vary from the generalized descriptions. Where a core break appears to be due to drilling and not to natural causes, it has not been considered as a break for accessing fracture frequency. Frequency shown on the Test Boring Logs represents conditions of core as removed from the core barrel.

WEATHERING

(The action of the elements in altering the color, texture, and composition of the

Very Slightly

Rock generally fresh, joints stained, some joints may contain thin clay coatings, crystals in broken face show bright. Rock rings under hammer if crystalline.

Slightly

Rock generally fresh, joints stained, and discoloration extends into rock up to 1-inch. Joints may contain clay. In granitoid rocks, some occasional feldspar crystals are dull and discolored. Crystalline rocks ring under hammer.

Moderately

Significant portions of rock show discoloration and weathering effects. In granitoid rocks, most feldspars are dull and discolored; some may be decomposed to clay. Rock has dull sound under hammer and has a significant loss of strength compared with fresh rock.

Severely

All rock except quartz discolored or stained. Rock "fabric" clear and evident but reduced in strength to strong soil. In granitoid rocks, all feldspars kaolinized to some extent. Some fragments of strong rock usually left.

Very Severely

All rock except quartz discolored or stained. Rock "fabric" discernible, but mass effectively reduced to "soil" with only fragments of strong rock remaining.

Completely

All rock completely altered to soil-like material.

JOINTS, BEDDING AND FOLIATION

Joints	Bedding and Foliation	Spacing
Very Close	Fissile	< 0.25-in
Close	Very Thin	< 2-in
Moderately Close	Thin	2-in to 1-ft
Wide	Medium	1 to 3-ft
Very Wide	Thick	3 to 10-ft
	Very Thick	> 10-ft

NOTE: Refers to perpendicular distance between discontinuities.

Attitude

Angle (Degrees)

Vertical	0 to 5
Steep or High Angle	5 to 35
Moderately Dipping	35 to 55
Shallow to Low Angle	55 to 85
Horizontal	85 to 90



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Title:

FIELD CLASSIFICATION SYSTEM FOR ROCK EXPLORATION

Figure No:

B-3

Drawn:

KPR

Approved:

JLT






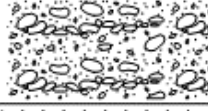

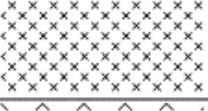

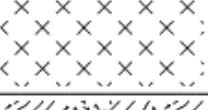
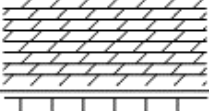

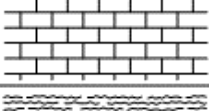



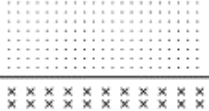
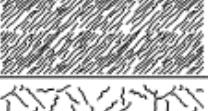
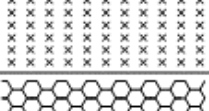

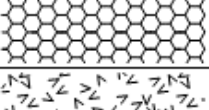

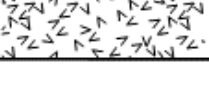

Date:

July 2019

Comm No:

General

ROCK CLASSIFICATION CHART

ROCK TYPE	SYMBOLS	ROCK TYPE	SYMBOLS
Bedrock		Breccia	
Decomposed Rock		Chert	
Boulders		Conglomerate	
Claystone		Diorite	
Coal		Gabbro	
Dolomite		Gneiss	
Limestone		Granite	
Mudstone		Marble	
Sandstone		Phyllite	
Siltstone		Quartz/Quartzite	
Basalt/Metabasalt		Schist	
Diabase/Granofels		Shale	



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Title:

ROCK CLASSIFICATION SYSTEM

Figure No:

B-4

Drawn:

KPR

Approved:

JLT

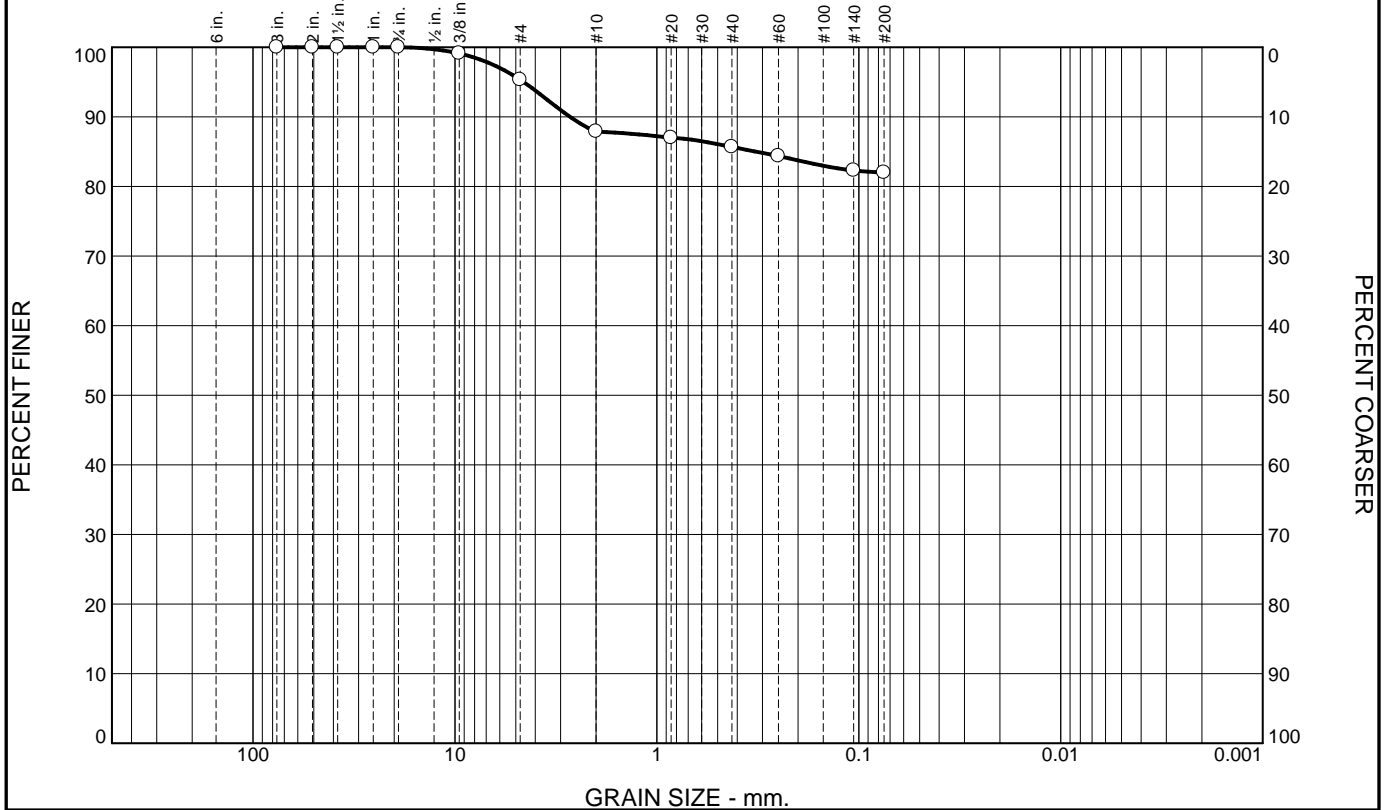
Date:

July 2019

Comm No:

General

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	4.7	7.4	2.2	3.7		82.0

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3	100.0		
2	100.0		
1.5	100.0		
1	100.0		
3/4	100.0		
3/8	99.1		
#4	95.3		
#10	87.9		
#20	87.0		
#40	85.7		
#60	84.4		
#140	82.3		
#200	82.0		

Soil Description
Red, brown, Lean CLAY with Sand

Atterberg Limits
 PL= 19 LL= 28 PI= 9

Coefficients
 D₉₀= 2.6921 D₈₅= 0.3226 D₆₀=
 D₅₀= D₃₀= D₁₅=
 D₁₀= C_u= C_c=

Classification
 USCS= CL AASHTO= A-4(6)

Remarks
Natural Moisture: 16.9%

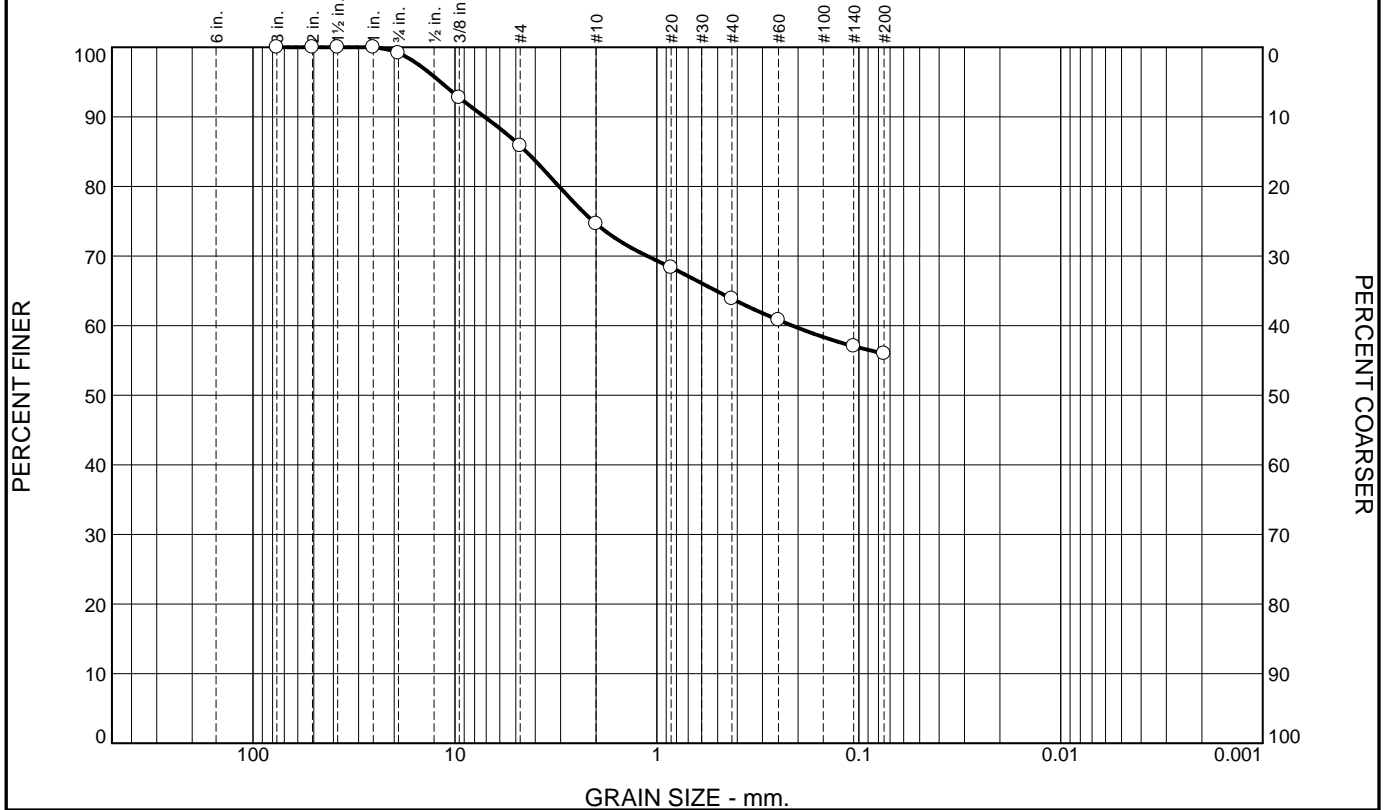
* (no specification provided)

Source of Sample: B-1 Depth: 8.5'-10.0'
Sample Number: S-4

Date: 6/21/19

E2CR, Inc. Baltimore, MD	Client: RK&K Project: Creamery Road PS Project No: 19517-03
Figure	

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.8	13.4	11.2	10.7	7.9	56.0	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3	100.0		
2	100.0		
1.5	100.0		
1	100.0		
3/4	99.2		
3/8	92.8		
#4	85.8		
#10	74.6		
#20	68.4		
#40	63.9		
#60	60.8		
#140	57.0		
#200	56.0		

Soil Description

Purple, brown, Sandy Lean CLAY

Atterberg Limits

PL= 19 LL= 33 PI= 14

Coefficients

D₉₀= 7.1317 D₈₅= 4.4290 D₆₀= 0.2135
D₅₀= D₃₀= D₁₅=
D₁₀= C_u= C_c=

Classification

USCS= CL AASHTO= A-6(5)

Remarks

Natural Moisture: 17.7%

* (no specification provided)

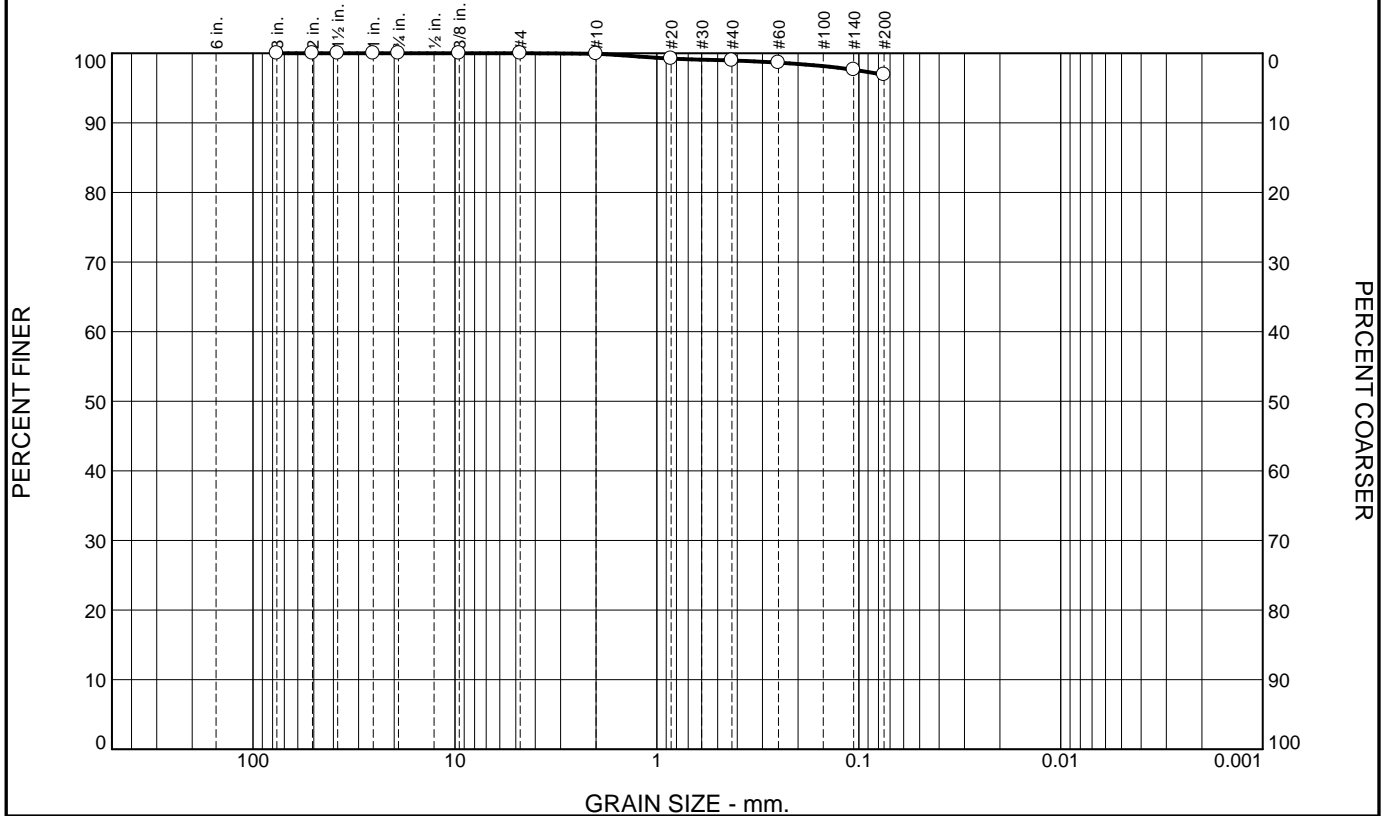
Source of Sample: B-2
Sample Number: Bulk

Depth: 5.0'-10.0'

Date: 6/21/19

E2CR, Inc. Baltimore, MD	Client: RK&K Project: Creamery Road PS Project No: 19517-03
Figure	

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.1	0.9	2.1	96.9	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X-NO)
3	100.0		
2	100.0		
1.5	100.0		
1	100.0		
3/4	100.0		
3/8	100.0		
#4	100.0		
#10	99.9		
#20	99.2		
#40	99.0		
#60	98.6		
#140	97.6		
#200	96.9		

Soil Description

Gray, brown, Lean CLAY

Atterberg Limits

PL= 20 LL= 45 PI= 25

Coefficients

D₉₀= D₈₅= D₆₀=
D₅₀= D₃₀= D₁₅=
D₁₀= C_u= C_c=

Classification

USCS= CL AASHTO= A-7-6(26)

Remarks

Natural Moisture: 23.7%

* (no specification provided)

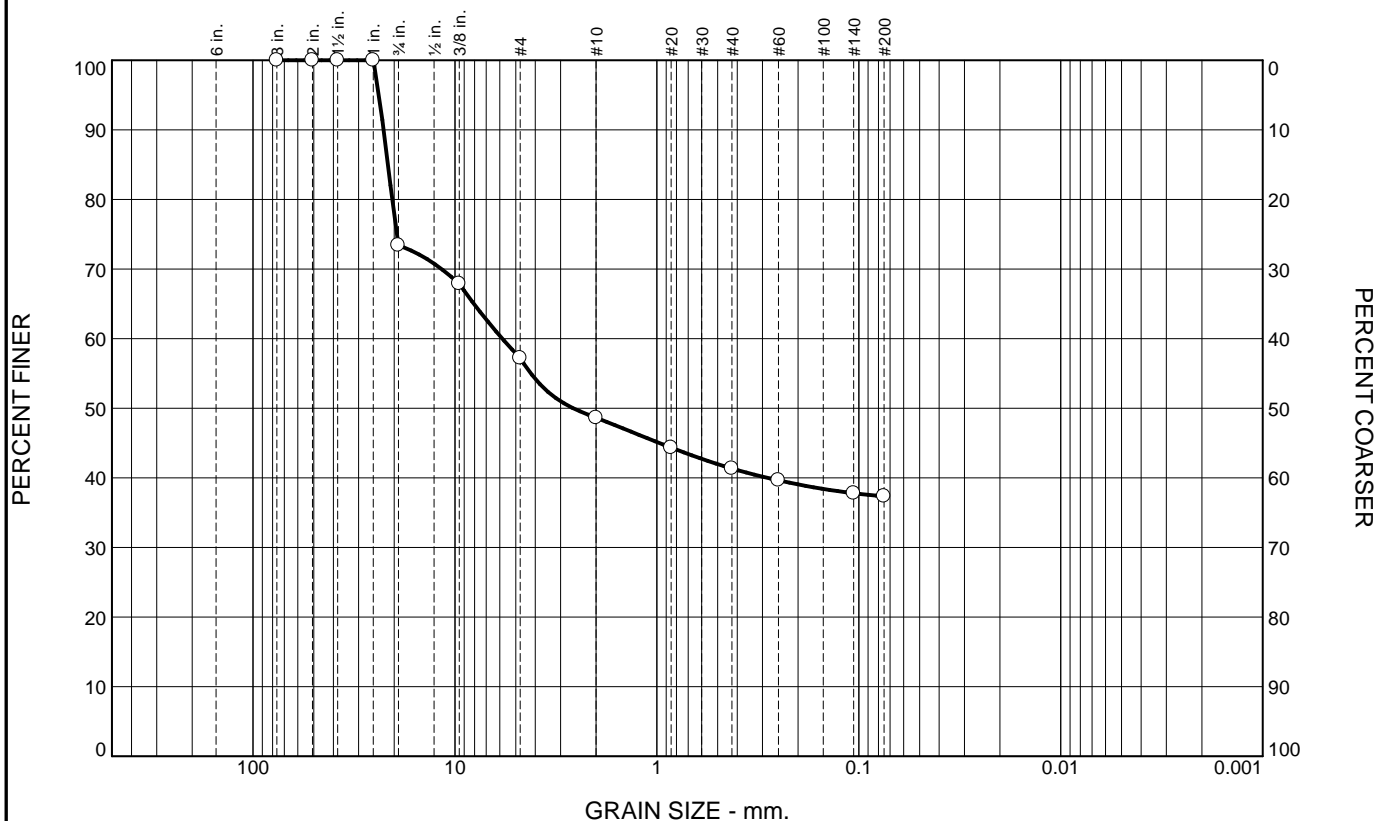
Source of Sample: B-2
Sample Number: S-3

Depth: 6.0'-7.5'

Date: 6/21/19

E2CR, Inc. Baltimore, MD	Client: RK&K Project: Creamery Road PS Project No: 19517-03
Figure	

Particle Size Distribution Report



GRAIN SIZE - mm.

% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	26.6	16.2	8.6	7.3	3.9	37.4	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X-NO)
3	100.0		
2	100.0		
1.5	100.0		
1	100.0		
3/4	73.4		
3/8	67.9		
#4	57.2		
#10	48.6		
#20	44.4		
#40	41.3		
#60	39.7		
#140	37.8		
#200	37.4		

Soil Description

Gray, red, brown, Clayey GRAVEL with Sand

Atterberg Limits

PL= 18 LL= 35 PI= 17

Coefficients

D₉₀= 22.5502 D₈₅= 21.4810 D₆₀= 5.8275
D₅₀= 2.5959 D₃₀= D₁₅=
D₁₀= C_u= C_c=

Classification

USCS= GC AASHTO= A-6(2)

Remarks

Natural Moisture: 20.5%

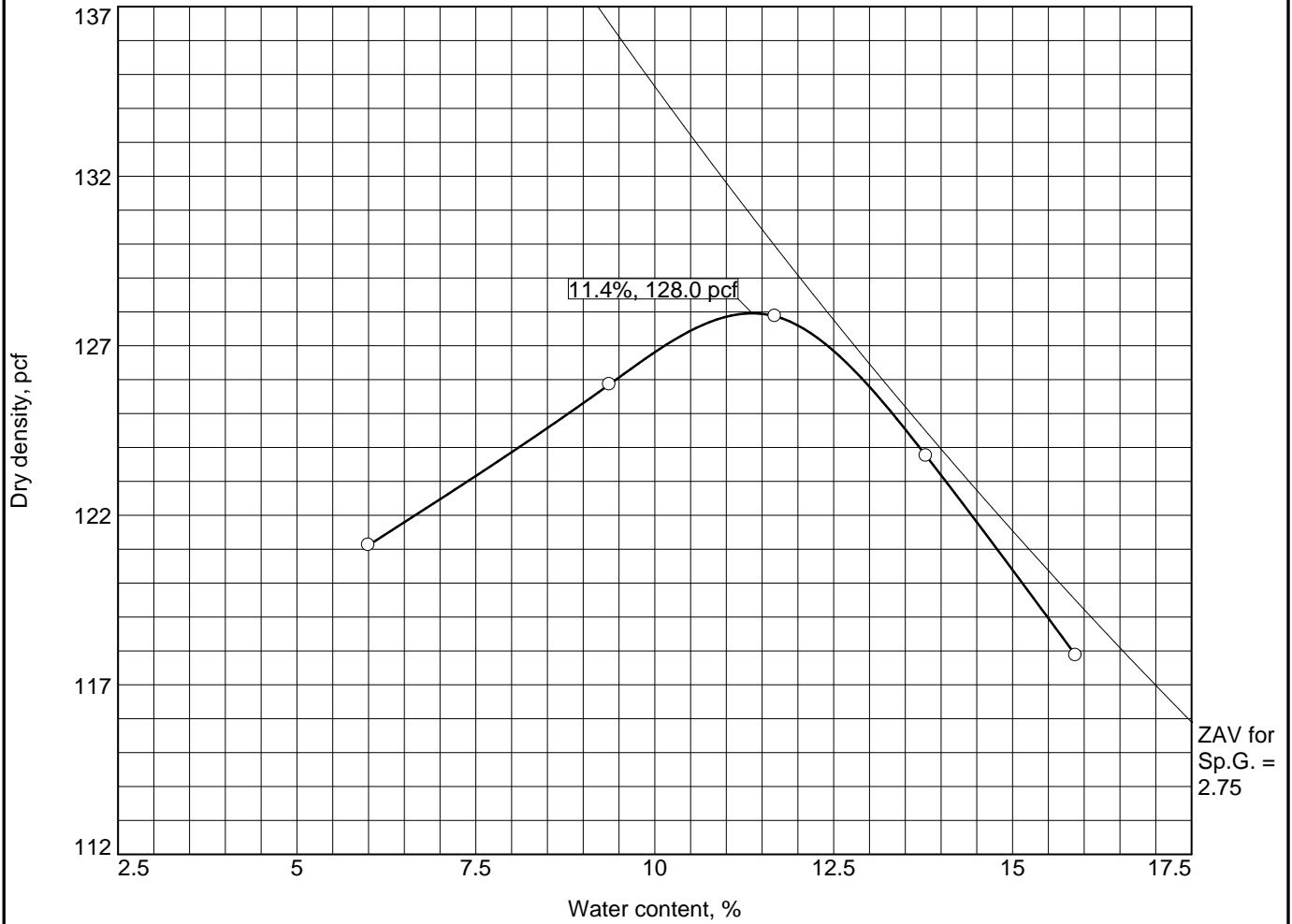
* (no specification provided)

Source of Sample: B-2 Depth: 13.5'-15.0'
Sample Number: S-6

Date: 6/21/19

E2CR, Inc. Baltimore, MD	Client: RK&K Project: Creamery Road PS Project No: 19517-03
Figure	

COMPACTION TEST REPORT



Test specification: AASHTO T 180-01 Method C Modified using Mechanical Circular Rammer

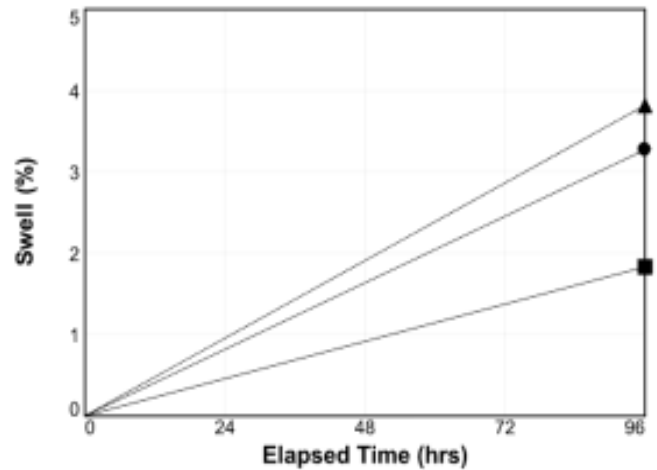
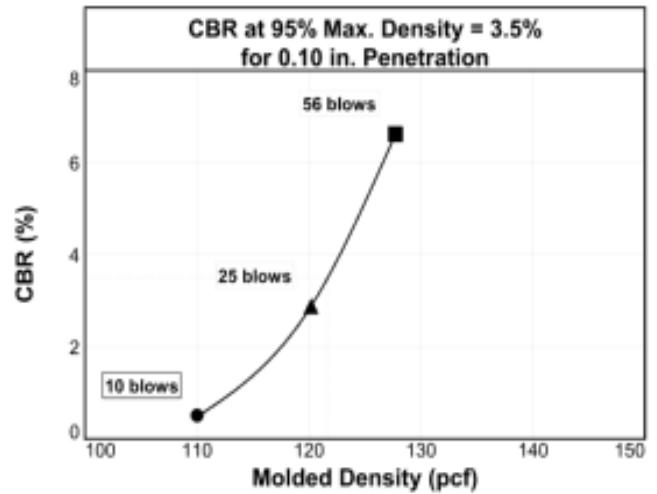
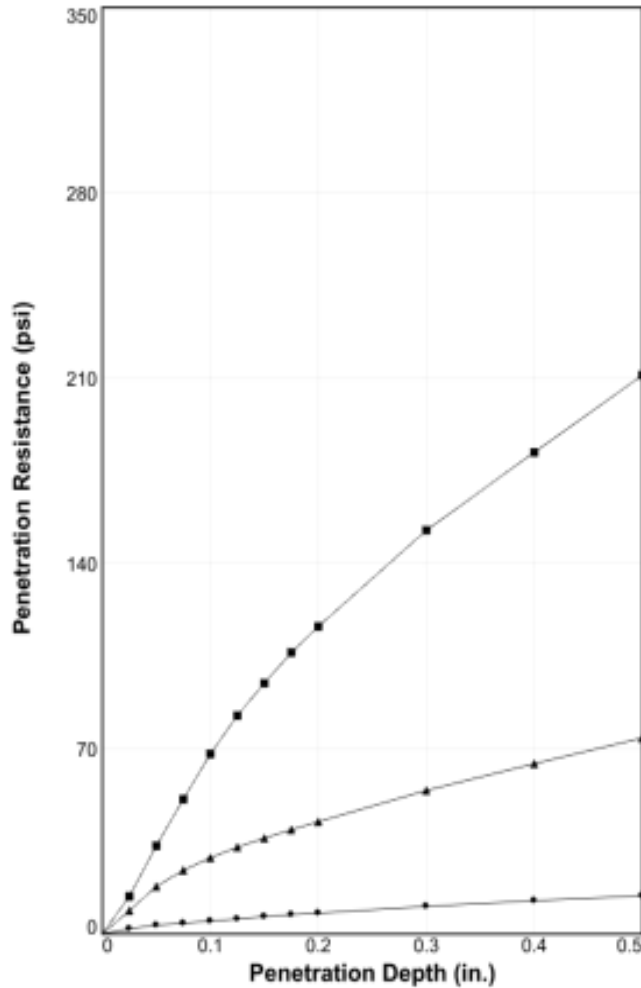
Elev/ Depth	Classification		Nat. Moist.	Sp.G.	LL	PI	% > 3/4 in.	% < No.200
	USCS	AASHTO						
5.0'-10.0'	CL	A-6(5)	17.7		33	14	0.8	56.0

TEST RESULTS	MATERIAL DESCRIPTION
Maximum dry density = 128.0 pcf Optimum moisture = 11.4 %	Purple, brown, Sandy Lean CLAY
Project No. 19517-03 Client: RK&K Project: Creamery Road PS ○ Source of Sample: B-2 Sample Number: Bulk E2CR, Inc. Baltimore, MD	Remarks:

Figure

BEARING RATIO TEST REPORT

ASTM D1883-16



	Molded			Soaked			CBR (%)		Linearity Correction (in.)	Surcharge (lbs.)	Max. Swell (%)
	Density (pcf)	Percent of Max. Dens.	Moisture (%)	Density (pcf)	Percent of Max. Dens.	Moisture (%)	0.10 in.	0.20 in.			
1 ○	110.1	86	11.4	106.6	83.3	23.6	0.5	0.5	0.000	10	3.3
2 △	120.2	93.9	11.4	115.8	90.4	17.9	2.9	2.8	0.000	10	3.8
3 ■	127.7	99.8	11.4	125.4	98	15.0	6.6	7.7	-0.003	10	1.8

Material Description	USCS	Max. Dens. (pcf)	Optimum Moisture (%)	LL	PI
	Purple, brown, Sandy Lean CLAY	CL	128.0	11.4	33

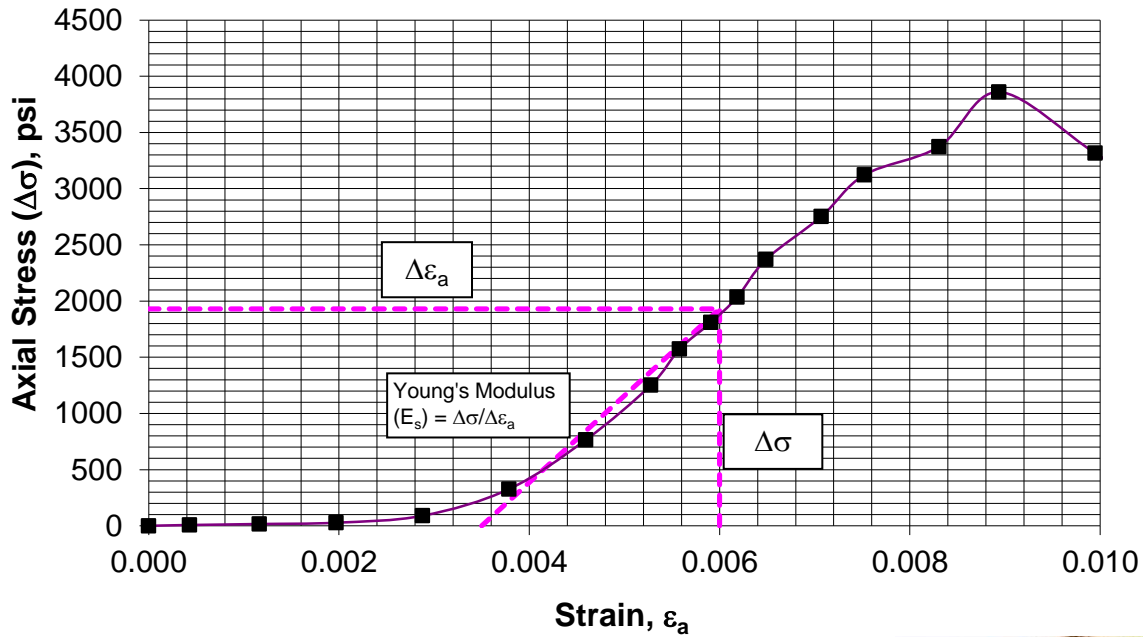
Project No: 19517-03
Project: Creamery Road PS
Source of Sample: B-2 **Depth:** 5.0'-10.0'
Sample Number: Bulk
Date: 6/21/19

Test Description/Remarks:

BEARING RATIO TEST REPORT

E2CR, Inc.

Figure _____



Boring No.	B-2	
Run No	R-1	
Depth	29.8'-30.4'	FEET
Diameter, D	1.982	INCH
Length, L	3.961	INCH
L/D Ratio	2.0	
Area (in ²)	3.09	
Axial Stress at Failure	3,860	PSI
Unit Weight (PCF)	165.99	PCF

Young's Modulus (E_s) @ 50% of Ultimate Strength (Secant Modulus)	7.72E+05	PSI
---	-----------------	------------



Description:

Type of Fracture :

 D



Cone (a)



Cone and Split (b)



Cone and Shear (c)



Shear (d)

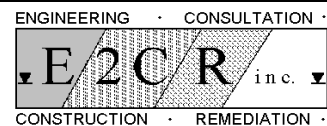


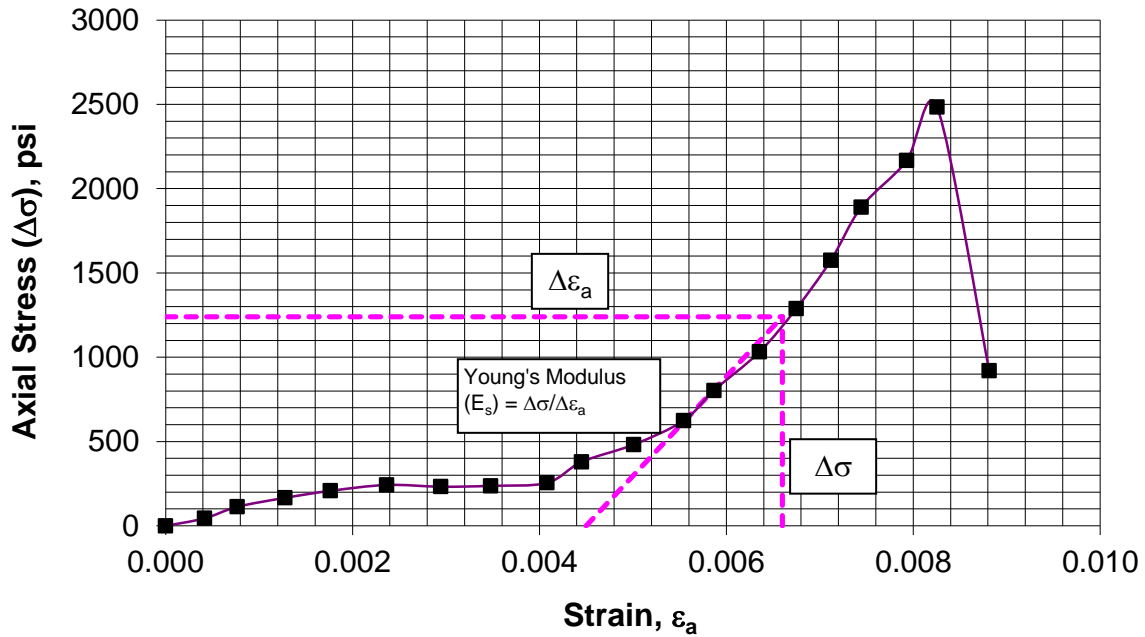
Columnar (e)

NOTE: Rock not prepared in accordance with the tolerances of ASTM D4543

Project Name:	Creamery Road Pump Station	Date:	6/19/19
Project No.:	19517-03	Figure:	

UNIAXIAL COMPRESSION OF ROCK CORE
ASTM-D7012





Boring No.	B-2
Run No	R-2
Depth	36.6'-37.0' FEET
Diameter, D	1.982 INCH
Length, L	4.312 INCH
L/D Ratio	2.2
Area (in ²)	3.09
Axial Stress at Failure	2,480 PSI
Unit Weight (PCF)	168.17 PCF

Young's Modulus (E_s) @ 50% of Ultimate Strength (Secant Modulus)	5.90E+05	PSI
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Description:

Type of Fracture :

 D



Cone (a)



Cone and Split (b)



Cone and Shear (c)



Shear (d)

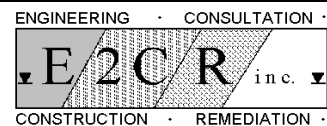


Columnar (e)

NOTE: Rock not prepared in accordance with the tolerances of ASTM D4543

Project Name:	Creamery Road Pump Station	Date:	6/19/19
Project No.:	19517-03	Figure:	

UNIAXIAL COMPRESSION OF ROCK CORE
ASTM-D7012



APPENDIX B
BUILDING PERMIT AND PLACARD

**FREDERICK COUNTY DIVISION OF PLANNING AND PERMITTING
DEPARTMENT OF PERMITS AND INSPECTIONS**

PERMIT NUMBER 436345

APPLICATION TYPE : NONRESIDENTIAL BUILDING PERMIT

APPLICATION DATE: 11/21/2022

APPLICANT(S)

Brian Rowland
3501 Concord Road, Suite 100
York 17402
Day Phone: (717)600-2220
E-Mail Address: browland@rkk.com

CONTRACTOR/CONTACT

BURGESS & COMM. OF EMMITS.

Brian Rowland

PROPERTY INFORMATION

STREET ADDRESS: 17700 CREAMERY RD **TOWN NAME:** EMMITSBURG
UNIT/SUITE NUMBER:
PARCEL: 05159040 **SUBDIVISION:** NA
TAX ID NUMBER: 05159040 **SEC. NUM:** **LOT NUM:** 00000
TAX MAP: 0009 **SEWER TYPE:** TOWN
INCORPORATED TOWN: Y **WATER TYPE:** TOWN
PROPERTY OWNER: BURGESS & COMM OF EMMITS

PARENT PERMIT No.:

AP NAME: Town of Emmitsburg Creamery Road Pumping Station
PROJECT/PHASE NAME:
TYPE OF WORK: NEW COMPLETE BUILDING
ZONING USE:
TYPE OF CONSTRUCTION: COMPLETE
BUILDING USE: SEWAGE PUMPING STATION
DECLARED VALUE : \$3,350,000
DESCRIPTION OF WORK: Construction of the New Creamery Road Sewage Pumping Station to include a new wet well and valve vault. Associated with Grading Permit #370855 and Construction Drawings #PW266346. Replaces expired permit 405651.
LOCATION: Creamery Road Sewage Pumping Station located at 17700 Creamery Road, Emmitsburg, MD 21727

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Non-Residential Information

Construction Type	COMPLETE	Site Plan?	PW266346
Building Use	SEWAGE PUMPING STATION		
Occupant Load	0		
Operating Hours			
Liquor Lic Involved?	N	<u>Cell Tower Details:</u>	
Food Related?	N	New Cellular Site?	N
		New Access Road?	N
		Height of Structure Equip	0
Outdoor Storage?	N	Height of New Antennas	0
Type of Storage		How Many Antennas?	0
		# of Equipment Cabinets	0
<u>Room Use:</u>		Sq. Ft. Foundat'n of Any New Bldg.	0
New Rooms	Existing Rooms	Sq. Ft. Foundat'n of Any New Tower	0
		Sq. Ft. of New Pad for Cabinets	0
		Additional Electric?	Y
		Additional Plumbing?	Y

Buiding Detail

Site Information:

Lot Size (S.F.)
Dist Area
Qty of Cut + Fill cu yd
Storm Water Plan? N
New Driveway Apron? N
how many? 0

Foundation Wall
Exterior Wall Const.
Exterior Wall Cov.
Roof Type
Roof Composition
Interior Wall

Setbacks & Measurements:

Front 0 **Right** 0
Rear 0 **Left** 0
Building Height
of levels incl bsmt
Gross Floor Area Altered

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Open or Closed Section
Driveway?

Floor Covering

Mechanical Information:

Basement Information:

Sprinkler System
Heating Fuel
Heating System
Central Air N
Chimney
Fireplace(s)

Unfin Bsmt N Fin Bsmt N
Part Fin Bsmt N No Bsmt N
Egrees Type

Septic Information:

Structure Size:

New Septic? N
Connect to existing septic? N
Conventional? N
Sand Mound? N
Name of Septic Installer

Septic and Const area staked? N

Bedrooms
Baths
Full Baths
Half Baths
Baths Rough In
Garage N # Cars
Carport N # Cars
Unfinished Room above Garage N
Finished Room above Garage N
Deck N Porch N

Agency Approval Finals:

Agency Name/Comments

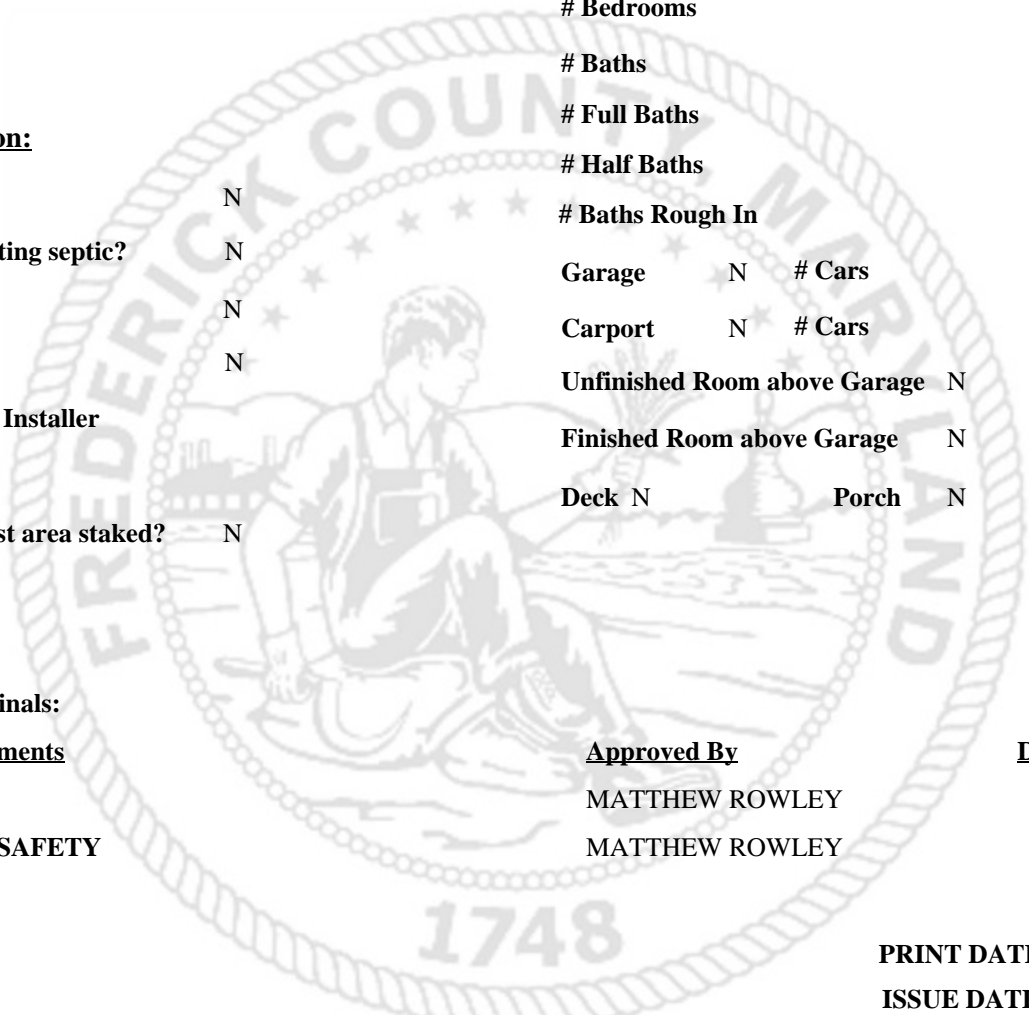
PLAN REVIEW
OFFICE OF LIFE SAFETY

Approved By

MATTHEW ROWLEY
MATTHEW ROWLEY

Date Approved

12/07/2022
12/07/2022



PRINT DATE: 12/08/2022
ISSUE DATE: 12/08/2022
EXPIRATION DATE: 12/08/2023

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Special Note:

Certificate of occupancy is required before building may be occupied.
Separate electrical, plumbing, fire, and grading permits are required if applicable.

The release of this Frederick County Permit does not constitute nor imply approval by the Frederick County Health Department Food Control Program. Please contact the Food Control Office at 301-600-2542 to arrange for Food Control review if this permit is for an establishment that is food related in any way.

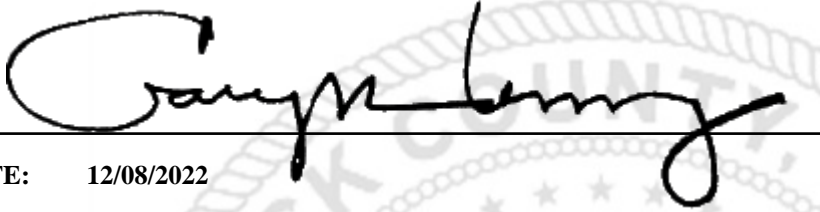
Plans must be maintained and available to the County Inspectors on the jobsite.

Any revisions to this issued building permit must be reviewed and approved prior to proceeding with inspections.

Approval of this permit, for a property served by public water and/or sewer, shall not be construed as a modification or amendment of any water or sewer easement nor constitute permission to encroach thereon. Should an encroachment be found in the future the cost to remedy said encroachment shall be borne by the property owner.

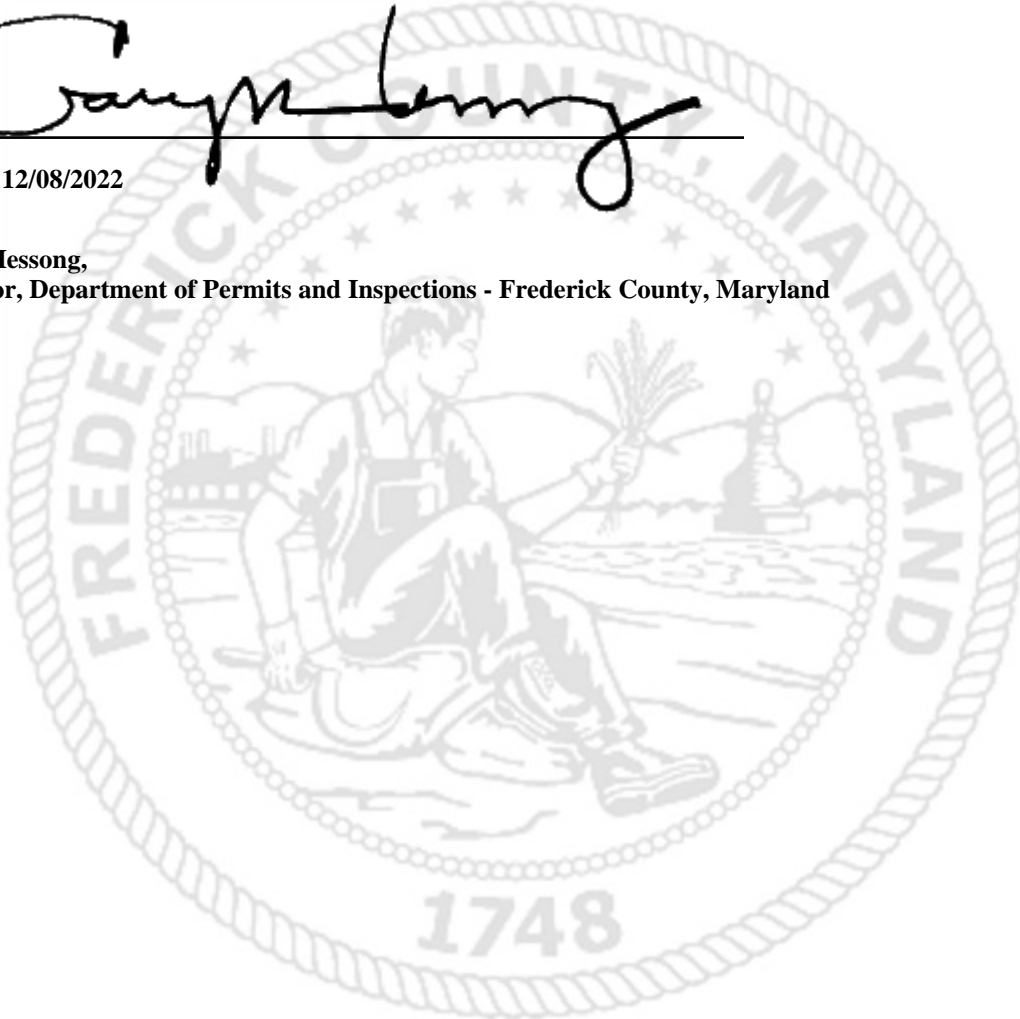
All building permits shall expire 1 year from the date of issuance except when an extension has been granted. Please login to the citizen portal (<https://planningandpermitting.frederickcountymd.gov/>), prior to expiration of the permit, to submit an extension request.

SIGNED: _____



ISSUE DATE: 12/08/2022

Gary Hessong,
Director, Department of Permits and Inspections - Frederick County, Maryland



FREDERICK COUNTY BUILDING PERMIT

436345

A/P NAME: Town of Emmitsburg Creamery Road
Pumping Station

CONTRACTOR: N/A

WORKTYPE: NEWCOMP

TYPE: NONRESIDENTIAL UTILITY/MISC

ADDRESS: 17700 CREAMERY RD

SUBDIVISION: NA

LOT NUMBER: NA

**DIVISION OF PLANNING AND PERMITTING
FREDERICK COUNTY, MARYLAND**

**Department of Permits and Inspections
30 North Market Street**

301-600-2313 <https://planningandpermitting.frederickcountymd.gov/>

***WHERE APPLICABLE SEPARATE PERMITS ARE REQUIRED FOR ELECTRICAL, FIRE
AND PLUMBING INSTALLATIONS***

THIS PERMIT EXPIRES 12/8/2023

To extend this permit, please log into your citizen portal account and submit an extension request prior to permit expiration. For questions please contact the Department of Permits and Inspections at 301.600.2313.